

Vermont Agency of Transportation

Research Advisory Committee
Project Quarterly Progress Reports

2014 – Q2

(1-01-2014 to 3-31-2014)

Improvement and Operation of the Vermont Travel Model

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE: 0001051

SPR: 302

B. PRINCIPLE INVESTIGATOR(s): Jim Sullivan

C. START AND END DATE (per grant assignment): October 1, 2013 –
September 30, 2014

D. ANTICIPATED COMPLETION DATE: September 30, 2014

E. PROJECT OBJECTIVES:

The overall objectives of this project are to:

1. Continue to move the Vermont Travel Model to being a comprehensive predictor of travel behaviors of Vermonters
2. Respond to requests from VTrans staff and its contractors to query or run the model for specific applications

F. REPORT PERIOD: January 1st through March 31st, 2014

G. ACCOMPLISHMENTS THIS PERIOD:

- Improvement of the Model:
 - Continued transferring the Model platform to TransCAD
 - Continued the re-assessment of all centroid connectors locations and resolution of TAZs
 - Began breaking up HBO and NHB trips in the Model with sub-categories (personal-discretionary, personal non-discretionary, and business) and distance classes (long and short distance) as data supports in accordance with NCHRP guidance
 - Began testing the validity of leaving the trip matrices asymmetrical, particularly for NHB travel, since NHB trips do not necessarily return to their origin daily
- Operation of the Model:
 - Used the Model to support RSG, Inc. in their estimation of external VMT for the EERPAT Model for Vermont
 - Used the Model to support Dunskey Energy Consulting in their development of a vehicle-ownership model for Vermont

- Used the Model to support the TRORC by simulating the impact of very-high growth scenarios in Vermont on the TRORC region

H. PROBLEMS ENCOUNTERED (If any):

I. TECHNOLOGY TRANSFER ACTIVITIES:

J. PERCENT COMPLETION OF TOTAL PROJECT: 50%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Improvement of the Model:
 - Complete transferring the Model platform to TransCAD
 - Continue the re-assessment of all centroid connectors locations and resolution of TAZs
 - Continue breaking up HBO and NHB trips in the Model with sub-categories (personal-discretionary, personal non-discretionary, and business) and distance classes (long and short - 50 mile cut-off) as data supports in accordance with NCHRP guidance
 - Continue testing the validity of leaving the trip matrices asymmetrical, particularly for NHB travel, since NHB trips do not necessarily return to their origin daily

Progress report prepared by: Jim Sullivan

Date Prepared: April 15, 2014

Vermont Idling Research Project

QUARTERLY REPORT

- A. PROJECT NUMBER AND TITLE:** 0001049
SPR: 307
- B. PRINCIPLE INVESTIGATOR(s):** Lisa Aultman-Hall
- C. START AND END DATE (per grant assignment):** Jan 2011 – Dec 2013
- D. ANTICIPATED COMPLETION DATE:** May 1, 2014
- E. PROJECT OBJECTIVES:** The objectives of current phase:
1. What are the most common locations and who are the most likely perpetrators of long discretionary-idling events? This will provide targets for future programs for idling limitations, education and enforcement.
 2. What is a more accurate estimate of state-wide passenger vehicle GHG emissions and fuel-use resulting from discretionary idling? This understanding will help policymakers understand the urgency of the problem as well as the GHG benefits that will accrue to program success.
 3. What are the temporal patterns of discretionary idling including the impact of outdoor temperature that will help develop targeted strategies to reduce or eliminate this behavior?
- F. REPORT PERIOD:** January 1, 2014 through March 31, 2014
- G. ACCOMPLISHMENTS THIS PERIOD:**
- No work was performed during this period.
- H. PROBLEMS ENCOUNTERED (if any):**
- I. TECHNOLOGY TRANSFER ACTIVITIES:**
- J. PERCENT COMPLETION OF TOTAL PROJECT:** 95% (only report finalization remains which is being supported by UTC funds.)
- K. ACTIVITIES PLANNED FOR NEXT QUARTER:**
- Make changes to report after VTrans review

Progress report prepared by: Lisa Aultman-Hall **Date Prepared:** April 2014

Evaluation of Experimental Features

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 352 Evaluation of Experimental Features

B. PRINCIPLE INVESTIGATOR(S):

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C. START AND END DATE (per grant assignment):

Ongoing

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: To evaluate experimental features and products on VTrans projects and installations. This includes installation or application, field monitoring and data collection, testing, photographic analysis and preparation of interim and final reports on the methods chosen. Publication or transmittal of experimental results will be sent to interested Agency units.

F. REPORT PERIOD: 1-1-14 to 3-31-14

G. ACCOMPLISHMENTS THIS PERIOD:

- The winter site visit for the experimental, Polymer crumb rubber with fibers and control, Type II and IV crackfill that was installed along VT Route 25 in Bradford-Corinth over the 2013 construction season was completed. During this visit distresses including adhesion, cohesion and spalling losses were measured and crack movement was documented.
- The winter site visit to collect rut readings along US Route 2 in accordance with WP 2012-R-3, Assessment of 40" Paving Skid Box was conducted.
- A winter site visit to document operations during a snow event was conducted in accordance with WP 2011-R-2, Assessment of Wavetronix SmartSensor Matrix Radar Stop Bar Detection System.
- Attended the preconstruction meeting for the Brookfield-Montpelier resurfacing project which will include a pavement marking test deck along I 89 SB. This project is expected to be completed in mid-August with markings being applied in Quarter 3.

- Reports published:
 - Report 2014 – 04 - Cargill SafeLane® HDX Overlay (WP 2006-R-4)
 - Report 2014 – 02 - Ennis Paint, Inc. Tyregrip High Friction Surface System (WP 2009-R-2)

H. PROBLEMS ENCOUNTERED (If any): None

I. TECHNOLOGY TRANSFER ACTIVITIES: Email notifications. Reports and updates are available electronically through the following link:
http://vtransengineering.vermont.gov/sections/materials_and_research/research/projects/completed

J. PERCENT COMPLETION OF TOTAL PROJECT: N/A

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Annual and seasonal visits to the following projects:
 - WP 2005-R-1: Fine Graded 75 Gyration Superpave Mix
 - WP 2005-R-2: 50 Gyration Superpave Mix
 - WP 2007-R-1: Reclaimed Stabilized Base with Cement
 - WP 2008-R-2 - Assessment of TechCrete, a Concrete Repair Material and Joint Sealant
 - WP 2011-R-1 - Assessment of Super-Slab, a Precast Concrete Slab in a Bridge Approach Application
 - WP 2011-R-2 - Wavetronix® SmartSensor Matrix™ Radar Stop Bar Detection
 - WP 2011-R-3 - Pedestrian Hybrid Beacon Crosswalk System (PHB) or High-Intensity Activated Crosswalk (HAWK)
 - WP 2011-R-4 - 9.5 mm Highly Polymer Modified Thin Hot Mix Asphalt (HMA) Overlay
 - WP 2011-R-5 - Assessment of Jahn Permeable Mortar System In a Historic Bridge Abutment Application
 - WP 2011-R-6 - Assessment of the Sterling Lloyd Eliminator Waterproofing Membrane System
 - WP 2012-R-1 - Assessment of the Bridge Preservation LLC's BDM Waterproofing Membrane System
 - WP 2012-R-2 - Poly-Carb Flexogrid Bridge Deck Overlay System
- Quarterly pavement marking data collection and site observations will be completed in Lyndon and St. Albans.
- JA MacDonald plans to cold plane and pave the section of I 89 SB in Hartford where Uretek performed a soil injection in accordance with WP 2012-R-4.

Uretek developed a deep injection method used to stabilize the underlying subsurface. The process utilizes an expansive polymer that is hydro-insensitive, ensuring that it will be unaffected by any water or wet soil that may lie under the surface pavement. The injection was completed at the Hartford subsidence site, along I 89 SB in late October/early December 2013. Prior to and immediately after cold planing and paving, the area will be surveyed and FWD testing will be conducted. All installation information will be available in an Initial Update after the paving, final 3D survey is completed, and FWD testing is conducted.

- Updates and reports for the following will be completed:
 - Experimental and control crackfill along VT Route 25 (Initial)
 - WP 2011-R-1: Assessment of Super-Slab, a Precast Concrete Slab in a Bridge Approach Application (Initial)
 - WP 2011-R-5: Assessment of Jahn Permeable Mortar System In a Historic Bridge Abutment Application (Initial)
 - WP 2011-R-6: Assessment of the Sterling Lloyd Eliminator Waterproofing Membrane System (Initial)
 - WP 2009-R-03: Glomarc 90 Polyurea Pavement Markings (Initial, Interim, Final)
 - WP 2005-R-1: Fine Graded 75 Gyration Superpave Mix (Initial and Interim reports will be completed)

Progress report prepared by: Wendy Ellis

Date Prepared: 4-29-2014

Porous Pavement Performance Evaluation in a Cold Weather Climate – Randolph Park and Ride

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 705 Porous Pavement Performance Evaluation in a Cold Weather Climate – Randolph Park and Ride

B. PRINCIPLE INVESTIGATOR(s):

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C. START AND END DATE (per grant assignment):

2008-2013

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: The objective of this research initiative is to examine the overall performance and pollutant removal efficiency of an experimental pervious Park and Ride located in the town of Randolph. This will be accomplished by documenting site characteristics such as soil permeability and frost susceptibility with reference to the water table, construction practices with special emphasis placed on grading, compaction and concrete placement, and the occurrence of any surface distresses including cracking and spalling. Infiltration efficiency will be monitored over time with respect to the pervious wearing course and underlying soils with consideration to winter maintenance practices and pressure washing activities. Pollutant removal will be assessed at varying depths within the basin as well as the incidence of bacterial growth at the interface of the basin and underlying soils.

F. REPORT PERIOD: January 1st, 2014 through March 31st, 2014

G. ACCOMPLISHMENTS THIS PERIOD: A meeting was held between Research, Environmental, Construction, and Operations to discuss forthcoming redesign and reconstruction of the park and ride. It was determined preliminarily that Stormcrete replaceable panels would be included for part of the lot, along with the possibility of a new cast in place mix design as developed through a project with UVM and Norwich, as well as porous asphalt.

H. PROBLEMS ENCOUNTERED (If any):

I. TECHNOLOGY TRANSFER ACTIVITIES: None

J. PERCENT COMPLETION OF TOTAL PROJECT: 90%

K. ACTIVITIES PLANNED FOR NEXT QUARTER: A final round of water quality sampling will be performed and delivered to the lab for analysis. Water level measurements, infiltration testing, and overall assessment will be conducted as well, all prior to any construction with regards to the re-design. Once all data is collected and compiled, data analysis and report writing will commence.

Progress report prepared by: Jason P. Tremblay

Date Prepared: May 7, 2014

Evaluation of Concrete Bridge Mix Designs for Control of Cracking QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 710 Evaluation of Concrete Bridge Mix Designs for Control of Cracking

B. PRINCIPLE INVESTIGATOR(s):

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C. START AND END DATE (per grant assignment):

2009 - 2012

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: Phase I: The objective of this research initiative is to examine a series of differing concrete mix designs in order to begin the process of selecting an optimum design for VTrans bare concrete bridge deck projects as well as other bridge projects. The desire is to lower the amount of cracking that is present on the bridge decks, possibly by using shrinkage control agents and/or by reducing the amount of cementitious material which would result in a reduction of needed mix water, based on the current water/cementitious ratios. Laboratory testing of this type is needed in order to provide a basis for support for using shrinkage reducing admixtures and/or adjusting current mix designs.

Mixes will fall within three groups. The first group will be the control group, consisting of batches of normal high performance concrete (HPC), classes A and B. The second group will make use of two different methods of shrinkage control within the control mixes, a shrinkage reducing admixture and a shrinkage compensating cementitious admixture. The third group will make use of an optimized gradation of aggregate and other various alterations.

Phase II: The objective of this second phase of the research initiative is to examine a select few of the top performing mixes tested in the previous study, alter a few key variables in their design, and zero in on the ideal design for the Agency's needs. The first component to evaluate will be the amount of cement required. One mix will be chosen from the initial study and the cement content varied at four different values, 400, 475, 550, and 610 per cubic yard. Four batches of each of these will be produced and tested.

As part of the process it is desired to mix the concrete in larger test batches than during the first study, where mixes were batched in house in approximately 1.5 cubic foot quantities. As part of this phase, mixes will be batched in a three cubic yard quantity; a standard quantity known to replicate the consistency of full scale pours well, and be done by a local concrete producer.

F. REPORT PERIOD: January 1st, 2014 through March 31st, 2014

G. ACCOMPLISHMENTS THIS PERIOD: A meeting was held between Research and Structural concrete to initiate and move forward with the planning phase of Phase II. It has been determined that a new concrete mixer will be purchased.

H. PROBLEMS ENCOUNTERED (If any):

I. TECHNOLOGY TRANSFER ACTIVITIES:

J. PERCENT COMPLETION OF TOTAL PROJECT: 98% (phase I), all production, testing, data compilations, and basic analysis has been completed, along with a partial draft report.

K. ACTIVITIES PLANNED FOR NEXT QUARTER: The new concrete mixer will be ordered and put into production. The phase I final report will be finalized and published. Equipment and supplies will be purchased for phase II and test batch preparation began.

Progress report prepared by: Jason Tremblay

Date Prepared: May 7, 2014

Correlating M-E PDG with Vermont Conditions – Phase II

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 711 Correlating M-E PDG with Vermont Conditions – Phase II

B. PRINCIPLE INVESTIGATOR(s):

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C. START AND END DATE (per grant assignment):

2010-2012

D. ANTICIPATED COMPLETION DATE: The funding has been extended into FFY '14, and it is anticipated the project will be complete by December 31, 2014.

E. PROJECT OBJECTIVES: Using the information gathered and work completed in Phase I, the first objective of this Phase is to determine the necessary beta-factors for calibration of the M-E PDG software by comparing in-situ pavement distresses with the software output. Both rutting and IRI will be compared at their present day values, along with their quantities over time. Using statistical methods along with NCHRP Report 1-40B *Local Calibration Guide*, a calibration and validation process will be developed and carried out to ascertain the adjustment factors to be used for pavement design in Vermont.

Continuing with the progress of the overall project, the second objective of this phase will be verification of the model. Using additional sites from the 2004 Layer Coefficient Study, in-situ values will be compared with predicted to insure the model is working correctly.

F. REPORT PERIOD: January 1, 2014—March 31, 2014

G. ACCOMPLISHMENTS THIS PERIOD:

The Addison model was updated using WIM traffic data. Information from this update revealed predicted IRI values very similar to those encountered in the field (more so than just by using the “out of the box” model). This update also revealed that rutting predictions were under predicted from those encountered in the field. The “out of the box” software over predicted rutting values.

H. PROBLEMS ENCOUNTERED (If any): The Prep-ME software requires a full year of monitored WIM data or requires manual inputs for the missing values. Although not a major concern, it limits the amount of accurate available data.

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. PERCENT COMPLETION OF TOTAL PROJECT:

85%

K. ACTIVITIES PLANNED FOR NEXT QUARTER: We plan on verifying all input data for the Addison model to ensure the data is accurate and up to date. Once that model is checked, we will update traffic information from the other sites and compare the results.

Progress report prepared by: Marcy Meyers **Date Prepared:** 5-1-2014

Life-Cycle Determination of Preventative Maintenance Treatments QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 713 Life-Cycle Determination of Preventative Maintenance Treatments

B. PRINCIPLE INVESTIGATOR(s):

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C. START AND END DATE (per grant assignment):

2009-2017

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: Preventative maintenance treatments, intended to arrest minor deterioration, retard progressive failures, and reduce the need for corrective maintenance, has the potential to both improve quality and reduce expenditures. The life cycle and associated cost-effectiveness of these treatments may vary significantly based upon the selected treatment, functional classification, traffic demand, condition of the roadway prior to application, constructability, and environmental conditions.

The primary intent of this research initiative is to determine the life expectancy and associated costs of preventative maintenance treatments currently used in the State of Vermont. This will be completed by evaluating the constructability, performance and cost effectiveness of all treatments encompassed within the study. The treatments will include paver placed surface treatments, micro-surfacing (Type I and II), chip seal, hot-in-place recycling, and standard mill and fill treatments.

F. REPORT PERIOD: 1-1-14 to 3-31-14

G. ACCOMPLISHMENTS THIS PERIOD:

- Finish counting cracks and update database.
- Work on reporting requirements.

H. PROBLEMS ENCOUNTERED (If any): None

I. TECHNOLOGY TRANSFER ACTIVITIES: None.

J. PERCENT COMPLETION OF TOTAL PROJECT: 65%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Work on reporting requirements.
- Annual site visits.

Progress report prepared by: Wendy Ellis

Date Prepared: 4-30-14

Evaluation of Effectiveness of Centerline Rumble Stripes on Rural Roads

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 714 Evaluation of Effectiveness of Centerline Rumble Stripes on Rural Roads

B. PRINCIPLE INVESTIGATOR(s):

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C. START AND END DATE (per grant assignment):

2009-2014

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: The primary objective of this research directly aimed at increasing the safety of the traveling public, one of the Agency's four primary goals, through the use and implementation of centerline rumble stripes. The evaluation will include an assessment of the overall durability and resistance to wear characteristics of the centerline rumble stripes in terms of preexisting pavement and climatic conditions as well as winter maintenance practices. Ease of installation will also be documented along with the design of the rumble stripes in conjunction with the adjacent pavement markings. The stripes will be installed on two projects in summer of 2009. One location will be on preexisting pavement on US 4 in Mendon-Killington and another on new pavement on VT 105 in Sheldon-Enosburg.

These experimental rumble stripes are intended to alert drivers that they have crossed into the path of oncoming traffic. However, there are several concerns that have not yet been adequately studied according to a recent report from the National Cooperative Highway Research Program (NCHRP) including roadside noise complaints, pavement condition, drivers reacting to the left, striping visibility, increased wear from winter maintenance practices, limited after data, lack of widely accepted guidelines, and affect of water, snow, and ice accumulation. This study seeks to address these concerns and draw associated future implementation recommendations for the State of Vermont as well as perform a cost benefit analysis.

F. REPORT PERIOD: 1-1-14 to 3-31-14

G. ACCOMPLISHMENTS THIS PERIOD

- No work was completed on this project.

H. PROBLEMS ENCOUNTERED (If any): None.

I. TECHNOLOGY TRANSFER ACTIVITIES: None.

J. PERCENT COMPLETION OF TOTAL PROJECT: 75%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Work on reporting requirements.

Progress report prepared by: Wendy Ellis

Date Prepared: 4-30-14

Evaluation of Skid Resistance of Bare Concrete Bridge Decks QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 715 Evaluation of Skid Resistance of Bare Concrete Bridge Decks

B. PRINCIPLE INVESTIGATOR(S):

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C. START AND END DATE (per grant assignment):

2010-2012

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: The objective of this research initiative is to examine different concrete surface finishing techniques currently in place on bare bridge decks in order to determine which methodologies lead to the greatest skid resistance. Two differing methods of skid resistance testing will be performed, including the use of a British Pendulum Tester as well as a locked wheel skid test. The Structures Section has comprised a list of fifteen bridges that will be tested around the state, 32 years or younger, with five or more different surface finishing techniques used among them. Analysis of the skid resistance data will help lead to the selection of an optimal concrete surface finish thereby increasing the overall safety of the traveling public.

The analysis of these finishing techniques will also include other factors, such as cost, long term durability, quality assurance, construction feasibility and probability of success.

F. REPORT PERIOD: January 1st, 2014 through March 31st, 2014

G. ACCOMPLISHMENTS THIS PERIOD: None; draft report has been reviewed in house and sent to Wayne Symonds for Structures review, as they were the originators of the solicitation. Awaiting comments for finalization.

H. PROBLEMS ENCOUNTERED (If any):

I. TECHNOLOGY TRANSFER ACTIVITIES:

J. PERCENT COMPLETION OF TOTAL PROJECT: 95%, all data collected; data analysis and draft report finished.

K. ACTIVITIES PLANNED FOR NEXT QUARTER: Final report will be finalized and published.

Progress report prepared by: Jason Tremblay

Date Prepared: May 7, 2014

Assessment of Design Parameters and Construction Requirements for Full Depth Reclamation Projects with Cement

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 718 Assessment of Design Parameters and Construction Requirements for Full Depth Reclamation Projects with Cement

B. PRINCIPLE INVESTIGATOR(s):

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C. START AND END DATE (per grant assignment): January 12, 2011 – July 12, 2012

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: The objectives of this research initiative include examining alternative means and methods for assessing performance characteristics of the reclaimed stabilized base material; this data would then be used to develop acceptance criteria and to validate design assumptions with an overall objective of optimizing VTrans' RSB pavement design model.

F. REPORT PERIOD: 1-1-14 to 3-31-14

G. ACCOMPLISHMENTS THIS PERIOD:

- A TAC meeting was held early in the quarter to discuss the annual project testing and recommendations to move forward with.
- Final data analysis including overall project analysis was completed.
- A final report was completed.

H. PROBLEMS ENCOUNTERED (If any): None

I. TECHNOLOGY TRANSFER ACTIVITIES: None

J. PERCENT COMPLETION OF TOTAL PROJECT: 90%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- The final report will be distributed to TAC members for their review.
- The final report will be published.
- Any testing recommendations will be input into the 2014 testing plan.

Progress report prepared by: Wendy Ellis

Date Prepared: 4-30-14

Project Title

QUARTERLY REPORT

- A. **PROJECT NUMBER AND TITLE:** Use of Piles in Slope Stabilization
SPR: RSCH014-719
- B. **PRINCIPAL INVESTIGATOR(s):** Callie Ewald, Chris Benda and Mandar Dewoolkar
- C. **START AND END DATE (per grant assignment):** February 1, 2011 through March 31, 2012. Extended through May 2014 – Extending to August (will finish this summer)
- D. **ANTICIPATED COMPLETION DATE:** August 2014
- E. **PROJECT OBJECTIVES:** The primary objective of this research is to provide the Agency with design guidance for reinforcing unstable slopes with steel H-Piles and to gap design software omissions. The primary design tool used by the Agency does not consider every aspect of failure in the piles and does not account for soil stiffness. A second objective of the research is to evaluate the suitability of using the Borehole shear Test (BST) apparatus as an aid in establishing soil parameters for analysis. The BST is a test that is performed in the field which determines effective shear strength parameters of the in-situ soil. Due to the high expense and length of time required for laboratory testing, this device could be of significant benefit in slide mitigation activity. A site in Cornwall, VT has been identified to conduct a field investigation and testing program.
- F. **REPORT PERIOD:** January 14, 2014 through April 15, 2014
- G. **ACCOMPLISHMENTS THIS PERIOD:** Continued monitoring of the inclinometers installed during Phase II boring investigation. Analyzed BST data versus laboratory test data for inclusion in the report. Began to develop figures for report. Developed first draft of timeline for report.
- H. **PROBLEMS ENCOUNTERED (If any):** The inclinometers are being read this spring to determine if any and where movement is occurring. This is needed to perform the necessary analysis.
- I. **TECHNOLOGY TRANSFER ACTIVITIES:** None
- J. **PERCENT COMPLETION OF TOTAL PROJECT:** 75%
- K. **ACTIVITIES PLANNED FOR NEXT QUARTER:** Provide a finalized report by the end of the summer. Develop a remediation for the slide in Cornwall to provide to the District.

Progress report prepared by: Callie Ewald
Date Prepared: May 7th, 2014

Verification of Abutment and Retaining Wall Design Assumptions

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 720 Verification of Abutment and Retaining Wall Design Assumptions

B. PRINCIPAL INVESTIGATOR(s):

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Christopher C. Benda, P.E.
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C. START AND END DATE (per grant assignment): October 1, 2013 – December 31, 2013.

D. ANTICIPATED COMPLETION DATE: May 30, 2014

E. PROJECT OBJECTIVES: The primary objective of this research is to verify that the backfill and drainage details currently used on cast-in-place concrete cantilevered retaining walls and bridge abutments on VTrans projects perform as expected, i.e. will provide zero pressure head differential on both faces of the wall, and that the backfill has the engineering properties assumed in the design. A second objective is to find the most cost effective backfill details. Included in this objective is developing selection guidelines, soil parameters, drainage details and construction specifications that will allow the use of backfill materials with greater fines content than that currently specified.

F. REPORT PERIOD: 2014 Q2

G. ACCOMPLISHMENTS THIS PERIOD: A revised version of the TRB manuscript was invited to be submitted for the Journal of Transportation Research Record. The final project report is nearly complete.

H. PROBLEMS ENCOUNTERED (If any): No significant problems to report.

I. TECHNOLOGY TRANSFER ACTIVITIES: A manuscript based on this research has been tentatively accepted by the journal of Transportation Research Record.

J. PERCENT COMPLETION OF TOTAL PROJECT: 99%

K. ACTIVITIES PLANNED FOR NEXT QUARTER: Finish the final report.

Progress report prepared by: Mandar Dewoolkar and Chris Benda

Date Prepared: May 5, 2014

Evaluation of Load Characteristics of I-89 Bridges 58 N&S, Richmond – Phase II QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 721 Evaluation of Load Characteristics of I-89 Bridges 58 N&S, Richmond

B. PRINCIPLE INVESTIGATOR(s):

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C. START AND END DATE (per grant assignment): June 1, 2011 – December 31, 2012

D. ANTICIPATED COMPLETION DATE: *August 2013. This extension was approved by VTrans as a no-cost extension.*

E. PROJECT OBJECTIVES:

The objective of this research initiative is to instrument bridge number 58 (north) on Interstate 89 in the town of Richmond, in an effort to determine its load bearing capabilities. Currently AASHTO distribution factors are used to determine load ratings on the bridges, which lead to possibly conservative estimates, thus restricting some overweight load passage. Accurate determination of the load bearing characteristics would allow for as-tested values to be used in lieu of the AASHTO distribution factors and therefore lead to a more accurate load rating. In addition, due to questions pertaining to the original design plans it is currently unknown what grade of steel was used in the stringers; a separate concurrent project will be undertaken to determine this accurately.

Determination of the load bearing characteristics of this bridge will be done through the use a series of remain-in-place strain and/or displacement gauges installed on three of the bridges stringers; one near and abutment, one near a pier, and one in a negative moment region. The system will be capable of recording continuous load data, thus displaying characteristics over a wide range of traffic types and streams. Instrumentation plans specifics, as well as all work, will be done through a consultant, selected through a request for proposal (RFP) process. Special attention will be paid to the data when a known heavyweight vehicle or load will be traversing the bridge and in conjunction with nearby weigh in motion (WIM) stations. Information will be used in an effort to determine whether or not special care need be taken when overweight loads cross the bridge, and to possibly revise bridge load ratings.

F. REPORT PERIOD: January 1st 2014 through March 31st 2014

G. ACCOMPLISHMENTS THIS PERIOD:

- All field activities and computational work related to this project have been completed.

H. PROBLEMS ENCOUNTERED (If any):

I. TECHNOLOGY TRANSFER ACTIVITIES:

J. PERCENT COMPLETION OF TOTAL PROJECT: 99%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Submit final report.

Progress report prepared by: Eric M. Hernandez, Ph.D.

Date Prepared: May 13th 2014

Harvesting Data from Advanced Technologies for Real Time Transportation Network Management

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 723 Harvesting Data from Advanced Technologies for Real Time Transportation Network Management

B. PRINCIPLE INVESTIGATOR(s):

Xindong Wu, PI
Department of Computer Science
University of Vermont
33 Colchester Ave
Burlington, VT 05405
Telephone: (802) 656-7839

Robert T. White, Co-PI
Director of ConnectVermont
State of Vermont AOT
Phone: 802-828-2781
Fax: 802-828-2848
Robert.T.White@state.vt.us

C. START AND END DATE (per grant assignment): January 1, 2011 – December 31, 2013

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES:

- Develop a suite of state of the art modeling tools that provides real-time congestion monitoring, facilitates real-time incident management and accurate network state estimation. This will be achieved by using advanced data gathering, processing and mining tools to estimate the current and future transportation system performance. The resulting modeling tools will be enabled by emerging technologies suitable for implementation by transportation agencies in Vermont.

- Quantify travel behavior changes influenced by the use of advanced technologies and the resulting modeling challenges brought forth by this change.

F. REPORT PERIOD: October 1, 2013 – December 31, 2013

G. ACCOMPLISHMENTS THIS PERIOD:

We submitted the Project Report with all requested documentation.

H. PERCENT COMPLETION OF TOTAL PROJECT: 100%.

I. ACTIVITIES PLANNED FOR NEXT QUARTER: N/A.

Progress report prepared by: Xindong Wu Date Prepared: 5/5/2014

Work Zones and Travel Speeds: The Effects of Uniform Traffic Control Offices & Other Speed Management Measures

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 726

B. PRINCIPLE INVESTIGATOR(s): Brian H. Y. Lee

C. START AND END DATE (per grant assignment): 1 Feb 2012 – 30 Sep 2013

D. ANTICIPATED COMPLETION DATE: 31 March 2014

E. PROJECT OBJECTIVES:

This research project focuses on enhancing enforcement of work zone traffic laws, with a specific emphasis on the effects of Uniform Traffic Officers (UTO) and other speed management measures on driver compliance with reduced work zone speed limits. The primary objective of this work is to assess the effectiveness of these interventions on maintaining safe travel speeds and to help guide the Vermont Agency of Transportation (VAOT) in the provision of proper resource allocation for improving work zone safety. At least three different types of work zone speed management scenarios will be examined, including

1. Use physical traffic calming measures only (i.e., without any enforcement) as the base scenario;
2. Employ UTOs when work zones are active; and
3. Perform targeted enforcement at selected periods.

In all scenarios, the travel speeds will be measured before, during, and after their implementation to examine the effects of the interventions.

F. REPORT PERIOD: 1 Jan through 31 Mar 2014

G. ACCOMPLISHMENTS THIS PERIOD:

- Completed draft final report submitted to the TAC group
- Received feedback from TAC members & addressed their comments
- Submitted final report

H. PROBLEMS ENCOUNTERED (If any): N/A

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. PERCENT COMPLETION OF TOTAL PROJECT: 100%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Complete final report.

Progress report prepared by: Brian H. Y. Lee

Date Prepared: 1 May 2014

Statistical Analysis of Weigh-in-Motion Data to Validate Use of HL-93 AASHTO Vehicle Live Load for Bridge Design in Vermont

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 729 Statistical Analysis of Weigh-in-Motion Data to Validate Use of HL-93 AASHTO Vehicle Live Load for Bridge Design in Vermont

B. PRINCIPLE INVESTIGATOR(s):

Eric M. Hernandez, Ph.D.
Assistant Professor
College of Engineering and Mathematical Sciences
School of Engineering
University of Vermont
301 Votey Hall, 33 Colchester Ave.
Burlington, VT, 05405

C. START AND END DATE (per grant assignment): March 1, 2012 – February 28, 2013

D. ANTICIPATED COMPLETION DATE: *Sept 30th, 2014.* This was a no cost extension approved by VTrans.

E. PROJECT OBJECTIVES:

The objective of the proposed research is to investigate the adequacy of the AASHTO HL-93 design vehicular live load for Vermont. Since the LRFD is a probabilistic based design code, that is, each load combination is intended to provide a uniform and very low probability of exceedance in terms of structural demands, the adequacy of the HL-93 must be investigated in probabilistic terms.

The main objective of the proposed research can be divided into three sequential aspects:

1. Collect/Transfer/Classify data from WIM stations
2. Perform statistical analysis of WIM truck data recorded at all the operating stations in Vermont
3. Perform stochastic structural analysis simulations under various conditions of number and length of spans. The main objective is to compare the lane bending moments and shears of the actual/measured truck data with those provided by the LRFD vehicular design live load. This will enable us to

compute the expected probability of exceedance with respect to the LRFD HL-93 vehicular loading and compare AASHTO LRFD design target.

F. REPORT PERIOD: January 1st 2014 through March 31st 2014

G. ACCOMPLISHMENTS THIS PERIOD:

Up to this date, the following goals have been accomplished:

- We have completed the analysis all available WIM data from VTrans corresponding to years 2000-2011 and 2012.
- We have simulated stochastic structural analysis models for the effect (lane shear and bending moment) of vehicular loads on various types of single spans (< 60 m). We have determined the probability of failure for every year/station. These computed probabilities of failure will be compared with target probability of failure induced from AASHTO LRFD design criteria.
- We performed extreme value statistical analysis of the lane demands (shear and bending moment). We have found that statistical non-stationarity plays a significant role in the probability of failure.
- We are ready to submit a paper for the Journal of Structural Safety on the research carried out in this grant.

H. PROBLEMS ENCOUNTERED (If any): We are missing data from one station near Montpellier (W088). We are waiting on VTrans to provide this data.

I. TECHNOLOGY TRANSFER ACTIVITIES:

J. PERCENT COMPLETION OF TOTAL PROJECT: 95%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- a. Study possible recommendations regarding potential modifications to the AASHTO vehicular live load distribution for its application in Vermont.

Progress report prepared by: Eric M. Hernandez, Ph.D.

Date Prepared: May 13th, 2014

**Designing Porous Concrete to Resist Damage from
Deicing Salts and Freeze-Thaw
QUARTERLY REPORT**

A. PROJECT NUMBER AND TITLE:

SPR: 730 Designing Porous Concrete to Resist Damage from Deicing Salts and Freeze-Thaw

B. PRINCIPAL INVESTIGATOR(s):

Dr. Mandar Dewoolkar
Associate Professor
School of Engineering - University of Vermont
(802)656-1942

Dr. Edwin R. Schmeckpeper, Associate Professor
Dr. Adam F. Sevi, Assistant Professor
Civil and Environmental Engineering
Norwich University

C. START AND END DATE (per grant assignment): June 1, 2012 – May 31, 2013.

D. ANTICIPATED COMPLETION DATE: August 31, 2014

E. PROJECT OBJECTIVES: The scope of this research is to: (1) evaluate in the laboratory porous concrete mixes for their resistance to deicing chemicals; (2) quantify the effects of sand addition on the resistance to deicing salts; (3) quantify the effects of fly ash replacement on resistance to deicing salts; (4) evaluate various chemical admixtures to determine if they improve resistance of porous concrete to deicing salts; and (5) determine how curing time affects resistance to deicing salts.

F. REPORT PERIOD: January 1, 2014 – March 31, 2014 (2014 Q2)

G. ACCOMPLISHMENTS THIS PERIOD: The testing program is progressing. The samples are continued to be tested for hydraulic conductivity, void content, compressive strength and Freeze-Thaw cycles at UVM and Norwich. A request for a no-cost extension was made, which was approved by VTrans.

H. PROBLEMS ENCOUNTERED (If any): None thus far.

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. PERCENT COMPLETION OF TOTAL PROJECT: 87%

K. ACTIVITIES PLANNED FOR NEXT QUARTER: Freze-Thaw testing at UVM and Norwich will continue.

Progress report prepared by: Mandar Dewoolkar

Date Prepared: April 15, 2014

Prediction and Mitigation of Scour for Vermont Bridges QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 731 Prediction and Mitigation of Scour for Vermont Bridges

B. PRINCIPAL INVESTIGATOR(s):

Mandar Dewoolkar, Ph.D., P.E.
Associate Professor
School of Engineering - University of Vermont

C. START AND END DATE (per grant assignment): June 1, 2012 – May 31, 2015.

D. ANTICIPATED COMPLETION DATE: August 31, 2015

E. PROJECT OBJECTIVES: Successfully mitigating scour related problems associated with bridges is dependent on engineers' ability to reliably estimate scour potential, design effective scour prevention and countermeasures, design safe and economical foundation elements accounting for scour potential, and design reliable and economically feasible monitoring systems. The specific objectives of this research are to: (1) conduct an extensive literature review on methods to estimate scour potential, methods of monitoring, design methodologies, and countermeasures, and summarize the results in a summary document and make recommendations on specific methodologies that would be adaptable for Vermont; (2) develop a methodology for semi-empirically linking rapid geomorphic assessments (RGA) to observed bridge scour as a predictive tool; and (3) instrument select test sites with relatively low-cost passive sensors that will actively yet remotely communicate excessive scour.

F. REPORT PERIOD: 2014 Q2: January 2014 to March 2014

G. ACCOMPLISHMENTS THIS PERIOD: A second prototype of a bridge scour sensor is in lab testing. Papers regarding scour prediction, rating, and effects of Tropical Storm Irene were presented at as a poster to ASCE Geo-Congress, presentation to ASCE Structures Congress and SPIE Smart Structures/NDE 2014. Additional stream information, namely watershed area and stream order were added to the State-wide bridge/stream database. Analysis has continued to identify traits common among Irene damaged bridges.

H. PROBLEMS ENCOUNTERED (If any):

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. PERCENT COMPLETION OF TOTAL PROJECT: 45%

K. ACTIVITIES PLANNED FOR NEXT QUARTER: The literature review will continue. A character identification on important parameters among damaged bridges is being conducted. A review of bridge records and scour design procedures is scheduled to begin. Current design practices, as well as inspection and repair are planned areas of investigation for the coming quarters. Scour probe prototype testing may be implemented at a field site. Investigations into countermeasures and design alternatives will continue.

Progress report prepared by: Ian Anderson and Mandar Dewoolkar

Date Prepared: April 15, 2014

Pavement Marking Comparison Study

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 732 Pavement Marking Comparison Study

B. PRINCIPLE INVESTIGATOR(s):

Wendy Ellis
Research Technician V
Vermont Agency of Transportation
2178 Airport Rd., Unit B
Berlin, VT 05641
Telephone: (802) 828-6918
Fax: (802) 828-2792

C. START AND END DATE (per grant assignment): January 1, 2013 – September 30, 2018

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: The objectives of this research initiative include examining and evaluating the reflective and durable characteristics of recessed and surface applied pavement markings in both wet and dry conditions and to classify durable tapes into performance categories based on their durability and adhesion capabilities.

F. REPORT PERIOD: 1-1-14 to 3-31-14

G. ACCOMPLISHMENTS THIS PERIOD:

- Bids were opened on January 10th, 2014 for Brookfield-Montpelier (Paint test deck).
- Selected optic packages for each paint marking type for WP 2013-R-3.
- Draft sole source justification was prepared to purchase an adhesion tester that will be utilized for both WP 2013-R-3 and WP 2013-R-4.
- Annual calibration of the retroreflectometer (Stripemaster 2 Touch) will be conducted.

H. PROBLEMS ENCOUNTERED (If any): None

I. TECHNOLOGY TRANSFER ACTIVITIES: None

J. PERCENT COMPLETION OF TOTAL PROJECT: 15%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Attend preconstruction meeting for Brookfield-Montpelier which will house the paint test deck.
- Experimental feature work plan for WP 2013-R-3 will be revised to meet project and specification expectations and will be incorporated into a change order (Agency driven) to ensure ideal marking conditions and applications.
- Work on database.
- Finalize sole source justification documents to purchase the adhesion tester and purchase the equipment.

Progress report prepared by: Wendy Ellis

Date Prepared: 4-30-14

Long-Term & Short-Term Measures of Roadway Snow & Ice Control Performance

QUARTERLY REPORT

- A. PROJECT NUMBER AND TITLE:** RSCH016
SPR: 733
- B. PRINCIPLE INVESTIGATOR(s):** Jim Sullivan
- C. START AND END DATE (per grant assignment):** April 1, 2013 – July 31, 2014
- D. ANTICIPATED COMPLETION DATE:** ~~July 31, 2014~~ March 31, 2015
- E. PROJECT OBJECTIVES:** The objectives of this project are to improve the performance of RSIC activities by the VTrans fleet by developing a plan for implementation of new performance measures. Long-term, seasonal measures will be developed which implement a time-to-normal approach. A short-term measure will be pilot-tested, utilizing real-time image processing.
- F. REPORT PERIOD:** January 1st through March 31st, 2014
- G. ACCOMPLISHMENTS THIS PERIOD:**
- Began testing and troubleshooting thermal infrared camera equipment in a private passenger vehicle
 - Conducted a field inspection of RSIC vehicles at the District 5 garage
 - Completed collection of speed data from the WIM stations for winter storm events
- H. PROBLEMS ENCOUNTERED (if any):**
- Speed data collection at RWIS stations was not possible due to malfunctioning field equipment and malfunctioning data-servers required for collection and querying of the speed data
 - Testing, troubleshooting and field inspection for installation of thermal infrared camera equipment was not completed in time to collect thermal video imagery in a winter storm. Therefore, we are requesting a new end date of 3/31/2015 for the project at no additional cost. No effort will be incurred from April 1, 2014 to October 1, 2014 as the project will be on hold. The remaining budget will be used between October 1, 2014 and March 31, 2015 to accomplish the originally defined scope.
- I. TECHNOLOGY TRANSFER ACTIVITIES:**

J. PERCENT COMPLETION OF TOTAL PROJECT: 60%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- None. Project is on hold until October 1, 2014.

Progress report prepared by: Jim Sullivan

Date Prepared: April 11, 2014

Development of GIS Tools to Optimize Identification of Road Segments Prone to Flood Damage

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE: RSCH016
SPR: 734

B. PRINCIPLE INVESTIGATOR(s): Jim Sullivan

C. START AND END DATE (per grant assignment): April 1, 2013 – September 30, 2014

D. ANTICIPATED COMPLETION DATE: September 30, 2014

E. PROJECT OBJECTIVES: The objectives of this project are to

- Identify road segments in Vermont with highest probability of flood damage
- Validate methodology against damage from Tropical Storm Irene and re-calibrate if necessary
- Develop an exportable ArcGIS model

F. REPORT PERIOD: January 1st through March 31st, 2014

G. ACCOMPLISHMENTS THIS PERIOD:

- Completed the hydrologic analysis with the ArcHydro platform
- Geocoded peak flow data from VTrans Hydraulics Reports
- Began the multi-scale spatial regression of selected watershed parameters and peak flows

H. PROBLEMS ENCOUNTERED (if any):

I. TECHNOLOGY TRANSFER ACTIVITIES:

J. PERCENT COMPLETION OF TOTAL PROJECT: 55%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Complete the multi-scale spatial regression of selected watershed parameters and peak flows
- Begin spatial identification of bridge and culvert capacities, and/or height differences between road surface

Progress report prepared by: Jim Sullivan

Date Prepared: April 15, 2014

Strategic Location of Satellite Salt Storage for Roadway Snow and Ice Control in Vermont

QUARTERLY REPORT

- A. PROJECT NUMBER AND TITLE:** RSCH016
SPR: 735
- B. PRINCIPLE INVESTIGATOR(s):** Jim Sullivan
- C. START AND END DATE (per grant assignment):** April 1, 2013 – May 31st, 2014
- D. ANTICIPATED COMPLETION DATE:** May 31st, 2014
- E. PROJECT OBJECTIVES:** The objective of this project is to improve the effectiveness of winter RSIC activities by optimizing the storage locations of RSIC materials throughout the state.
- F. REPORT PERIOD:** October 1st through December 31st, 2013
- G. ACCOMPLISHMENTS THIS PERIOD:**
- Surveyed approaches used by other DOTs to strategically locate RSIC materials on the roadway network
 - Completed computer coding to implement the method for locating satellite salt locations.
- H. PROBLEMS ENCOUNTERED (if any):**
- I. TECHNOLOGY TRANSFER ACTIVITIES:**
- J. PERCENT COMPLETION OF TOTAL PROJECT:** 80%
- K. ACTIVITIES PLANNED FOR NEXT QUARTER:**
- Complete simulation analysis to develop optimal satellite salt storage locations
 - Write the draft project report and submit to the TAC for review.

Statewide Analysis of Guardrails, Curves and Crashes

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 736

B. PRINCIPLE INVESTIGATOR(s): Brian H. Y. Lee

C. START AND END DATE (per grant assignment): 1 Mar 2013 – 30 Sep 2014

D. ANTICIPATED COMPLETION DATE: 30 Sep 2014

E. PROJECT OBJECTIVES:

This research project focuses on the placement of guardrails and the location of curves, both with respect to crash incidents. Since guardrails and curves are often co-located (i.e., many guardrails are placed along curves and many curves have guardrails), it is highly likely that these two road features are correlated in space and confound each other's relationship with crashes. Both guardrails and curves may vary in their attributes by location (e.g., guardrails in size, material, offset; curves in radii, length, pavement material) and can relate to crashes in positive and negative ways. In this project, both guardrails and curves are considered together in a single, holistic statewide study, while maintaining the ability to discuss each of these issues separately.

There are two project objectives:

Objective 1: Develop guidelines that will inform road engineers about contexts in which the use of guardrails to help prevent crashes is appropriate. This would include taking into account of the site conditions, the users, and the types of facilities and guardrails.

Objective 2: Determine curve characteristics that are highly correlated with crashes to help identify locations where safety interventions may be warranted. Similar to Objective 1, this would include taking into account of the site conditions, the users, the types of facilities, and the presence of different interventions.

F. REPORT PERIOD: 1 Jan through 31 Mar 2014

G. ACCOMPLISHMENTS THIS PERIOD:

- Developed preliminary methods for assigning curve and guardrail feature data to crash points
- Additional crash report fields from 2007-2012 crash data received, processed, and prepared for use in project
- TAC meeting held 25 Mar 2014 to discuss methods
- Subset crashes to state roads with LRS value from crash database
- Assigned horizontal curvature values to crash points
- Performed preliminary statistical analysis on crash data
- Started draft report

H. PROBLEMS ENCOUNTERED (If any):

- Latest delivery of Fugro vertical curves (24 March 2014) are in profile view instead of plan view

I. TECHNOLOGY TRANSFER ACTIVITIES:

N/A

J. PERCENT COMPLETION OF TOTAL PROJECT: 40%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Continue QA/QC of Fugro data through course of analysis
- Complete assignment of roadway feature data to crash points
- Perform QA/QC on roadway feature data assignment methods and results
- Finalize development of spatial statistical models
- Perform spatial statistical modelling
- Perform QA/QC of spatial statistical modelling
- Complete draft report
- Submit draft report to TAC for review

Progress report prepared by: Sean Neely

Date Prepared: 8 April 2014

Quantifying the Vulnerability of Vermont Bridges to Seismic Loading QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 737 Quantifying the Vulnerability of Vermont Bridges to Seismic Loading

B. PRINCIPAL INVESTIGATOR(s):

Mandar Dewoolkar, Ph.D., P.E.
Associate Professor
School of Engineering - University of Vermont
(802) 656 1942

Eric Hernandez, Ph.D.
Assistant Professor
School of Engineering - University of Vermont
(802) 656-3331

C. START AND END DATE (per grant assignment): May 15, 2013 – May 31, 2016.

D. ANTICIPATED COMPLETION DATE: May 31, 2016

E. PROJECT OBJECTIVES: The overarching objective of this research is to assist the Agency in establishing a methodology for the seismic assessment of their inventory of bridges; that is, to provide a rational basis for ranking their bridges according to their seismic vulnerability in consideration of variations in seismicity, foundation, terrain, and geologic conditions, and structure type, age and importance. The specific objectives are to: (1) review and update Agency's bridge inventory; (2) conduct a thorough literature review on seismic vulnerability ranking of bridges; (3) develop an appropriate seismic vulnerability ranking system for Vermont bridges and slopes associated with bridges; (4) assign and validate the rankings by conducting thorough seismic analysis of select bridge sites; and (5) prepare training materials and final report to assist Agency personnel in the upkeep of the inventory and rating system for retrofitted and new bridges.

F. REPORT PERIOD: 2014 Q2

G. ACCOMPLISHMENTS THIS PERIOD:

Examined and used the Vermont NBI database as part of the vulnerability ranking system to be developed for VTrans. Performed a preliminary evaluation of the seismic vulnerability of the entire state bridge inventory using the NBI VT 2012 database via a modified version of the New York State Department of Transportation (NYSDoT) seismic vulnerability screening model. Presented a

summary of these preliminary screening findings to VTrans as illustrated in a poster session at the ASCE Structures Congress on April 3, 2014 in Boston.

In progress are a review and summary of published literature on seismic vulnerability rating and recommendations for a rating system to use in Vermont.

H. PROBLEMS ENCOUNTERED (If any): None to date.

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. PERCENT COMPLETION OF TOTAL PROJECT: 28%

K. ACTIVITIES PLANNED FOR NEXT QUARTER: The literature review and corresponding summary preparation will continue along with analysis to support recommending a seismic vulnerability rating system to be used by VTrans.

Progress report prepared by: John Lens and Mandar Dewoolkar

Date Prepared: April 15, 2013

Demonstration and Purchase of PG Binder Testing Equipment QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 905 Demonstration and Purchase of PG Binder Testing Equipment

B. PRINCIPAL INVESTIGATOR(s):

Troy Lawson
Asphalt & Hot Mix Unit
Materials and Research

C. START AND END DATE (per grant assignment): December 15, 2013 – September 3, 2014.

D. ANTICIPATED COMPLETION DATE: September 3, 2014

E. PROJECT OBJECTIVES: Materials and Research initiated an effort to procure the same PG Binder lab equipment that it acquired earlier in a Pooled Fund Project. The Pooled Fund project was a New England wide project where the New England states would use the same testing equipment to unify the testing processes and for comparisons. With the pooled fund project terminating early, this effort was initiated to complete the equipment acquisition.

F. REPORT PERIOD: 2014 Q2

G. ACCOMPLISHMENTS THIS PERIOD:

Having two sets of equipment allows for more production and confidence. Results can be compared from one DSR to the other in addition to running the cal gel and temp sweep.

H. PROBLEMS ENCOUNTERED (If any):

The new PAV operates slightly differently than our first Prentex PAV, but once you adjust for that it is not a problem.

I. TECHNOLOGY TRANSFER ACTIVITIES: None

J. PERCENT COMPLETION OF TOTAL PROJECT: 95%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

To utilize the additional equipment to reduce turnaround time and increase production in the Binder lab.

**Progress report prepared by: Troy Lawson
Date Prepared: May 14, 2014**

Pavement Performance and Annualized Cost Study

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 921 Pavement Performance and Annualized Cost Study

B. PRINCIPLE INVESTIGATOR(S):

Wendy Ellis
Research Technician V
Vermont Agency of Transportation
2178 Airport Rd., Unit B
Berlin, VT 05641
Telephone: (802) 828-6918
Fax: (802) 828-2792

C. START AND END DATE (per grant assignment):

ongoing

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: To collect performance data from a comprehensive array of pavement rehabilitation techniques for the purpose of monitoring effectiveness and costs. The evaluation is centered upon those projects which have rehabilitated existing pavements with reclaimed base stabilization, cold recycled bituminous concrete, milling followed by overlay, and overlays. Projects have been selected from distinct microclimates representing the range of Vermont weather conditions. This project is vital to the ongoing success of our paving program. Findings from this study will be used to determine the most cost effective treatment based upon various factors including daily traffic, underlying soils and pavement profile, and roadway condition prior to any rehabilitation efforts.

F. REPORT PERIOD: 1-1-14 to 3-31-14

G. ACCOMPLISHMENTS THIS PERIOD:

- Remaining data was counted and entered in to the ongoing spreadsheet for cracking and rutting.
- Projects for the 2014 construction season were selected.

H. PROBLEMS ENCOUNTERED (If any): None

I. TECHNOLOGY TRANSFER ACTIVITIES: None

J. PERCENT COMPLETION OF TOTAL PROJECT: N/A

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Pre-construction information and documents for the 2014 construction projects selected for evaluation will be gathered.
- Pre-construction site visits will be conducted to document existing site conditions and distresses including rutting and various cracking.
- Annual site visits will be conducted.
- Any applicable preconstruction meetings will be attended.

Progress report prepared by: Wendy Ellis

Date Prepared: 4-30-14

An Assessment of Culvert Replacements Modified for Fish Passage

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:

SPR: 969 An Assessment of Culvert Replacements Modified for Fish Passage

B. PRINCIPLE INVESTIGATOR(s):

Wendy Ellis
Research Technician V
Vermont Agency of Transportation
2178 Airport Rd., Unit B
Berlin, VT 05641
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Fax: (802) 828-2792

C. START AND END DATE (per grant assignment):

2008-2013

D. ANTICIPATED COMPLETION DATE: *If different from the END DATE in paragraph C., the reason must be given.*

E. PROJECT OBJECTIVES: With over 50 modified culverts previously installed throughout the State of Vermont, the objective of this research project is to determine the effectiveness of fish passage restoration. An examination of representative fish passage structures will define the character, durability and stability of the constructed habitats and improved connectivity up and downstream of the culvert. In addition, the research project will evaluate the cost-effectiveness of these types of structures, including the timing of the natural bed load accumulation in the structure.

F. REPORT PERIOD: 1-1-14 to 3-31-14

G. ACCOMPLISHMENTS THIS PERIOD:

- Initial report draft is in review.

H. PROBLEMS ENCOUNTERED (If any): None

I. TECHNOLOGY TRANSFER ACTIVITIES: None

J. PERCENT COMPLETION OF TOTAL PROJECT: 90%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Reporting requirements will be worked on.

Progress report prepared by: Wendy Ellis

Date Prepared: 4-30-14

**PERFORMANCE MONITORING OF JOINTLESS BRIDGES – PHASE III
QUARTERLY REPORT**

A. PROJECT NUMBER AND TITLE: Performance Monitoring of Jointless Bridges – Phase III
SPR: 986

B. PRINCIPLE INVESTIGATOR(s): UMass professors Scott Civjan and Sergio Brena

C. START AND END DATE: **Start:** October 5, 2007 **End:** May 31, 2014

D. ANTICIPATED COMPLETION DATE: May 31, 2014

E. PROJECT OBJECTIVES:

The objectives of this research project are to increase the knowledge base of VTrans' engineers and answer as many design and construction related questions as possible while 1) providing appropriate documentation of the research, 2) outlining current performance issues, and 3) providing recommendations for the design and construction of jointless bridges.

F. REPORT PERIOD: January 1, 2014 to March 31, 2014

G. ACCOMPLISHMENTS THIS PERIOD:

- 1) Routine data downloads.
- 2) All plots have been updated for the instrumentation data collected to date.
- 3) A final draft report has been issued to VTrans for review
- 4) Cost proposals for various options of continued monitoring were prepared by UMass and given to VTrans for review and discussion.
- 5) VTrans has decided on a minimum proposal to keep data collection ongoing. VTrans will assume responsibility for regular (3-4 times per year) downloads, and sending the data to UMass. UMass will update plots as necessary with no further reporting requirements.

H. PROBLEMS ENCOUNTERED (If any):

I. TECHNOLOGY TRANSFER ACTIVITIES:

- 1) The Consultant will present paper/presentation at TRB in Washington, D.C in Jan. 2014.
- 2) Abstract for paper, to the World Steel Bridge Symposium in Toronto, Canada (March 2014).
- 3) Engineering Structures journal to publish paper in November 2013.

J. PERCENT COMPLETION OF TOTAL PROJECT:

98% [\$634,612.65 of \$646,392 funds have been expended: Consultant Activities through March, 2014.]

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

Final report will be published, along with an updated Phase I interim report with VTrans' comments addressed. Download activities will transfer to VTrans, with a training session to be

**PERFORMANCE MONITORING OF JOINTLESS BRIDGES – PHASE III
QUARTERLY REPORT**

held between Brooke Quinn, UMass graduate student, and Joe Staab, Eric Denardo, and Jason Tremblay of Materials and Research.

Progress report prepared by: Jason P. Tremblay **Date Prepared:** May 7, 2014

TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Date: 3/31/2014

Lead Agency (FHWA or State DOT): Vermont Agency of Transportation

INSTRUCTIONS:

Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # <i>(i.e., SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX))</i> TPF-5(222)		Transportation Pooled Fund Program - Report Period: <input checked="" type="checkbox"/> Quarter 1 (January 1 – March 31) <input type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 1 – December 31)	
Project Title: New England Transportation Consortium (VI)			
Name of Project Manager(s): Bill Ahearn		Phone Number: 802-828-2561	E-Mail Bill.Ahearn@state.vt.us
Lead Agency Project ID: CA0306		Other Project ID (i.e., contract #): NETC 06-4 NETC 07-1 NETC 09-2 NETC 09-3 NETC 10-3	Project Start Date: 9/16/13 7/1/13 9/1/13 9/1/13 9/16/13
Original Project End Date: NETC 06-4 9/15/15 NETC 07-1 3/31/16 NETC 09-2 2/28/16 NETC 09-3 8/31/15 NETC 10-3 9/15/15		Current Project End Date: 9/15/15 3/31/16 2/28/16 8/31/15 9/15/15	Number of Extensions: 0 0 0 0 0

Project schedule status:

- On schedule
 On revised schedule
 Ahead of schedule
 Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
NETC 06-4 \$242,909	\$0	10%
NETC 07-1 \$198,154	\$3,380	15%
NETC 09-2 \$80,000	\$1,083	15%
NETC 09-3 \$165,000	\$39,217	55%
NETC 10-3 \$150,158	\$0	20%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter			Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
NETC 06-4	\$0	0%	\$0	27%
NETC 07-1	\$3,380	0%	\$0	26%
NETC 09-2	\$1,083	0.9%	\$683	19%
NETC 09-3	\$39,217	15.4%	\$25,452	27%
NETC 10-3	\$0	0%	\$0	27%

Project Description:

- 06-4 Preventative Maintenance and Timing of Applications
- 07-1 In-Place Response Mechanisms of Recycled Layers Due to Temperature and Moisture Variations
- 07-3 Determining Optimum Distance for a Lane Drop Downstream from a Signalized Intersection
- 09-2 Effective Establishment of Native Grasses on Roadsides
- 09-3 Advanced Composite Materials: Prototype Development and Demonstration
- 10-3 Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

06-4, UMass Dartmouth hosted the project Kick-Off Meeting on February 12th, 2014. UMass Dartmouth continued work on the literature review and internet survey.

07-1, The research team has begun testing on the two existing sites in NH. To date, the Warren Flats site has been tested on February 21 and on March 21. On both dates, thermistor data suggests that there was some temporary thawing down to about 5 inches beneath the top of pavement. In between those temporary thawing events, there have been refreezing events. Based upon forecast air temperatures and cumulative thawing indices, it is anticipated that the current thawing event (beginning March 28) is likely to continue with minimal or no refreezing. The first Kancamangus testing will thus likely be during early thaw conditions; frozen conditions will be tested in 2015. Testing of both the Warren Flats and Kancamangus sites will continue through the next quarter, to capture stiffness data during the thaw-weakened period as well as the recovery period. The research team has also been working with the ME DOT to identify an appropriate location for instrumentation on the PMRAP Waterford/Norway project.

09-2, Two investigators – Kuzovkina and Dreyer – attended the Ecological Landscape Symposium: New Directions in the American Landscape on January 9-10, 2014 at the Connecticut College Arboretum to gather relevant information for the Manual and to meet the practitioners in the field of ecological restoration. Kuzovkina and Schulthess conducted the candidate search and interviewing through the American Society for Horticultural Sciences for the Graduate Assistant position to work on this project. February 26, 2014 all co-PIs and candidate for the Graduate Assistant John Campanelli met with the practitioner Larry Weaner at the Connecticut College Arboretum to discuss the selection of native grasses for demonstration sites along Rt. 6 in Connecticut. January-March 2014 all co-PIs conducted the literature search to access all relevant information for the Manual. February-March 2014 – development of the specifications of native grass plantings for the demonstration sites. 5 March, 2014 – phone discussion with Colonial Seed LLC about the plant specifications for the demonstration sites. February-April 2014 communication with Dr. Rebecca Brown from the University of Rhode Island about the project: development of the bluestem ecotype study and discussion of the specifications for the demonstration sites. March 25, 2014 – Kuzovkina visited the University of Delaware to communicate with the colleagues – Susan Barton and Valann Budischak – working on similar DOT project in Delaware. Discussion about saw-dust establishment protocol. March 29-31, 2014 – John Campanelli initiated seed ordering from Ernst Conservation Co.

09-3, Draft specifications have been submitted to committee and vendors for review. Vendors are still providing feedback.

10-3, UMass Dartmouth hosted the project Kick-Off Meeting on February 7th, 2014. UMass Dartmouth conducted two phone meetings with two contractors (Palmer Paving - MA, & Tilcon - CT) who will produce mixtures for this study. Due to plant limitations, the batch plant mixtures may not be produced in 2014, but may be produced in 2015. The remaining mixtures are scheduled to be produced in late April or early May 2014. UMass Dartmouth will be on site during production for sampling and specimen production. A production information sheet was developed (also attached to this report) to be utilized to quantify the critical production parameters related to the mixtures. UMass Dartmouth updated the internet survey based on the comments obtained during the Kick-Off Meeting. Subsequently, UMass Dartmouth began the process of loading the surveys onto the internet system for solicitation of responses.

Anticipated work next quarter:

06-4, Continue working on Literature Review and Internet Survey.

07-1, The research team will be conducting tests on the two existing sites during the 2014 spring thaw period. The team will also work to finalize the selection of targeted test sites for installation of instrumentation during the 2014 construction season.

09-2, Continue the literature review, spring plantings of the demonstration plots and research experimental units as described in the proposal. Continue the discussions with the stakeholders to receive sufficient feedback about the project. Outline the precise species composition and establishment techniques. Planting and data collection.

09-3, Completion of approve specifications. Determine list of bridge projects that can be included for demonstrations. Vendor evaluation checklist to be submitted. Host vendor meetings with technical committee. Materials characterization of witness plates.

10-3, Complete Literature Review. Determine Critical Information. Work on WMA Technologies Selection Process, Identify Moisture Susceptibility Test, and Develop a Testing Matrix.

Significant Results:

None as of this reporting period.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

NETC 09-2 and 09-3 contracts were executed 6 weeks after the start date listed in the contract. This should not cause a significant delay in the project.

Potential Implementation:

The 5 research projects listed above are fairly new. Implementations of the results of those projects are not anticipated in the near future.

Project Number	Project Name	PI	Contract Execution Date	Start Date		End Date		Most Recent Quarterly Report Date =	Spent Burdget (as of most recent Quarterly Report)		Progress (as of most recent Quarterly Report)		Progress Broken Down by Task	
				Anticipated	Actual	Anticipated	Actual	3/31/2014	Anticipated	Actual	Anticipated	Actual		
05-5	Measurement of Adhesion Properties Between Topcoat Paint and Metalized/Galvanized Steel with Surface Energy Measurement Equipment	Sze Yang, URI	9/11/2008	3/1/2008	9/11/2008	8/31/2009	TBD	1. COMDOT transitioned contractual obligations to FHWA-CT. 2. The 400+ page appendix underwent significant reorganization at the completion of the project	\$ 125,000.00	\$ 125,000.00	\$ 124,895.54	100%	95%	
06-4	Preventative Maintenance and Timing of Applications	Walaa S. Mogawer, Umass	8/21/2013	9/16/2013	9/16/2013	9/15/2015	TBD		\$ 242,909.00	\$ 65,308.87	\$ -	27%	10%	Task 1: Kick-Off Meeting (100%) Task 2: Literature Review (10%) Task 3: Internet Survey (5%) Task 4: Assess Current Preventive Maintenance (PM) Practices in New England States (0%) Task 5: Development of Pavement Preventive Maintenance Procedures for New England (0%) Task 6: Laboratory and Field Testing (0%) Task 7: Determination of Feedback Mechanism (0%) Task 8: Development of Pavement Preventive Maintenance (PPM) Manual (0%) Task 9: Training (0%) Task 10: Preparation of the Final Report (0%)
07-1	In-Place Response Mechanisms of Recycled Layers Due to Temperature and Moisture Variations	Jo Sias Daniel, UNH	7/23/2013	7/1/2013	7/23/2013	3/31/2016	TBD	1. The PI originally listed a Project End Date beyond 4/2/16, which is the end date of UVM's contract to Coordinate NETC. The contract and proposal had to be revised accordingly.	\$ 198,154.00	\$ 50,648.32	\$ 3,380.03	26%	15%	Task 1: Conduct Survey and Identify Potential Test Sites (90%) Task 2: Select Test Sites and Develop Work Plan (80%) Task 3: Execution of Work Plan (10%) Task 4: Data Analysis (5%) Task 5: Final Report (0%)
09-2	Effective Establishment of Native Grasses on Roadsides	Julia Kuzovkina, Uconn	10/16/2013	9/1/2013	10/16/2013	2/28/2016	TBD	1. Uconn requested some revisions to the contractual language with respect to final financial reporting and insurance requirements.	\$ 80,000.00	\$ 15,352.60	\$ 1,083.20	19%	15%	Task1: Literature Review (20%) Task 2: Interviews (10%) Task 3: Field Inspections/Testing (15%) a. Select a suite of native grasses with the most potential for roadside establishment in New England b. Develop effective establishment protocols through modification of existing approaches Refinement of previously developed protocols Establishments of the demonstration plots c. Evaluate native grass tolerances and potential for degradation of roadside contaminants Final Task: Publication of a Manual
09-3	Advanced Composite Materials: Prototype Development and Demonstration	Roberto Lopez-Anido, UMaine	10/14/2013	9/1/2013	9/25/2013	8/31/2015	TBD	1. Umaine requested some revisions to the contractual language with respect to insurance requirements (and some other minor requests)	\$ 165,000.00	\$ 43,765.96	\$ 39,217.00	27%	55%	Task 1: Conduct review of typical bridge drain details that are representative in New England. (95%) Task 2: Develop standard drain requirements for new and rehabilitation projects (85%) Task 3: Identify and contact FRP composite manufacturers (100%) Task 4: Identify two or three bridges being constructed within New England where the FRP standard drains can be used. (10%) Task 5: Coordinate with field personnel at each of the bridge sites selected and document the installation (0%) Task 6: Document the FRP drain initial condition after installation (0%) Task 7: Prepare a final project report highlighting the outcomes of the research (0%)
10-3	Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology	Walaa S. Mogawer, Umass	8/21/2013	9/16/2013	9/16/2013	9/15/2015	TBD		\$ 150,158.00	\$ 40,371.70	\$ -	27%	20%	Task 1: Literature Review (25%) Task 2: Determine Critical Information (50%) Task 3: WMA Technologies Selection Process (15%) Task 4: Identify Moisture Susceptibility Test (0%) Task 5: Development of a Testing Matrix (50%) Task 6: Obtain Plant Produced Samples (5%) Task 7: Laboratory Testing of Plant Produced Samples (0%) Task 8: Prepare a Final Report (0%) Task 9: Execute Implementation Plan (0%)
13-1	Development of High Early Strength Connections for Accelerated Bridge Construction.	TBD	New Project						\$ 175,000.00	\$ -				
13-2	HMA Mixtures Containing Recycled Asphalt Shingles (RAS): Low Temperature and Fatigue Performance of Plant-Produced Mixtures	TBD	New Project						\$ 250,000.00	\$ -				
13-3	Improved Regionalization of Quality Assurance (QA) Functions	TBD	New Project						\$ 200,000.00	\$ -				

Note: Highlighted boxes are used to demonstrate which projects are either behind schedule or over budget. Keep in mind that the "Anticipated" columns are calculated by dividing the days the project has been open by the total length of the project. Seeing as some project schedules and budgets are either front loaded or end loaded, these estimates are not always accurate. If a box is highlighted, the PI has been contacted and asked to explain the deviation in more detail to ensure we stay on track.

**NEW ENGLAND TRANSPORTATION CONSORTIUM
QUARTERLY PROJECT PROGRESS REPORT**

A. PROJECT NUMBER AND TITLE:

NETC 06-4 “Preventative Maintenance and Timing of Applications”

B. PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S):

Dr. Walaa Mogawer, P.E. University of Massachusetts Dartmouth

C. WEB SITE ADDRESS (If one exists):

http://www.uvm.edu/~transctr/?Page=netc/netc_fy/netc_fy2006.php#netc064

D. START DATE (Per NETC Agreement): 9/16/2013

E. END DATE (Per NETC Agreement): 9/15/2015

F. ANTICIPATED COMPLETION DATE:

*If different from the END DATE in paragraph E., the reason must be given. It is the responsibility of the Principal Investigator to insure that the project, including review of the draft report by the Project Technical Committee and the printing of the Final Report, is completed prior to the Agreement End Date. Costs incurred after the Agreement End Date cannot be reimbursed. **Requests for extensions of the Agreement End Date must contain the reasons for the request and be submitted so as to arrive in the Coordinator’s office at least 90 days prior to the Agreement End Date.***

9/15/2015

G. 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.

H. REPORT PERIOD:

2014 Quarter 1 – January through March

I. ACCOMPLISHMENTS THIS PERIOD:

1. UMass Dartmouth hosted the project Kick-Off Meeting on February 12th, 2014. A DRAFT copy of the meeting minutes has been attached to this report. The meeting minutes contain a list of attendees, description of the meeting, and an overview of the discussions.
2. UMass Dartmouth continued work on the literature review and internet survey.

J. PROBLEMS ENCOUNTERED (If any):

None

K. TECHNOLOGY TRANSFER ACTIVITIES: *List any reports, papers, presentations published/presented during the report period or anticipated for the next quarter.*

None during the current period.

L. STATUS BY TASK: *Show Work Task Number, description and % complete for each task including those completed, those underway, and those not started.*

Task 1: Kick-Off Meeting (100%)

Task 2: Literature Review (10%)

Task 3: Internet Survey (5%)

Task 4: Assess Current Preventive Maintenance (PM) Practices in New England States (0%)

Task 5: Development of Pavement Preventive Maintenance Procedures for New England (0%)

Task 6: Laboratory and Field Testing (0%)

Task 7: Determination of Feedback Mechanism (0%)

Task 8: Development of Pavement Preventive Maintenance (PPM) Manual (0%)

Task 9: Training (0%)

Task 10: Preparation of the Final Report (0%)

M. PERCENT COMPLETION OF TOTAL PROJECT: 10%

N. ACTIVITIES PLANNED FOR NEXT QUARTER:

Hold Kick-Off Meeting. Start Literature Review. Start Internet Survey.

O. FINANCIAL STATUS:

As of: 12/31/13

Total Project Budget: \$ \$242,908.82

Total Expenditures: \$

Note: This report should not require more than 2-3 pages & should be e-mailed to the NETC Coordinator so as to arrive no later than three (3) working days after the end of each calendar quarter.

New England Transportation Consortium (NETC)

Project 06-4

“Preventive Maintenance and Timing of Applications”

Meeting Minutes – Kick-Off Meeting

February 12th, 2014 @ 10:00am

UMass Highway Sustainability Research Center (HSRC) Fall River MA

Attendees:

Dr. Wala S. Mogawer, P.E. - UMass HSRC – Project PI
David Peshkin, P.E. - Applied Pavement Technology (APT) [Project Consultant]
Amanda R. Hanaway-Corrente, P.E. - New England Transportation Consortium (NETC)
Paul Petsching, Rhode Island Department of Transportation (RIDOT)
Louis Allegro, Connecticut Department of Transportation (ConnDOT)
Mark Brum, Massachusetts Department of Transportation (MassDOT)
Deirdre (Dee) Nash, New Hampshire Department of Transportation (NHDOT)
Derek J. Nener-Plant, Maine Department of Transportation (MaineDOT)

Committee Members Unable to Attend:

Ted Domey, Vermont Agency of Transportation (VTrans)

Meeting Minutes:

The meeting began with a brief welcoming and introduction by Dr. Wala S. Mogawer, the Principal Investigator for NETC 06-4. Dr. Mogawer then introduced David Peshkin of Applied Pavement Technology who will be a consultant for this project and Amanda R. Hanaway-Corrente, P.E. the NETC coordinator who was also in attendance. Dr. Mogawer then conducted a presentation for the technical committee outlining the project on a task-by-task basis as outlined in the proposal. General discussions of the project and action plan items then ensued. The following outlines these discussions:

- The NETC coordinator stated that they would prefer that a working draft final report be updated and sent to the technical committee periodically throughout the project as opposed to one submission at the conclusion of the project. The UMass HSRC will attempt to supply the technical committee with updated working copies of the final report throughout the project.

Discussion Points

- The project consultant asked the technical committee if the focus of the project was on in-house or outsourced (contracted) pavement preservation treatments. The technical committee responded that the project should focus on contracted treatments.
- The project consultant then asked the technical committee if the type of contract (method specification versus performance based) was something that should be considered for this project. In a method specification contract the contractor is paid based on production and in-place properties of the specified treatment during construction. In a performance-based specification contract, the contractor will warranty the treatment post construction based on certain quantifiable pavement distress performance measures (quantity of cracks, surface texture, bleeding, etc.) over a specified period. The project consultant noted that performance based contracts are typically more expensive, due to the added risk for the contractor over the performance period. The technical committee responded that type of contract should be considered, with performance-based contract preferable. The project consultant noted that a

performance period of 1-2 years is typical. Longer performance periods may result in situations where contractors may not bid on the projects.

- MaineDOT asked that the project address how State DOTs can write contracts for treatments when a majority of treatments include proprietary products or processes. The UMass HSRC will attempt to address this topic in the literature review.
- Dr. Mogawer asked the technical committee to identify the contact persons at each DOT responsible for pavement preservation. The following outlines the initial responses of the technical committee members:

ConnDOT	Edgardo Block
MaineDOT	Derek J. Nener-Plant
NHDOT	Deirdre (Dee) Nash & Eric Thibodeau
RIDOT	Paul Petsching & Jose Lima
MassDOT	Ed Naras
VTrans	Unknown

- Dr. Mogawer asked the technical committee to identify any upcoming preservation treatment projects to be placed in 2014. MaineDOT stated that they were placing ultra-thin bonded course on I95 and hot-in-place recycling on other projects. NHDOT stated that they were utilizing NovaChip, asphalt rubber chip seals, cold-in-place recycling, and conventional chip seals. ConnDOT thought they were placing a stress absorbing membrane interlayer (SAMI) followed by a thin overlay. RIDOT may be placing rubberized chip seals and paver placed elastomeric surface treatment (PPEST). Dr. Mogawer asked each committee member to supply the following information for each project:
 - Road Identification
 - Traffic Volume and Type
 - Treatment Being Placed
 - Existing Roadway Condition (Distresses in Severity and Extent or PCI)
- The project consultant noted that Massachusetts, Maine and Rhode Island are scheduled to place pavement preservation treatments for high volume roads (Urban ADT>10,000) in 2014 for SHRP 2 R26 project “Preservation Approaches For High-Traffic-Volume Roadways And Guidelines For Preservation Of High-Traffic-Volume Roadway.” The UMass HSRC will follow up with the selected DOTs to see if these treatment placements could be utilized for this project.
- Dr. Mogawer asked the technical committee to identify treatments to be used and those to omit from the study. There was no preference noted by the technical committee. Dr. Mogawer asked the project consultant for suggestions of new treatments that should be considered for use in the project. The project consultant identified the following treatments: microsurfacing for enhanced flexibility through the use of fibers and softer binders, hot-in-place recycling, cold-in-place recycling, NovaChip type materials, and crack sealing.
- Dr. Mogawer asked the technical committee to identify the manual/methodology to quantify existing pavement condition and methods to select roads for preservation. The following outlines the initial responses of the technical committee members:

ConnDOT	For roads resurfaced in the last five years, ConnDOT utilizes extensive video archives and analyzes potential roadway distresses via this video year-to-year for comparisons of distress. This is followed by a site visit by experienced personnel who make the final decision.
MaineDOT	Utilizes IRI and rutting data which are then used to prioritize projects.
NHDOT	Utilizes experience and only considers roads resurfaced in the last five years.
RIDOT	Uses the SHRP manual to quantify distresses. RIDOT further stated that all New England states utilize dTIMS software for pavement management activities.
MassDOT	Uses a MassDOT specific manual to quantify distresses.
VTrans	Unknown

Action Plan

- MaineDOT suggest the UMass HSRC contact the National Center for Pavement Preservation (NCP) to get a distribution list for the internet survey to be developed in this project.
- The project consultant suggested contacting local contractors in the region to see if there are any new treatment products available. The technical committee agreed. The UMass HSRC will contact some regional contractors to see if any new treatments are available.

**NEW ENGLAND TRANSPORTATION CONSORTIUM
QUARTERLY PROJECT PROGRESS REPORT**

A. PROJECT NUMBER AND TITLE:

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

B. PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S):

Jo Sias Daniel, Ph.D., P.E., Department of Civil Engineering, University of New Hampshire

C. WEB SITE ADDRESS (If one exists):

<http://www.unh.edu/civil-engineering/materials>
http://www.uvm.edu/~transctr/?Page=netc/netc_fy/netc_fy2007.php#netc071

D. START DATE (Per NETC Agreement):

7/1/2013

E. END DATE (Per NETC Agreement):

3/31/2016

F. ANTICIPATED COMPLETION DATE:

*If different from the END DATE in paragraph E., the reason must be given. It is the responsibility of the Principal Investigator to insure that the project, including review of the draft report by the Project Technical Committee and the printing of the Final Report, is completed prior to the Agreement End Date. Costs incurred after the Agreement End Date cannot be reimbursed. **Requests for extensions of the Agreement End Date must contain the reasons for the request and be submitted so as to arrive in the Coordinator’s office at least 90 days prior to the Agreement End Date.***

3/31/2016

G. PROJECT OBJECTIVES:

The main objectives of this research are to:

- Determine the in-place properties of pavement cross-sections containing recycled materials common to the New England region
- Relate changes in those properties to variations in temperature and moisture, particularly during the spring thaw period

H. REPORT PERIOD:

2014 Quarter 1 – January through March

I. ACCOMPLISHMENTS THIS PERIOD:

The research team has begun testing on the two existing sites in NH. To date, the Warren Flats site has been tested on February 21 and on March 21. On both dates, thermistor data suggests that there was some temporary thawing down to about 5 inches beneath the top of pavement. In between those temporary thawing events, there have been refreezing events. The interpolated frost and thaw depths measured at the Warren Flats site through March 29 are shown in Figure 1 below. Based upon forecast air temperatures and cumulative thawing indices, it is anticipated that the current thawing event (beginning March 28) is likely to continue with minimal or no refreezing. The first Kancamangus testing will thus likely be during early thaw conditions; frozen conditions will be tested in 2015. Testing of both the Warren Flats and Kancamangus sites will continue through the next quarter, to capture stiffness data during the thaw-weakened period as well as the recovery period.

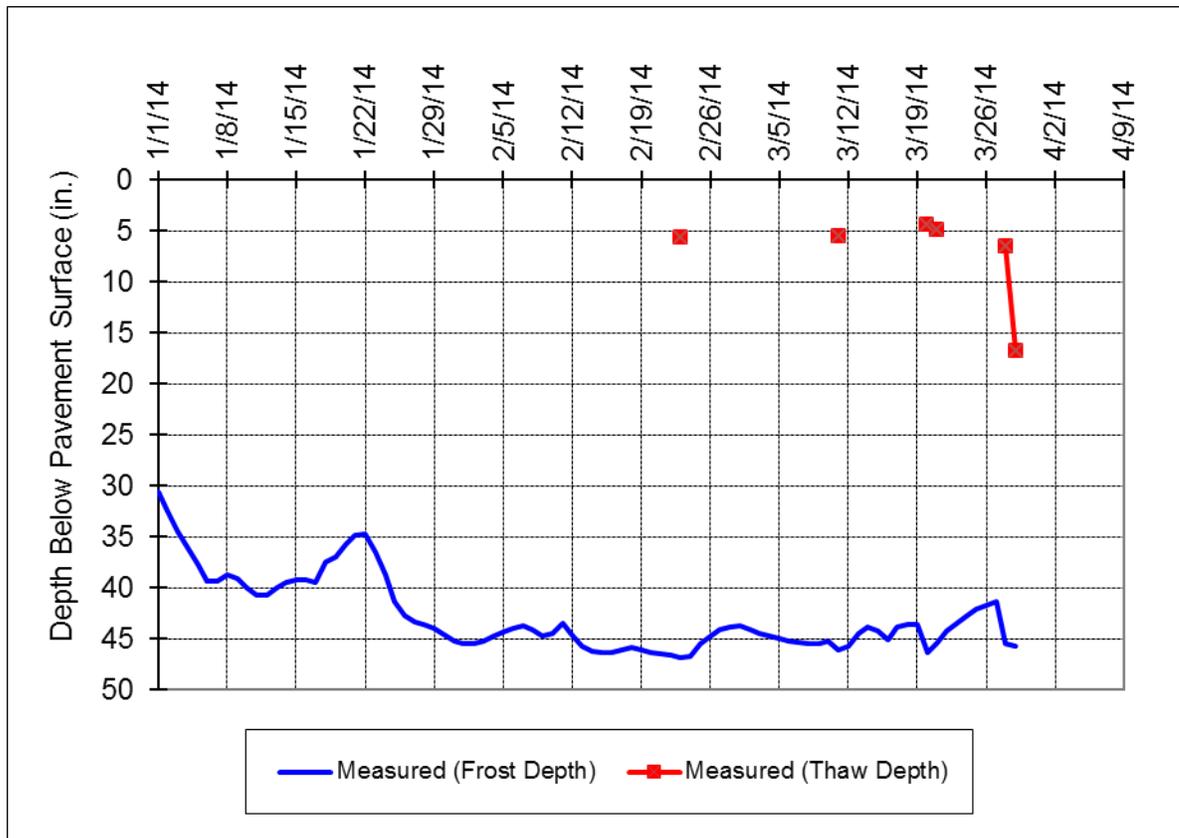


Figure 1. Frost and Thaw Depth Data from Warren Flats Site

The research team has also been working with the ME DOT to identify an appropriate location for instrumentation on the PMRAP Waterford/Norway project.

J. PROBLEMS ENCOUNTERED (If any):

The research team had planned on an additional instrumentation site in Caratunk, ME; however, this construction will not happen until the 2016 season. The research team is in the process of identifying one more instrumentation site for 2014.

K. TECHNOLOGY TRANSFER ACTIVITIES: *List any reports, papers, presentations published/presented during the report period or anticipated for the next quarter.*

None during the current period.

L. STATUS BY TASK: *Show Work Task Number, description and % complete for each task including those completed, those underway, and those not started.*

Task 1: Conduct Survey and Identify Potential Test Sites (90%)

Task 2: Select Test Sites and Develop Work Plan (80%)

Task 3: Execution of Work Plan (10%)

Task 4: Data Analysis (5%)

Task 5: Final Report (0%)

M. PERCENT COMPLETION OF TOTAL PROJECT: 15%

N. ACTIVITIES PLANNED FOR NEXT QUARTER:

The research team will be conducting tests on the two existing sites during the 2014 spring thaw period. The team will also work to finalize the selection of targeted test sites for installation of instrumentation during the 2014 construction season.

O. FINANCIAL STATUS:

As of: 3/31/14

Total Project Budget: \$ 198,154

Total Expenditures : \$ 3,420

Note: This report should not require more than 2-3 pages & should be e-mailed to the NETC Coordinator so as to arrive no later than three (3) working days after the end of each calendar quarter.

**NEW ENGLAND TRANSPORTATION CONSORTIUM
QUARTERLY PROJECT PROGRESS REPORT**

A. PROJECT NUMBER AND TITLE:

NETC 09-2: “Effective Establishment of Native Grasses on Roadsides”

B. 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

C. WEB SITE ADDRESS (If one exists):

D. START DATE (Per NETC Agreement): 09/1/2013

E. END DATE (Per NETC Agreement): 02/28/2016

F. ANTICIPATED COMPLETION DATE: 02/28/2016

If different from the END DATE in paragraph E., the reason must be given. It is the responsibility of the Principal Investigator to insure that the project, including review of the draft report by the Project Technical Committee and the printing of the Final Report, is completed prior to the Agreement End Date. Costs incurred after the Agreement End Date cannot be reimbursed. Requests for extensions of the Agreement End Date must contain the reasons for the request and be submitted so as to arrive in the Coordinator’s office at least 90 days prior to the Agreement End Date.

G. 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.

A. REPORT PERIOD: 1/1/2014 - 03/31/2014

B. ACCOMPLISHMENTS THIS PERIOD:

The following activities were implemented during this reporting period:

Two investigators – Kuzovkina and Dreyer – attended the Ecological Landscape Symposium: New Directions in the American Landscape on January 9-10, 2014 at the Connecticut College Arboretum to gather relevant information for the Manual and to meet the practitioners in the field of ecological restoration.

Kuzovkina and Schulthess conducted the candidate search and interviewing through the American Society for Horticultural Sciences for the Graduate Assistant position to work on this project.

February 26, 2014 all co-PIs and candidate for the Graduate Assistant John Campanelli met with the practitioner Larry Weaner at the Connecticut College Arboretum to discuss the selection of native grasses for demonstration sites along Rt. 6 in Connecticut.

January-March 2014 all co-PIs conducted the literature search to access all relevant information for the Manual.

February-March 2014 – development of the specifications of native grass plantings for the demonstration sites.

5 March, 2014 – phone discussion with Colonial Seed LLC about the plant specifications for the demonstration sites.

February-April 2014 communication with Dr. Rebecca Brown from the University of Rhode Island about the project: development of the bluestem ecotype study and discussion of the specifications for the demonstration sites.

March 25, 2014 – Kuzovkina visited the University of Delaware to communicate with the colleagues – Susan Barton and Valann Budischak – working on similar DOT project in Delaware. Discussion about saw-dust establishment protocol.

March 29-31, 2014 – John Campanelli initiated seed ordering from Ernst Conservation Co.

C. PROBLEMS ENCOUNTERED (If any):

No problems were encountered during this reporting period.

D. TECHNOLOGY TRANSFER ACTIVITIES: *List any reports, papers, presentations published/presented during the report period or anticipated for the next quarter.*

No technology transfer activities are reported for this period.

E. STATUS BY TASK: *Show Work Task Number, description and % complete for each task including those completed, those underway, and those not started.*

Task1: Literature Review

Research the information resources to provide a synthesis of the knowledgebase relevant to the establishment and management of native grasses and forbs in New England. This literature review will survey scholarly articles, books, working papers and other relevant sources (dissertations, conference proceedings), providing a description, summary, and critical evaluation of the materials to determine which information sources make a significant contributions to the understanding of the topic of the potential of native grasses for roadside planting.

20% complete

Task 2: Interviews

Develop a questionnaire to invite New England DOT's to be the target audience to evaluate the current status of the use of native and exotic plants on roadsides, to assess the interest level in using native species, and to examine the likelihood of roadside managers adopting this approach.

10% complete

Task 3: Field Inspections/Testing

Identify native species with the best potential for roadside plantings in New England; identify ecotypes which should be recommended for New England. Develop effective establishment protocols through modification of existing approaches. Evaluate native grass tolerances and potential for degradation of roadside contaminants

15% complete

F. PERCENT COMPLETION OF TOTAL PROJECT: 15%

G. ACTIVITIES PLANNED FOR NEXT QUARTER:

Continue the literature review, spring plantings of the demonstration plots and research experimental units as described in the proposal. Continue the discussions with the stakeholders to receive sufficient feedback about the project. Outline the precise species composition and establishment techniques. Planting and data collection.

H. FINANCIAL STATUS:

As of: *Month, Day, Year*

Total Project Budget: \$ 80,000

Total Expenditures : \$ 400

Note: This report should not require more than 2-3 pages & should be e-mailed to the NETC Coordinator so as to arrive no later than three (3) working days after the end of each calendar quarter.

NEW ENGLAND TRANSPORTATION CONSORTIUM
QUARTERLY PROJECT PROGRESS REPORT

A. PROJECT NUMBER AND TITLE: NETC 09-03: Advanced Composite Materials in New England's Transportation Infrastructure: Design, Fabrication and Installation of ACM Bridge Drain System

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

C. WEB SITE ADDRESS: *www.composites.umaine.edu*

D. START DATE: September 1, 2013

E. END DATE (Per NETC Agreement): August 31, 2015

F. ANTICIPATED COMPLETION DATE: Same as End Date

If different from the END DATE in paragraph E., the reason must be given. It is the responsibility of the Principal Investigator to insure that the project, including review of the draft report by the Project Technical Committee and the printing of the Final Report, is completed prior to the Agreement End Date. Costs incurred after the Agreement End Date cannot be reimbursed. Requests for extensions of the Agreement End Date must contain the reasons for the request and be submitted so as to arrive in the Coordinator's office at least 90 days prior to the Agreement End Date.

G. 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.

H. REPORT PERIOD: 1/1/2014 to March 31, 2014

I. ACCOMPLISHMENTS THIS PERIOD:

- Draft specifications have been submitted to committee and vendors for review
 - Vendors are still providing feedback.

J. PROBLEMS ENCOUNTERED (If any): None

K. TECHNOLOGY TRANSFER ACTIVITIES: *List any reports, papers, presentations published/presented during the report period or anticipated for the next quarter.*

None completed or anticipated for next quarter.

L. STATUS BY TASK: *Show Work Task Number, description and % complete for each task including those completed, those underway, and those not started.*

Task	Percent of project	Percent complete
1 - Review of typical bridge drains	10%	95%
2- Develop standard drain requirements	40%	85%
3 - Identify and contact FRP manufacturers	10%	100%
4 -Identify demonstration bridges	10%	10%
5 - Coordinate installation at demonstration bridges	10%	0%
6 - Document drain condition after installation	10%	0%
7 - Prepare final report	10%	0%
	100%	54.5%

M. PERCENT COMPLETION OF TOTAL PROJECT: 54.5%

N. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Completion of approve specifications.
- Determine list of bridge projects that can be included for demonstrations.
- Vendor evaluation checklist to be submitted.
- Host vendor meetings with technical committee
- Materials characterization of witness plates

O. FINANCIAL STATUS:

As of: *March 31, 2014*

Total Project Budget: \$ 165,000

Total Expenditures: \$ 39,217

Note: This report should not require more than 2-3 pages & should be e-mailed to the NETC Coordinator so as to arrive no later than three (3) working days after the end of each calendar quarter.

**NEW ENGLAND TRANSPORTATION CONSORTIUM
QUARTERLY PROJECT PROGRESS REPORT**

A. PROJECT NUMBER AND TITLE:

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

B. PRINCIPAL INVESTIGATOR(S) & UNIVERSITY(S):

Professor Walaa S. Mogawer, PE, F.ASCE, Highway Sustainability Research Center (HSRC), University of Massachusetts

C. WEB SITE ADDRESS (If one exists):

http://www.uvm.edu/~transctr/?Page=netc/netc_fy/netc_fy2010.php#netc103

D. START DATE (Per NETC Agreement):

9/16/2013

E. END DATE (Per NETC Agreement):

9/15/2015

F. ANTICIPATED COMPLETION DATE:

*If different from the END DATE in paragraph E., the reason must be given. It is the responsibility of the Principal Investigator to insure that the project, including review of the draft report by the Project Technical Committee and the printing of the Final Report, is completed prior to the Agreement End Date. Costs incurred after the Agreement End Date cannot be reimbursed. **Requests for extensions of the Agreement End Date must contain the reasons for the request and be submitted so as to arrive in the Coordinator’s office at least 90 days prior to the Agreement End Date.***

9/15/2015

G. 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, as described later in the proposal, 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.

H. REPORT PERIOD:

2014 Quarter 1 – January through March

I. ACCOMPLISHMENTS THIS PERIOD:

1. UMass Dartmouth hosted the project Kick-Off Meeting on February 7th, 2014. A DRAFT copy of the meeting minutes has been attached to this report. The meeting minutes contain a list of attendees, description of the meeting, and an overview of the discussions.
2. UMass Dartmouth conducted two phone meetings with two contractors (Palmer Paving - MA, & Tilcon - CT) who will produce mixtures for this study. Based on these conversations, UMass Dartmouth developed a production matrix as shown below:

Plant Type	% Binder Replaced	WMA Type								
		Organic			Chemical			Foam		
		WMA Dosage			WMA Dosage			WMA Dosage		
		Typical	Typical+0.25%	Typical-0.25%	Typical	Typical+0.25%	Typical-0.25%	Typical	Typical+0.25%	Typical-0.25%
Drum	0	X	-	-	X	-	-	X	-	-
	1.5	X	X	X	X	X	X	X	X	X
	2.0	X	X	X	X	X	X	X	X	X
	2.5	X	X	X	X	X	X	X	X	X
Batch	0	X	-	-	X	-	-	X	-	-
	1.5	X	X	X	X	X	X	X	X	X
	2.0	X	X	X	X	X	X	X	X	X

Due to plant limitations, the batch plant mixtures may not be produced in 2014, but may be produced in 2015. The remaining mixtures are scheduled to be produced in late April or early May 2014. UMass Dartmouth will be on site during production for sampling and specimen production. A production information sheet was developed (also attached to this report) to be utilized to quantify the critical production parameters related to the mixtures.

3. UMass Dartmouth updated the internet survey based on the comments obtained during the Kick-Off Meeting. Subsequently, UMass Dartmouth began the process of loading the surveys onto the internet system for solicitation of responses.

J. PROBLEMS ENCOUNTERED (If any):

None

K. TECHNOLOGY TRANSFER ACTIVITIES: *List any reports, papers, presentations published/presented during the report period or anticipated for the next quarter.*

None during the current period.

L. STATUS BY TASK: *Show Work Task Number, description and % complete for each task including those completed, those underway, and those not started.*

- Task 1: Literature Review (25%)
- Task 2: Determine Critical Information (50%)
- Task 3: WMA Technologies Selection Process (15%)

- Task 4: Identify Moisture Susceptibility Test (0%)
- Task 5: Development of a Testing Matrix (50%)
- Task 6: Obtain Plant Produced Samples (5%)
- Task 7: Laboratory Testing of Plant Produced Samples (0%)
- Task 8: Prepare a Final Report (0%)
- Task 9: Execute Implementation Plan (0%)

M. PERCENT COMPLETION OF TOTAL PROJECT: 20%

N. ACTIVITIES PLANNED FOR NEXT QUARTER:

Complete Literature Review. Determine Critical Information.

O. FINANCIAL STATUS:

As of: 03/31/14

Total Project Budget: \$ 150,157.70

Total Expenditures : \$ 0

Note: This report should not require more than 2-3 pages & should be e-mailed to the NETC Coordinator so as to arrive no later than three (3) working days after the end of each calendar quarter.

New England Transportation Consortium (NETC)

Project 10-3

“Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology”

Meeting Minutes – Kick-Off Meeting

February 7th, 2014 @ 10:00am

UMass Highway Sustainability Research Center (HSRC) Fall River MA

Attendees:

Dr. Walaa S. Mogawer, P.E. UMass HSRC – Project PI
Mr. Denis M. Boisvert, New Hampshire Department of Transportation (NHDOT)
Mr. Bryan Engstrom, Massachusetts Department of Transportation (MassDOT)
Mr. David J. Kilpatrick, Connecticut Department of Transportation (ConnDOT)
Mr. Richard Bradbury, Maine Department of Transportation (MaineDOT)

Committee Members Unable to Attend:

Mr. Mike Byrne, Rhode Island Department of Transportation

Meeting Minutes:

The meeting began with a brief welcoming and introduction by Dr. Walaa Mogawer (Principal Investigator for NETC 10-3). Dr. Mogawer then conducted a presentation for the technical committee outlining the project on a task-by-task basis as outlined in the proposal. Dr. Mogawer also supplied the technical committee with a draft copy of questions to be included in the State DOT and Contractor surveys to be conducted in Task 2 “Determine Critical RAP & WMA Information” for the approval. General discussions of the project and action plan items then ensued. The following outlines these discussions:

- It was asked what is considered a high amount of RAP. Dr. Mogawer suggested this would be a RAP content relating to 2.5% binder replaced (approximately 40% RAP). ConnDOT suggested defining what is considered a high amount of RAP on the surveys. The UMass HSRC will adjust the survey language accordingly.
- ConnDOT asked if both contractors will utilize the same WMA technologies. Dr. Mogawer replied that the contractors will utilize the WMA technologies that they are familiar with as long as they are on the approved NEAUPG list. Dr. Mogawer further reiterated that the aggregate sources between the two contractors will be different and an attempt will be made to keep the WMA utilized between the two contractors the same if the plant capabilities allow for it. This will be done in an effort to minimize the project variables.

Discussion Points

- All committee members noted that they specify WMA technologies on the NEAUPG approved list. No new WMA technologies for inclusion in the study were presented. NHDOT noted that typically only foaming WMA is utilized in New Hampshire unless otherwise specified. NHDOT will supply the UMass HSRC with the latest version of the NEAUPG list.
- ConnDOT would like a third contractor from the New England states to produce mixtures for this study. The UMass HSRC will follow up with other contractors. Additionally, MaineDOT offered to contact contractors in their area.

- MassDOT would like to limit all foaming WMA to mechanical foaming devices as opposed to foaming based additives like Advera. There was no disagreement from other committee members regarding this proposal.
- Discussion about the specific laboratory moisture and low temperature cracking tests were brief as the final selection will be made in a future meeting. As of this meeting, the moisture tests in consideration were the E* ratio, Hamburg Wheel Tracking Device test, and AASHTO T283. MassDOT noted that they are phasing out AASHTO T283 in lieu of the HWTD. MaineDOT noted that AASHTO AMRL is developing a replacement for AASHTO T283 involving the use of the AMPT. This replacement test may be similar to the E* ratio test proposed. The low temperature tests in consideration were the TSRST and IDT. Dr. Mogawer noted that there is much data to suggest that the IDT does not correlate well with the binder low temperature grade. Thus IDT may only be performed on select mixtures in this study until it is clear if the low temperature cracking predictions using the IDT data correlate well with the binder low temperature grade.
- Either a 9.5mm or 12.5mm mixture was proposed for this study. MassDOT stated that they prefer 12.5mm mixtures. There was no opposition from the other committee members, thus it will be attempted to make all mixtures 12.5mm NMAS.
- NHDOT inquired about how moisture content will be varied and measured. Dr. Mogawer stated that the exact methodology will be determined after discussion with the two contractors (Palmer Paving - MA, & Tilcon - CT) that will take place within the next two weeks. Additionally information collected during the surveys will also be utilized.
- ConnDOT asked if the literature review showed any new test or information related to this project. Dr. Mogawer explained that there is a new method to using Atomic Force Microscopy (AFM) to determine the degree of blending between RAP and virgin binders. This method is in its infancy and will likely not be used for this project.
- MaineDOT asked if sampling of foamed mixtures at the plant and on-site will be done in an effort to quantify the moisture content or moisture susceptibility. Dr. Mogawer explained that mixtures will be sampled at each location to evaluate the moisture susceptibility of the mixture, not moisture content.
- MaineDOT suggested, in addition to normal production information, that bin (batch plant), stack, and bag house temperatures also be documented during production. The UMass HSRC will attempt to get this data as well.
- ConnDOT asked if the produced mixtures will be placed and cataloged for field monitoring purposes. Dr. Mogawer responded that this is unlikely because these mixtures will not likely be placed for DOT projects. However, the location of the mixtures will be documented in case funding is available for monitoring the field performance.
- MaineDOT suggested to start with a typical RAP moisture content in New England as a base value, then adjust moisture content up from that starting point. Also it was suggested to reword the survey to ask what a typical RAP moisture content is rather than allowable moisture content. The UMass HSRC will revise the surveys accordingly.
- NHDOT suggested to ask the contractors if they can produce a dry batch of aggregate and RAP to determine if the elevated temperature of the heated virgin aggregate sufficiently dries out the moisture in the RAP prior to adding the binder. Maine DOT believed this would be feasible at both plant types. NHDOT further suggested that this should be completed first at the highest RAP and moisture content.

The theory being if the RAP is sufficiently dried at the maximum amount and moisture content, there would be no further need to explore the moisture content variable as all the moisture will be removed. This would eliminate some production/experimental work and also further help isolate any moisture effects from foaming WMA processes. The UMass HSRC will explore this idea with the contractors.

Action Plan

- The UMass HSRC will edit the State DOT and Contractor surveys based on the kick-off meeting discussion and then post them for solicitation of responses. Once responses are received, the UMass HSRC will begin tabulation of responses.
- The UMass HSRC will meet with two contractors (Palmer Paving - MA, & Tilcon - CT) within the next two weeks to discuss production of the mixtures for this study. The dry batch experiment suggested by NHDOT will also be explored.
- The UMass HSRC will send out a DRAFT testing plan in March/April 2014 for committee approval.

The next meeting for this project will be scheduled to discuss the final testing matrix and laboratory testing plan. This meeting will be scheduled after all the details of the plant production are determined.

ENTER Mixture ID Here		Production Sheet for NETC 10-3																													
		Company:										Date:																			
		City:					Inspector:																								
COMPONENT MATERIALS		Plant ID		Stockpile Check																											
(d) = Drum Mix Plant Only				Stone: <input type="checkbox"/>				Fine Agg: <input type="checkbox"/>				RAP: <input type="checkbox"/>																			
(b) = Batch Plant Only																															
		Bin Number		Moisture %		Name and City of Aggregate Producer																									
Coarse Aggregate		inch stone																													
		inch stone																													
		inch stone																													
		inch stone																													
Fine Aggregate Blend		% Screenings																													
		% Stone Sand																													
		% Sand																													
RAP:		inch				Mineral Filler % and Kind:																									
RAP:		inch		%PGAB		Special Material:																									
PGAB:				Refineries &																											
WMA Type:																															
WMA Dosage:																															
ANTI-STRIP:		% of PGAB & Manufacturer:								Silicone:		oz. per		gals PGAB																	
MIX: ENTER MIX ID		2"		1.5"		1"		3/4"		1/2"		3/8"		#4		#8		#16		#30		#50		#100		#200		PGAB			
PLANT: d		PGAB:		50mm		37.5mm		25mm		19mm		12.5mm		9.5mm		4.75mm		2.36mm		1.18mm		0.6mm		0.3mm		0.15mm		75µm		%	
JMF DATE:																															
RAP%:		Size:																													
Time:				lbs. / tph		Batch <input type="checkbox"/>		Drum <input checked="" type="checkbox"/>		Ran auto. <input type="checkbox"/>		w / printer <input type="checkbox"/>																			
%Voids:		G _{mm} :		Bin % of mix		1) 0		2) 0		3) 0		0.00		4) 0.00		5) 0		6) 0													
Production Parameters																															
Lot - Sublot #				Aggregate Temperature:				°F/°C				Stack Temperature:				°F/°C															
Weather:				RAP Temperature:				°F/°C				Baghouse Temperature:				°F/°C															
Temperature:				RAP Moisture Content:				%				Silo Storage Time:				°F/°C															
Time:				Dry Mixing Time:				Sec.				Discharge Temperature:				hrs.															
Date:				Wet Mixing Time:				Sec.				Compaction Temperature:				°F/°C															
				Bin Temperature (Batch):				°F/°C																							
Lot - Sublot #				Aggregate Temperature:				°F/°C				Stack Temperature:				°F/°C															
Weather:				RAP Temperature:				°F/°C				Baghouse Temperature:				°F/°C															
Temperature:				RAP Moisture Content:				%				Silo Storage Time:				°F/°C															
Time:				Dry Mixing Time:				Sec.				Discharge Temperature:				hrs.															
Date:				Wet Mixing Time:				Sec.				Compaction Temperature:				°F/°C															
				Bin Temperature (Batch):				°F/°C																							
Lot - Sublot #				Aggregate Temperature:				°F/°C				Stack Temperature:				°F/°C															
Weather:				RAP Temperature:				°F/°C				Baghouse Temperature:				°F/°C															
Temperature:				RAP Moisture Content:				%				Silo Storage Time:				°F/°C															
Time:				Dry Mixing Time:				Sec.				Discharge Temperature:				hrs.															
Date:				Wet Mixing Time:				Sec.				Compaction Temperature:				°F/°C															
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Temperature:				RAP Moisture Content:				%				Silo Storage Time:				°F/°C															
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Date:				Wet Mixing Time:				Sec.				Compaction Temperature:				°F/°C															
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