Vermont Agency of Transportation

Research Advisory Committee

Project Quarterly Progress Reports

2014 – Q1

(10-01-2013 to 12-31-2013)

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: October 1st through December 31st, 2013

G. ACCOMPLISHMENTS THIS PERIOD:

- Improvement of the Model:
    - Began implementation of recommendations contained in the Travel Demand Improvement Program Report, by transferring the Model platform to TransCAD
    - Began the re-assessment of all centroid connectors locations and resolution of TAZs
- Operation of the Model:
    - None

H. PROBLEMS ENCOUNTERED (If any):

I. TECHNOLOGY TRANSFER ACTIVITIES:

J. PERCENT COMPLETION OF TOTAL PROJECT: 25%

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
    - Begin 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
    - Begin 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:** January 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: March 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: Oct 1, 2013 through December 31, 2013

G. ACCOMPLISHMENTS THIS PERIOD:

- The data analysis was re-run with improved modeling techniques (this was funded by the UTC grant not the VTrans grant).

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:** January 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: 10-1-13 to 12-31-13

G. ACCOMPLISHMENTS THIS PERIOD:

- Quarterly pavement marking data collection and site observations were completed in Lyndon.
- Uretek and JA MacDonald contractors performed 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. The final portion of the project including surveying the site and finish paving will take place in the Spring when weather permits. All installation information will be available in an Initial Update after the paving, final 3D survey is completed, and FWD testing is conducted.
- Multiple pavement marking meetings were held in the planning phase of WP 2014-R-3 and WP 2014-R-4 and SPR 732, two upcoming pavement marking test deck evaluations. The test decks will compare: 1) pavement marking liquid binders and optics along I 89 SB in conjunction with the Brookfield-Montpelier

resurfacing project in 2014 and 2) high performance and permanent pavement marking tape and preformed thermoplastic along US 302 in conjunction with the Berlin resurfacing project in 2015.

- Updates published:
  - Wavetronix SmartSensor Matrix Radar Stop Bar Detection (WP 2011-R-2)
  - Bridge Preservation LLC's BDM Waterproofing Membrane System (WP 2012-R-1)
  - Poly-Carb Flexogrid Bridge Deck Overlay System (WP 2012-R-2)
  - 40" Wide Paving Skid Box (WP 2012-R-3)
  - Detectable Warning Surface summary
  - Annual pavement marking data collection summary
- Reports published:
  - Ultraliner PVC Alloy™ Pipeliner (WP 2001-R-8)
  - Asphalt Treated Permeable Base (WP 1997-R-8)
  - Tech Crete a Concrete Repair Material and Joint Sealant (WP 2008-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:

- 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. During this visit distresses including adhesion, cohesion and spalling losses will be measured, crack movement will be documented
- Quarterly visits will be made to take retroreflectivity readings in St. Albans and Lyndon-Barton.
- 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 will be conducted.
- A winter site visit to document operations during a snow event will be conducted in accordance with WP 2011-R-2, Assessment of Wavetronix SmartSensor Matrix Radar Stop Bar Detection System.
- Updates 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

- WP 2011-R-5: Assessment of Jahn Permeable Mortar SystemIn a Historic Bridge Abutment Application
- WP 2011-R-6: Assessment of the Sterling Lloyd Eliminator Waterproofing Membrane System

Progress report prepared by: Wendy Ellis
Date Prepared: 2-4-2014

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: October 1st, 2013 through December 31st, 2013

G. ACCOMPLISHMENTS THIS PERIOD: Infiltration testing was completed for 2013, with only four of the original nine locations providing adequate infiltration and a sound, flat surface for measurement; two of the locations have been patched over with asphalt as the concrete structure was deteriorated. Bottles and supplies were received for water quality sampling, however water was not collected as of yet. A meeting was held onsite to discuss methods of repair/replacement of part of the porous concrete.

H. PROBLEMS ENCOUNTERED (If any):

I. **TECHNOLOGY TRANSFER ACTIVITIES**: None

J. **PERCENT COMPLETION OF TOTAL PROJECT:** 85%

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. Once all data is collected and compiled, data analysis and report writing will commence.

Progress report prepared by: Jason P. Tremblay
Date Prepared: February 3, 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/cementious 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: October 1st, 2013 through December 31st, 2013

G. ACCOMPLISHMENTS THIS PERIOD: Comments were requested again for the final draft of phase I. A meeting was held between Research and Structural concrete to initiate and move forward with the planning phase of Phase II. It was discussed what test batches would be produced, what testing will occur, and what equipment and supplies may need to 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 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: February 3, 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: October 1, 2013—December 31, 2013

G. ACCOMPLISHMENTS THIS PERIOD:
The updated traffic data for the test sites was collected and continued to be processed and analyzed with the M-E PDG software. The software program Prep-ME developed by Oklahoma State University was downloaded and will continue to be used to import WIM data to be used in the M-E PDG software.

H. PROBLEMS ENCOUNTERED (If any): The Prep-ME software requires our WIM data to be reformatted which has proven to be time inhibiting. In addition, it was discovered that some of the climate data that took information from multiple locations, has a few erroneous values that need to be repaired.

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. PERCENT COMPLETION OF TOTAL PROJECT:

85%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

Adjusted traffic and climate data will be updated and analyses run with the five projects. The predicted values generated with the M-E PDG software will be compared with the field results.

Progress report prepared by: Marcy Meyers **Date Prepared:** 2-12-2014

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: 10-1-13 to 12-31-13

G. ACCOMPLISHMENTS THIS PERIOD:

- Work on counting cracks and data entry.

H. PROBLEMS ENCOUNTERED (If any): None

I. TECHNOLOGY TRANSFER ACTIVITIES: None.

J. PERCENT COMPLETION OF TOTAL PROJECT: 65%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

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

Progress report prepared by: Wendy Ellis
Date Prepared: 2-4-14

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: 10-1-13 to 12-31-13

G. ACCOMPLISHMENTS THIS PERIOD

- Completed investigative report which compiled all data collection efforts and repair methods in conjunction with the centerline rumble stripes which were installed along VT Route 104 in Cambridge in 2012. This is not part of the original project scope however due to negative publicity and Research involvement, this will be included in the report of 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: 2-4-14

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: October 1st, 2013 through December 31st, 2013

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:** A meeting will be set up between research and structures to help facilitate comments and guidance. Final report will be finalized and published.

Progress report prepared by: Jason Tremblay
Date Prepared: February 3, 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: 10-1-13 to 12-31-13

G. ACCOMPLISHMENTS THIS PERIOD:

- Preliminary data analysis was completed for the 2013 collection season.

H. PROBLEMS ENCOUNTERED (If any): None

I. TECHNOLOGY TRANSFER ACTIVITIES: None

J. PERCENT COMPLETION OF TOTAL PROJECT: 80%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

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

Progress report prepared by: Wendy Ellis
Date Prepared: 2-4-14

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

D. **ANTICIPATED COMPLETION DATE:** May 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:** October 16, 2013 through December 31, 2013

G. **ACCOMPLISHMENTS THIS PERIOD:** Continued monitoring of the inclinometers installed during Phase II boring investigation. Developed an updated cross section and determined that movement is needed in the new inclinometers to determine the critical slip surface and therefore remediation needed to fix the slide. Started analyzing BST data versus laboratory test data for inclusion in the report.

H. **PROBLEMS ENCOUNTERED (If any):** The slide is proving to be very complex, both because of the pile installation as well as the discovery that the critical surface extends beyond where we had originally thought. The inclinometers need to be read this spring to determine if any and where movement is occurring.

I. **TECHNOLOGY TRANSFER ACTIVITIES**: The service learning project with UVM went well. The students evaluated the slope and came up with general recommendations. The common theme was lowering the water table within the slope.

J. **PERCENT COMPLETION OF TOTAL PROJECT:** 75%

K. **ACTIVITIES PLANNED FOR NEXT QUARTER:** Develop report figures based on laboratory and field test data, produce an outline for the report and finish a first draft of the report.

Progress report prepared by: Callie Ewald
Date Prepared: February 11, 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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C. START AND END DATE (per grant assignment): October 1, 2013 – December 31, 2013.

D. ANTICIPATED COMPLETION DATE: February 15, 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 Q1

G. ACCOMPLISHMENTS THIS PERIOD: All testing and data have been collected. Some follow up finite element analysis was conducted. A presentation was prepared for an oral presentation for the 2014 TRB Annual Meeting. 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 was to TRB as mentioned earlier. The final project report is nearly complete.

J. **PERCENT COMPLETION OF TOTAL PROJECT:** 98%

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

Progress report prepared by: Mandar Dewoolkar and Chris Benda
Date Prepared: January 28, 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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Eric M. Hernandez, Ph.D.
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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. All field and computational activities related to this project have been completed.*

E. PROJECT OBJECTIVES: The objective of this research initiative is to instrument bridge number 58 (south) 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 truer 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: October 2013 through December 2013

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: 95%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Complete final report.

Progress report prepared by: Eric M. Hernandez, Ph.D.
Date Prepared: Feb. 11, 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):

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Robert T. White, Co-PI
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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:

1 Data from RWIS

We have set up a file transfer protocol server to receive data from the RWIS server every five minutes. The data is extracted to include sensor ID, data time, traffic speed, and volume. They consist of history data for statistical analysis and current data for traffic prediction.

2 Data Model for Traffic Prediction

A data model for different seasons and time periods has been developed to deal with heterogeneous data to ensure that the information can be used for traffic state estimation. More importantly, by using the history data and current data from the available sensors, the model can efficiently predict traffic for some areas of roads where no sensors are deployed.

3 Traffic Detection and Visualization

We use density of cars and speed to indicate the current traffic status. E.g. a group with a greater number of cars running in a higher speed may cause accidents, and a group with a greater number of cars running in a lower speed may cause traffic jam. Meanwhile, the traffic status is shown on the map using different colors.

4 Sensors Purchase

Four new sensors have been purchased, and will be installed in different places on I89 for our project.

5 Data Fusion

In order to make a full use of all available data, a strategy was designed to integrate data from heterogeneous sources. The traffic data and the weather data are different in source, sensor type, location, time, and data format. Therefore, a strategy was built to fuse them first.

6 Traffic Prediction Model

The continuous real-time traffic can be modeled according to the real-time data collected by the sensors and all other available knowledge generated by data fusion. The model will be used for real-time traffic prediction and travel-time guidance. The main idea of our prediction model is that the real-time traffic at a particular site associates with time, weather, location, and the previous traffic situation, the traffic situation some distance before and so on.

7 Travel-Time Estimation

When a travel-time request occurs, our model uses the real-time traffic state for estimation. Firstly, the model identifies the starting and ending sites from the request. Secondly, the two sites are mapped into several adjacent roads on a highway. Thirdly, the travel-time of each road is calculated according to the real-time traffic of that road. Finally, the overall travel-time is the sum of all travel-time on every road.

8 Visualization Portal

A visualization portal was built to display the traffic of the entire transportation system as geographical objects on a map, and then changes the color, size, and displays of meaningful markers and curves based on the real-time traffic prediction, to allow users to quickly grasp the traffic of the entire system or some particular location.

9 Traffic Prediction Model Optimization

Due to the large number of high-dimensional data items, the prediction model is very complex and inefficient. Some attributes of the data are not only useless in providing valid information for prediction, but may also decrease the prediction performance. Therefore, the feature selection techniques were employed to reduce the complexity and to improve the efficiency of our prediction model.

10 Traffic Prediction for More Roads

We exploited our traffic prediction model to predict the traffic on both I89 and I91to further refine and verify the model. In order to validate the scalability and effectiveness of our prediction model, synthetic data was used to simulate the prediction for more other roads.

11 Traffic Prediction Model Optimization

We tried more of the available technology to further reduce the model complexity, and improve the prediction performance.

12 Bayesian Network for Prediction

A Bayesian network is a probabilistic graphical model (a type of statistical model) that represents a set of random variables and their conditional dependencies via a directed acyclic graph. We tried a Bayesian network for traffic prediction too.

13 Visualization Portal Optimization

We used other Google map APIs to provide more user-friendly visualization and improve the stability and efficiency of the visualization portal.

14 Bridge Structural Health Monitoring

We developed an online system with integrative information system design to perform information integration, localization, and visualization for bridges.

15 Architecture for Data Sources

We developed an online architecture integrating roadway, bridge, traffic, sensor data, and crash information for data usage, archiving and sharing over a freeway and arterial network.

16 Predicting Transportation System State - Incident Management

We developed new techniques to capitalize on the data obtained from advanced technologies is the major goal of this task. For instance, when a lane-blocking incident occurs, traffic backs up and a bottleneck forms where the incident has taken place.

17 Visualization Portal Optimization

We further optimized the web portal to provide more user-friendly visualization and improve the stability and efficiency.

18 Architecture Optimization for Data Sources

We further optimized the online architecture to integrate roadway, bridge, traffic, sensor data, and crash information.

19 Updating for Data Sources

We updated the data for roadway, bridge, traffic, sensor data, and crash information for data usage.

20 Visualization Optimization for Transportation System State and Incident

Optimized the visualization component for showing the system state and incident on the web portal. The map information and transportation system infrastructures are updated. User-friendly interaction interface is improved. More information for the system state and incidents are well shown and organized.

21 Visualization for Weather Information

Developed a component to show the weather information in the web portal. Now, the weather information can be shown within the transportation system. It is very useful for drivers identifying and avoiding the routing with heavy traffic and bad weather condition at the same time.

22 Optimization for Weather Information Visualization

Optimized the visualization component for showing the weather information on the web portal. Now, the weather information is easier to access.

23 Optimization for Weather Information Updating Strategy

The weather information updating strategy was optimized. Now, the weather information is better updated and trustworthy.

Refereed Publication:

- Haiguang Li, Zhao Li, Robert T. White, and Xindong Wu. A Real-Time Transportation Prediction System. *Proc. of the 25th International Conference on Industrial, Engineering & Other Applications of Applied Intelligent Systems (IEA/AIE-2012)*, June 9-12, 2012, Dalian, China, accepted, 68-77.
- Haiguang Li, Zhao Li, Robert T. White, and Xindong Wu. A Real-Time Transportation Prediction System. *International Journal of Applied Intelligence*, **39**(2013), 4: 793-804.

H. PROBLEMS ENCOUNTERED (If any):

1 The Map Problem

We have been by integrating Google Map API that lets us embed a robust functionality and everyday usefulness of Google maps into our own website and applications, and overlay our data on top of them. However, not much information is available for traffic layout, such as drawing a parallel polyline on the roads. Moreover, highlighting a road on a map requires many coordinates to snap a path on the road. Less coordinates would not help build an entire road path, but it is difficult to get all coordinates.

I. TECHNOLOGY TRANSFER ACTIVITIES:

1 K-nearest neighbors

The ***k*-nearest neighbor algorithm** (*k*-NN) is a method for classifying objects based on the closest training examples in the feature space. In our data model, we use the *k*-NN approach to deal with noisy data and integrate heterogeneous traffic data sources.

2 Oracle data management and the Apache Tomcat real-time Web tool are used in our server.

3 A Google fusion table in the cloud is employed for data storage.

4 A Google map is adopted for visualization.

J. PERCENT COMPLETION OF TOTAL PROJECT: 100%.

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

Progress report prepared by: Xindong Wu Date Prepared: 1/15/2014

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 Oct through 31 Dec 2013

G. ACCOMPLISHMENTS THIS PERIOD:

- On Fri 11 Oct 2013, 6 iCones were placed at BR91 in St Albans, three each for both northbound and southbound, to collect pre-intervention speed and count data for construction in the right-hand lanes.
- On Fri 18 Oct 2013 two speed trailers were set up at BR91, one each for northbound and southbound.
- From Mon 21 Oct 2013 through Fri 25 Oct 2013, two Sheriff's deputies provided Uniform Traffic Officer (UTO) services, one deputy each for northbound and southbound, for the hours of 7am to 11am each day. The

speed trailers remained in place and the iCones continued collecting data during this intervention time period.

- On Mon 28 Oct 2013, the speed trailers were turned off. One was removed at that time, the second was removed on Tue 29 Oct 2013.
- On Mon 4 Nov 2013, the six iCones were removed from BR91 in St Albans after collecting one week of post-intervention data.
- During November 2013, preliminary analysis was done for data collected from iCones above.
- During December 2013, analysis was done for all iCones at St Albans bridges (BR89, BR90, BR91), the analysis was error checked, map figures were prepared, and the draft report was progressed.

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

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. PERCENT COMPLETION OF TOTAL PROJECT: 90%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Complete final report.

Progress report prepared by: Brian H. Y. Lee **Date Prepared:** 4 February 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
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Burlington, VT, 05405

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

D. ANTICIPATED COMPLETION DATE: *March 31, 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: October 1st 2013 through December 31st 2013

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 began to perform extreme value statistical analysis of the lane demands (shear and bending moment).
- We started writing a paper for the Journal of Structural Safety on the topic.

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: 90%

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: March 11th , 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 Enviornmental 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: October 1, 2013 – December 31, 2013 (2014 Q1)

G. ACCOMPLISHMENTS THIS PERIOD: The testing program is progressing. All specimens have now been casted at Norwich. The samples are continued to be tested for hydraulic conductivity, void content, compressive strength and Freeze-Thaw cycles at UVM and Norwich. A meeting was held at UVM with UVM team, Adam Sevi from Norwich and George Colgrove from VTrans to review the results obtained thus far. Additional scope of work was identified at this meeting.

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

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. **PERCENT COMPLETION OF TOTAL PROJECT: 80**%

K. **ACTIVITIES PLANNED FOR NEXT QUARTER:** Freze-Thaw testing at UVM and Norwich will continue. A request for extension with additional scope of work has been requested.

Progress report prepared by: Mandar Dewoolkar
Date Prepared: January 28, 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
1942.

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: October 01, 2013 to December 31, 2013 (2014 Q1)

G. ACCOMPLISHMENTS THIS PERIOD: A second prototype of a bridge scour sensor is being developed. Papers regarding scour prediction, rating, and effects of Tropical Storm Irene were submitted to ASCE Geo-Congress, and ASCE Structures Congress were revised and resubmitted. A State-wide bridge database combining available resources from VTrans and VANR has been refined, including the effects of tropical storm Irene, and rainfall intensities.

H. PROBLEMS ENCOUNTERED (If any):

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. **PERCENT COMPLETION OF TOTAL PROJECT:** 40%

K. **ACTIVITIES PLANNED FOR NEXT QUARTER:** The literature review will continue. A further in-depth investigation into the spatial relationships between vulnerable bridges, using VANR stream data is underway. Scour probe development is being continued by a Senior Design group. Investigations into countermeasures and design alternatives is beginning.

Progress report prepared by: Mandar Dewoolkar
Date Prepared: January 28, 2014

Pavement Marking Comparison Study

QUARTERLY REPORT

A. PROJECT NUMBER AND TITLE:
SPR: 732 Pavement Marking Comparison Study

B. PRINCIPLE INVESTIGATOR(s):
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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: 10-1-13 to 12-31-13

G. ACCOMPLISHMENTS THIS PERIOD:

- Experimental feature work plans were revised to meet project and specification expectations.
- Met with industry and Agency members to discuss changes and products to be used.
- In relation to this project, the pavement marking specifications underwent a large scale revision process. The changes will be reflected in both test decks. Specifications were approved at the December 3rd, 2013 Specification Committee meeting.
- Identified specific locations/placement of each tape/preformed thermoplastic.

H. PROBLEMS ENCOUNTERED (If any): None

I. TECHNOLOGY TRANSFER ACTIVITIES: None

J. PERCENT COMPLETION OF TOTAL PROJECT: 15%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Bids for Brookfield-Montpelier (Liquid Test Deck) will be opened on January 10th, 2014.
- Meet with manufacturers to determine proper optic packages for the paint markings. (Teleconference)
- Work on database.
- Calibrate retroreflectometer.
- Work on purchasing documents for adhesion tester.

Progress report prepared by: Wendy Ellis
Date Prepared: 2-4-14

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

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:** October 1st through December 31st, 2013

G. **ACCOMPLISHMENTS THIS PERIOD:**

- Completed the review of recent literature related to image-processing methods for analyzing roadway surfaces
- Purchased infrared equipment for pilot-testing the short-term performance metric
- Began collecting speed data from the WIM and RWIS stations

H. **PROBLEMS ENCOUNTERED (if any):**

I. **TECHNOLOGY TRANSFER ACTIVITIES**:

J. **PERCENT COMPLETION OF TOTAL PROJECT:** 50%

K. **ACTIVITIES PLANNED FOR NEXT QUARTER:**

- Begin testing and troubleshooting infrared equipment
- Complete collection of speed data from the WIM and RWIS stations for winter storm events

Progress report prepared by: Jim Sullivan **Date Prepared:** January 15, 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: October 1st through December 31st, 2013

G. ACCOMPLISHMENTS THIS PERIOD:

- Continued the hydrologic analysis with the ArcHydro platform
- Obtained and began geocoding peak flow data from VTrans Hydraulics Reports

H. PROBLEMS ENCOUNTERED (if any):

I. TECHNOLOGY TRANSFER ACTIVITIES:

J. PERCENT COMPLETION OF TOTAL PROJECT: 50%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Begin the multi-scale spatial regression of selected watershed parameters and peak flows

Progress report prepared by: Jim Sullivan **Date Prepared:** January 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:**

- Completed the method and scenario development
- Participated in a meeting of the Technical Advisory Committee (TAC)
- Determined the constrained (realistic) locations of potential satellite salt facilities

H. **PROBLEMS ENCOUNTERED (if any):**

I. **TECHNOLOGY TRANSFER ACTIVITIES**:

J. **PERCENT COMPLETION OF TOTAL PROJECT:** 50%

K. **ACTIVITIES PLANNED FOR NEXT QUARTER:**

- Survey approaches used by other DOTs to strategically locate RSIC materials on the roadway network
- Begin computer coding to implement the method for locating satellite salt locations.

Progress report prepared by: Jim Sullivan **Date Prepared:** January 15, 2014

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 Oct through 31 Dec 2013

G. ACCOMPLISHMENTS THIS PERIOD:

- Conducted preliminary literature review
- 2007-2012 crash data processed and prepared for use in project
- TAC meeting held 1 Nov 2013 to discuss various data needs and the purchase of road alignment data from Fugro
- Road signs data acquired from VTrans & filtered for project
- Methods in development to determine directionality of crash vehicles

H. PROBLEMS ENCOUNTERED (If any):

- N/A

I. TECHNOLOGY TRANSFER ACTIVITIES:

- N/A

J. PERCENT COMPLETION OF TOTAL PROJECT: 15%

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Collect Fugro curve data, this is to be purchased by VTrans
- Integrate all project data once the Fugro data is received
- Perform GIS data analysis
- Develop spatial statistical models

Progress report prepared by: Brian H. Y. Lee **Date Prepared:** 27 January 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.
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(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 Q1 (October 1 – December 31, 2013)

G. ACCOMPLISHMENTS THIS PERIOD:

Completed an online survey through AASHTO's list serve of state DoT's use of seismic hazard rating systems for bridges and submitted those results to VTrans.

Examined the Vermont NBI database as part of the vulnerability ranking system to be developed for VTrans. Obtained preliminary statistics from the database on bridge types and seismic evaluation related features.

In progress with a review of published literature and summary of seismic vulnerability rating systems.

Continued with evaluating applicability of using the FHWA and NYSDoT seismic rating systems for Vermont bridges.

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

I. TECHNOLOGY TRANSFER ACTIVITIES: N/A

J. PERCENT COMPLETION OF TOTAL PROJECT: 20%

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, Mandar Dewoolkar
Date Prepared: January 28, 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: 10-1-13 to 12-31-13

G. ACCOMPLISHMENTS THIS PERIOD:

- Published experimental feature report #: 2013-09: Evaluation of Asphalt Treated Permeable Base – Georgia, Vermont (WP 1997-R-08).

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:

- Remaining data will be counted and entered in to the ongoing spreadsheet for cracking and rutting.
- Projects for the 2014 construction season will be selected.
- Pre-construction information and documents for the 2014 construction projects selected for evaluation will be gathered.

Progress report prepared by: Wendy Ellis
Date Prepared: 2-4-14

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
Telephone: (802) 828-6918
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: 10-1-13 to 12-31-13

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: 2-4-14

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: October 1, 2013 to December 31, 2013

G. ACCOMPLISHMENTS THIS PERIOD:

1) Routine data downloads.
2) All plots have been updated for the instrumentation data collected to date.
3) A presentation was held by Prof. Civjan for interested members of the Agency. Current findings were presented and discussed. The direction of the final report was decided upon and the options for continued monitoring of the bridges beyond completion of the research project was discussed.
4) Cost proposals for various options of continued monitoring were prepared by UMass and given to VTrans for review and discussion.
5) Modem that had failed earlier in the year was repaired.

H. PROBLEMS ENCOUNTERED (If any):

Failing modem for East Montpelier bridge; to be replaced in October or November 2013.

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:

95% [$587,868.38 of $646,392 funds have been expended: Consultant Activities through June 30, 2013.]

K. ACTIVITIES PLANNED FOR NEXT QUARTER:

The decision will be made whether to continue monitoring, to what level, who will be responsible for what tasks, and how it will be paid for. The final report will begin to be prepared.

Progress report prepared by: Jason P. Tremblay **Date Prepared:** February 5, 2014

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Date: __12/31/2013_____

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.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(222)		**Transportation Pooled Fund Program - Report Period:** ☐Quarter 1 (January 1 – March 31) ☐Quarter 2 (April 1 – June 30) ☐Quarter 3 (July 1 – September 30) ☑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	0%
NETC 07-1 $198,154	$3,380	8%
NETC 09-2 $80,000	$400	10%
NETC 09-3 $165,000	$13,765	34%
NETC 10-3 $150,158	$0	0%

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	14%
NETC 07-1	$3,380	0%	$0	16%
NETC 09-2	$400	0.5%	$400	8%
NETC 09-3	$13,765	8.3%	$13,765	13%
NETC 10-3	$0	0%	$0	14%

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 is organizing the kickoff meeting for the week of January 20th, 2014. Also, UMass is developing an internet survey to properly determine the critical factors that relate to the selection and timing of a particular pavement preservation treatment.

07-1, The research team received the results of the Task 1 survey, collated the results, and held the initial meeting with the TC via webmeeting on November 6, 2013. Based on the currently available sites, the research team has developed a plan for testing two existing sites in NH (Kancamangus and Warren Flats) during the 2014 spring thaw.

09-2, The following activities were implemented during this reporting period: Kuzovkina met with the CT DOT transportation landscape designers Susan Fiedler in Storrs, CT on September 4, 2013 to discuss the selection of native grasses for a new site in Connecticut. First meeting of the project PIs at the Connecticut College Arboretum, New London, CT on September 13, 2013. Visited a few native grass planting at the Connecticut College Arboretum, to evaluate native grasses plantings and to discuss plant selection. Attended: Glenn Dryer, Robert Ricard, Cristian Schulthess, Julia Kuzovkina and three graduate students. Preliminary specifications of native grass plantings were sent to Susan Fiedler on September 20, 2013. 1st meeting with the Project Technical Committee took place on November 6, 2013 at the MassDOT District 3 Headquarters. Attended: Robert Moosmann, Susan Fiedler, George Batchelor, Guy Giunta, Robert Ricard, Cristian Schulthess, Glenn Dryer, Julia Kuzovkina. The initial plan for the field testing, survey instrument and manual content were discussed. Development of the survey instrument was initiated by Robert Ricard and three graduate students assisting with this project. 1st meeting with a stakeholder – the native seed producing company Colonial Seed LLC (Windsor, CT) took place on November 13, 2013 at the University of Connecticut in Storrs. Attended: Don Woodall, Mark Lavoie, Robert Ricard, Cristian Schulthess, Julia Kuzovkina and three graduate students. The best approaches to the manual compilation and potential mixtures for the demonstration plots were discussed.
2st meeting with the stakeholders – administrators and staff of the Colonial Seed LLC and Landscape Architect Horace Aikman (CRJA-IBI from Boston, MA) took place on December 2, 2013 at the office of the Colonial Seed LLC in Granby, CT. The discussion of the plant selection for roadside planting followed by a field trip to observe the native grasses research plots of the Colonial Seed LLC in Windsor, CT. Meeting with the CT DOT transportation landscape designers and Susan Fiedler December 2, 2013 to identify the location for the demonstration plots along Rt.6. Attended: Bruce Villwock Susan Fiedler, Greg, Robert Ricard, Cristian Schulthess, Julia Kuzovkina. Three sites were identified as suitable for spring establishment of the demonstration plots.

09-3, Vendors have been screened and selected for participation. Drain designs from participating DOTs were collected for review and comparison. Material properties are under review and being evaluated for inclusion to the specifications. Specifications are being re-written to comply to the FHWA specification format, completion date for end of January 2014. Questionnaire drafted and circulated to DOTs regarding problem areas and best practices as viewed by design and field Maintenance departments.

10-3, UMass Dartmouth contacted several producers of asphalt mixtures about their availability and willingness to participate in the study. Two producers, Palmer from Massachusetts and Tilcon from Connecticut agreed to provide the UMass Highway Sustainability Research Center with the following mixtures: 1.Control mixture produced with only virgin materials. 2. The same control mixture incorporating reclaimed asphalt pavement (RAP) at different binder replacement contents. These binder replacement contents will be higher than typically specified in the New England States. 3.The mixtures will incorporate RAP at different moisture contents. 4.Three different WMA will also be used to produce the above mixtures.

Anticipated work next quarter:

06-4, Hold Kick-Off Meeting. Start Literature Review. Start Internet Survey.

07-1, The research team will be developing a specific timeline for the FWD testing to be conducted 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, survey instrument development, preparation for the spring experiments as described in the proposal. Outline the precise species composition and order the seed mixture for spring plantings. Facilitate the discussions with the stakeholders to receive sufficient feedback about the project. Prepare the list of the survey recipients. Distribute the survey instrument to the recipients.

09-3, Completion of specifications. Determine list of bridge projects that can be included for demonstrations. Review of specifications and RFQs with vendors for listed projects. Vendor evaluation checklist to be developed.

10-3, Complete Literature Review. Determine Critical Information.

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 very new. Implementations of the results of those projects are not anticipated in the near future.

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:

2013 Quarter 4 – October through December

I. ACCOMPLISHMENTS THIS PERIOD:

UMass Dartmouth is organizing the kickoff meeting for the week of January 20th, 2014. Also, UMass is developing an internet survey to properly determine the critical factors that relate to the selection and timing of a particular pavement preservation treatment.

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 (5%)
Task 2: Literature Review (0%)
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: 0%

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

The importance of testing reclaimed layers with Falling Weight Deflectometer, evaluating the response at the different times of the year, and utilizing good practices during mix design and construction have

been emphasized by multiple researchers. Based on their conclusions, the following testing and analysis plan is proposed for the study. In order to accomplish this research, five tasks have been established and are broken into two Phases.

H. REPORT PERIOD:

2013 Quarter 4 – October through December

I. ACCOMPLISHMENTS THIS PERIOD:

The research team received the results of the Task 1 survey, collated the results, and held the initial meeting with the TC via webmeeting on November 6, 2013. Based on the currently available sites, the research team has developed a plan for testing two existing sites in NH (Kancamangus and Warren Flats) during the 2014 spring thaw.

J. PROBLEMS ENCOUNTERED (If any):

The research team had planned on collaborating with an already planned research instrumentation project at an additional site in RI during 2014, but the planned instrumentation did not get installed in that site.

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 (80%)
Task 2: Select Test Sites and Develop Work Plan (67%)
Task 3: Execution of Work Plan (0%)
Task 4: Data Analysis (0%)
Task 5: Final Report (0%)

M. PERCENT COMPLETION OF TOTAL PROJECT: 8%

N. ACTIVITIES PLANNED FOR NEXT QUARTER:

The research team will be developing a specific timeline for the FWD testing to be conducted 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: *12/31/13*
Total Project Budget: $ 198,154
Total Expenditures : $ 3,380

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: 09/1/2013-1/1/2014

B. ACCOMPLISHMENTS THIS PERIOD:

The following activities were implemented during this reporting period:

Kuzovkina met with the CT DOT transportation landscape designers Susan Fiedler in Storrs, CT on September 4, 2013 to discuss the selection of native grasses for a new site in Connecticut.

First meeting of the project PIs at the Connecticut College Arboretum, New London, CT on September 13, 2013. Visited a few native grass planting at the Connecticut College Arboretum, to evaluate native grasses plantings and to discuss plant selection. Attended: Glenn Dryer, Robert Ricard, Cristian Schulthess, Julia Kuzovkina and three graduate students.

Preliminary specifications of native grass plantings were sent to Susan Fiedler on September 20, 2013.

1st meeting with the Project Technical Committee took place on November 6, 2013 at the MassDOT District 3 Headquarters. Attended: Robert Moosmann, Susan Fiedler, George Batchelor, Guy Giunta, Robert Ricard, Cristian Schulthess, Glenn Dryer, Julia Kuzovkina. The initial plan for the field testing, survey instrument and manual content were discussed.

Development of the survey instrument was initiated by Robert Ricard and three graduate students assisting with this project.

1st meeting with a stakeholder – the native seed producing company Colonial Seed LLC (Windsor, CT) took place on November 13, 2013 at the University of Connecticut in Storrs. Attended: Don Woodall, Mark Lavoie, Robert Ricard, Cristian Schulthess, Julia Kuzovkina and three graduate students. The best approaches to the manual compilation and potential mixtures for the demonstration plots were discussed.

2st meeting with the stakeholders – administrators and staff of the Colonial Seed LLC and Landscape Architect Horace Aikman (CRJA-IBI from Boston, MA) took place on December 2, 2013 at the office of the Colonial Seed LLC in Granby, CT. The discussion of the plant selection for roadside planting followed by a field trip to observe the native grasses research plots of the Colonial Seed LLC in Windsor, CT.

Meeting with the CT DOT transportation landscape designers and Susan Fiedler December 2, 2013 to identify the location for the demonstration plots along Rt.6. Attended: Bruce Villwock Susan Fiedler, Greg, Robert Ricard, Cristian Schulthess, Julia Kuzovkina. Three sites were identified as suitable for spring establishment of the demonstration plots.

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 reporting 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.

– 10% completed

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% completed

Task 3: Field Inspections/Testing

Identify native species with the best potential for roadside planting 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

– 10% completed

F. PERCENT COMPLETION OF TOTAL PROJECT: 10%

G. ACTIVITIES PLANNED FOR NEXT QUARTER:

Continue the literature review, survey instrument development, preparation for the spring experiments as described in the proposal. Outline the precise species composition and order the seed mixture for spring plantings. Facilitate the discussions with the stakeholders to receive sufficient feedback about the project. Prepare the list of the survey recipients. Distribute the survey instrument to the recipients.

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.

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: 9/1/2013 to December 31, 2013

I. ACCOMPLISHMENTS THIS PERIOD:

- Vendors have been screened and selected for participation.
- Drain designs from participating DOTs were collected for review and comparison.
- Material properties are under review and being evaluated for inclusion to the specifications
- Specifications are being re-written to comply to the FHWA specification format, completion date for end of January 2014.
- Questionnaire drafted and circulated to DOTs regarding problem areas and best practices as viewed by design and field maintenance departments.

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%	60%
2- Develop standard drain requirements	40%	50%
3 - Identify and contact FRP manufacturers	10%	80%
4 -Identify demonstration bridges	10%	0%
5 - Coordinate installation at demonstration bridges	10%	0%
6 - Document drain condition after installation	10%	0%
7 - Prepare final report	10%	0%
	100%	34.0%

M. PERCENT COMPLETION OF TOTAL PROJECT: 34%

N. ACTIVITIES PLANNED FOR NEXT QUARTER:

- Completion of specifications.
- Determine list of bridge projects that can be included for demonstrations.
- Review of specifications and RFQs with vendors for listed projects.
- Vendor evaluation checklist to be developed.

O. FINANCIAL STATUS:
As of: *December 31, 2013*
Total Project Budget: $ 165,000
Total Expenditures: $ 13,765

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 20ºC. 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:

2013 Quarter 4 – October through December

I. ACCOMPLISHMENTS THIS PERIOD:

UMass Dartmouth contacted several producers of asphalt mixtures about their availability and willingness to participate in the study. Two producers, Palmer from Massachusetts and Tilcon from Connecticut agreed to provide the UMass Highway Sustainability Research Center with the following mixtures:

1. Control mixture produced with only virgin materials.
2. The same control mixture incorporating reclaimed asphalt pavement (RAP) at different binder replacement contents. These binder replacement contents will be higher than typically specified in the New England States.
3. The mixtures will incorporate RAP at different moisture contents.
4. Three different WMA will also be used to produce the above mixtures.

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 (5%)
Task 2: Determine Critical Information (0%)
Task 3: WMA Technologies Selection Process (5%)
Task 4: Identify Moisture Susceptibility Test (0%)
Task 5: Development of a Testing Matrix (0%)
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: 0%

N. ACTIVITIES PLANNED FOR NEXT QUARTER:

Complete Literature Review. Determine Critical Information.

O. FINANCIAL STATUS:
As of: *12/31/13*

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.

				Start Date		End Date		Most Recent Quarterly Report Date =	12/30/2013	Spent Burdget (as of most recent Quarterly Report)		Progress (as of most recent Quarterly Report)		
Project Number	Project Name	PI	Contract Execution Date	Anticipated	Actual	Anticipated	Actual	Reasons for variations	Total Budget	Anticipated	Actual	Anticipated	Actual	Progress Broken Down by Task
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. ConnDOT transitioned contractual obligations to FHWA-CT. 2. The 400+ page appedix 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	$ 34,986.89	$ -	14%	0%	Task 1: Kick-Off Meeting (5%) Task 2: Literature Review (0%) 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	$ 31,578.33	$ 3,380.03	16%	8%	Task 1: Conduct Survey and Identify Potential Test Sites (80%) Task 2: Select Test Sites and Develop Work Plan (67%) Task 3: Execution of Work Plan (0%) Task 4: Data Analysis (0%) 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	$ 6,593.41	$ 400.00	8%	10%	Task1: Literature Review (10%) Task 2: Interviews (10%) Task 3: Field Inspections/Testing (10%) 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	$ 21,728.40	$ 13,765.00	13%	34%	Task 1: Conduct review of typical bridge drain details that are representative in New England. (60%) Task 2: Develop standard drain requirements for new and rehabilitation projects (50%) Task 3: Identify and contact FRP composite manufacturers (80%) Task 4: Identify two or three bridges being constructed within New England where the FRP standard drains can be used. (0%) 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	$ 21,627.70	$ -	14%	0%	Task 1: Literature Review (5%) Task 2: Determine Critical Information (0%) Task 3: WMA Technologies Selection Process (5%) Task 4: Identify Moisture Susceptibility Test (0%) Task 5: Development of a Testing Matrix (0%) 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.