TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Date: 7/31/2017

Lead Agency (FHWA or State DOT): __Vermont Agency of Transportation_____

INSTRUCTIONS:

Transportation Pooled Fund Program Project #	**Transportation Pooled Fund Program - Report Period:**
TPF-5(222)	☐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):	**Phone Number:**	**E-Mail**
Joe Segale	802-828-2561	Joe.Segale@vermont.gov

Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
CA0306	NETC 06-4	9/16/13
	NETC 07-1	7/1/13
	NETC 09-2	9/1/13
	NETC 09-3	9/1/13
	NETC 10-3	9/16/13
	NETC 13-1	9/1/14
	NETC 13-2	6/1/14
	NETC 13-3	12/1/14
	NETC 14-1	3/1/15
	NETC 14-2	2/1/15
	NETC 14-4	7/06/15
	NETC 15-2	1/1/2017
	NETC 15-3	8/1/16

Original Project End Date:	**Current Project End Date:**	**Number of Extensions:**
NETC 06-4 9/15/15	9/15/15, NCE to 9/15/16	1
NETC 07-1 3/31/16	*3/31/16, NCE to 6/30/16*	*1*
NETC 09-2 2/28/16	*2/28/16*	*0*
NETC 09-3 8/31/15	*8/31/15, NCE to 12/31/15*	*1*
NETC 10-3 9/15/15	*9/15/15, NCE to 5/31/17*	*2 (for NETC)*
NETC 13-1 8/31/16	*4/2/16, NCE to 1/14/17*	*2 (for NETC)*
NETC 13-2 5/31/16	*4/2/16, NCE to 12/1/17*	*1 (for NETC)*
NETC 13-3 11/30/15	*3/31/16, NCE to 4/2/17*	*2 (for NETC)*
NETC 14-1 4/2/16	*4/2/16, NCE to 12/31/16*	*2 (for NETC)*
NETC 14-2 4/2/16	*4/2/17, NCE to 5/31/17*	*1 (for NETC)*
NETC 14-4 7/05/17	*7/05/17*	*0*
NETC 15-2 12/31/18	*12/31/18*	*0*
NETC 15-3 7/31/18	*7/31/18*	*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	$191,675.12	100%
NETC 07-1 $198,154	$190,421.37	100%
NETC 09-2 $80,000	$80,000.00	100%
NETC 09-3 $165,000	$149,695.39	100%
NETC 10-3 $150,158	*$65,317.38*	*90%*
NETC 13-1 $174,923	*$128,864.46*	*90%*
NETC 13-2 $249,785	*$56,000.00*	*50%*
NETC 13-3 $100,000	*$70,810.41*	*95%*
NETC 14-1 $100,000	*$22,521.32*	*40%*
NETC 14-2 $205,554	*$138,661.80*	*98%*
NETC 14-4 $200,000	*$82,174.86*	*70%*
NETC 15-2 $150,000	*$0.0*	*10%*
NETC 15-3 $150,000	*$0.0*	*5%*

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%	$0.0	180% (based on 24 months)
NETC 07-1	$0.0	0%	$0.0	127% (based on 33 months)
NETC 09-2	$0.0	0%	$0.0	133% (based on 30 months)
NETC 09-3	$0.0	0%	$0.0	164% (based on 28 months)
NETC 10-3	*$0.0*	*0%*	*$0.0*	*175% (based on 24 months)*
NETC 13-1	$0.0	0%	*$0.0*	*129% (based on 24 months)*
NETC 13-2	*$0.0*	*0%*	*$0.00*	*142% (based on 24 months)*
NETC 13-3	*$0.0*	*0%*	*$0.0*	*233% (based on 12 months)*
NETC 14-1	*$0.0*	*0%*	*$0.0*	*155% (based on 22 months)*
NETC 14-2	*$8,348.77*	*4.1%*	*$8,348.77*	*146% (based on 26 months)*
NETC 14-4	*$6,204.64*	*3.1%*	*$6,204.64*	*83% (based on 24 months)*
NETC 15-2	*$0.0*	*0%*	*$0.0*	*13% (based on 24 months)*
NETC 15-3	*$0.0*	*0%*	*$0.0*	*29% (based on 24 months)*

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
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
13-1 Development of High-Early Strength Concrete for Accelerated Bridge Construction Closure Pour Connections
13-2 HMA Mixtures Containing Recycled Asphalt Shingles (RAS): Low Temperature and Fatigue Performance of Plant-Produced Mixtures
13-3 Improved Regionalization of Quality Assurance (QA) Functions
14-1 Measuring the Effectiveness of Competency Models for Job-Specific Professional Development of Engineers & Engineering Technicians
14-2 Investigation of Northern Long Eared Bat Roosting Sites on Bridges
14-4 Optimizing Future Work Zones in New England for Safety and Mobility
15-2 Using the new SHRP2 Naturalistic Driving Study Safety Databases to Examine Safety Concerns for Teens and Older Drivers
15-3 Moisture Susceptibility Testing for Hot Mix Asphalt Pavements in New England

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):
NETC 06-4, UMass Dartmouth provided the final report, which incorporated the feedback of the technical advisory committee.

NETC 07-1, No work projected at this time.

NETC 09-2, In this quarter, the research team worked with the chair of the technical advisory committee to identify opportunities to continue to pilot the establishment of native grasses throughout New England.

NETC 09-3, In this quarter, the research team completed the final report in the NETC format and worked with the NETC Coordinator to address minor edits.

NETC 10-3,
1. UMass Dartmouth received the following plant produced mixtures from the second contractor (Palmer Paving, Springfield MA) in mid-May 2017:

- SSC 12.5mm 75 Gyration WMA with 29% RAP (1.5% Binder Replacement) Foaming WMA
- SSC 12.5mm 75 Gyration WMA with 39% RAP (2.0% Binder Replacement) Foaming WMA
- SSC 12.5mm 75 Gyration WMA with 48% RAP (2.5% Binder Replacement) Foaming WMA

These mixtures were tested this quarter. The following tests were completed on each mixture using multiple replicates:

Volumetric verification (density, VMA. VFA, etc.)
Moisture susceptibility testing using the Hamburg wheel tracking device (HWTD) in accordance with AASHTO T324 at 45°C
Low temperature cracking using the disk-shaped compact tension (DCT) test at -18°C
Constructed performance space diagram (HWTD vs. DCT) for each mixture
Moisture susceptibility (TSR) in accordance with AASHTO T283
Low temperature cracking using the thermal stress restrained specimen test (TSRST)
Mixture dynamic modulus and subsequent construction of mixture master curve
Dynamic modulus (E*) ratio evaluation of moisture susceptibility

Summary sheets of results were constructed and data was analyzed

2. UMass Dartmouth began work on the DRAFT final report.

NETC 13-1,
UMASS Amherst waiting for the review of a contract extension and coordinating with MassDOT to conduct freeze thaw testing.

NETC 13-2,

1. UMass Dartmouth consistently contacted the contractor during the last quarter to discuss production of the mixtures for this study. No response was received from the contractor.

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

NETC 13-3,
Revisions to the final report were made on basis of feedback from the project technical committee. Simultaneously Vermont Agency of Transportaiton (VAOT) established a Sharepoint file sharing site for all New England DOTs to share QA information for PCE/PSE in New England region.

NETC 14-1, The extension until 12/31/17 is now in place and work can resume. PI is working to get team back on salary and then work will resume.

NETC 14-2
• Updated Project Report to include guano ID and consultant species identification results
• Distributed Project Final Report
• Draft Final Report reviewed by technical committee
• Edited Final Report

• Submission of Final Report to NETC
• Submission of Project Fact Sheet and Project Poster to NETC
• Presented at 2017 International Conference on Ecology and Transportation, Salt Lake City, UT, May 2017

NETC 14-4,

Task 3 – Development of Methodology for Testing and Analyzing TTCPs

Naturalistic Driving Study Data

The team received the 2nd set of NDS data set on April 7, 2017 and started to analyze it in this quarter. We focused on the following data elements: 1) speed time series data, 2) acceleration/deceleration time series data, and 3) crash and near-crash events.

Analyzing the speed time series data was to identify traffic control strategies that have a major impact on vehicle speed in work zone. We found that presence of police vehicles can effectively reduce vehicle speed, while variable message signs and traffic cones are ineffective. Narrow lanes may help reduce vehicle speed. However, more NDS samples are needed to further confirm this conclusion. The team also analyzed the acceleration/deceleration time series data. Compared to the speed data, the acceleration/deceleration data was noisier and the corresponding analysis did not lead to definitive conclusions.

The analysis of the crash and near-crash events suggests that speeding may not be a major contributor to crashes in work zone, which is contrary to what people typically believe. The NDS data suggests that distraction, fatigue driving, sudden stop/deceleration of lead vehicle, and unsafe merging behavior were the major causes for the identified crash and near-crash events.

The team wanted to use the NDS speed time series data to validate the virtual reality driving simulator. From the 2nd NDS data set, we were unable to find enough runs with the same or similar work zone set up. For a single run of a particular NDS driver, it is probably unreasonable to expect driving simulation to generate very similar results due to driver heterogeneity. Therefore, no further validation attempts were taken.

Driving Simulator

A no-cost extension request has been submitted to the project advisory committee, in which the team proposed to reallocate funds to purchase a motion simulator and an eye tracking device. The motion simulator will further improve the fidelity of the driving simulator and give participating drivers' even more realistic driving experience. The eye tracking device will allow us to detect driver distraction, which is one of the major contributors to work zone crashes and near-crash events.

Task 5 – Evaluation of New TTCPs

In the 7th quarter, the team continued to evaluate the six speed control scenarios described in the 6th quarterly report using the Virtual Reality (VR) driving simulator. The evaluation results have been summarized in a paper entitled "Modelling Highway Work Zone Traffic Safety and Driver Behaviours Using a Virtual Reality Driving Simulator", which has been accepted for presentation at the 2017 Road Safety & Simulation International Conference.

In addition to the speed control strategies, the team also finished evaluating merge strategies using VISSIM. We considered the following merge strategies: conventional merge (i.e., no control), early and late merges, merge with priority rule, and signalized merge. For early and late merges, we developed custom code to force vehicles to merge at a specific location, which ranges from 200ft to 2500ft upstream of the beginning of a work zone with an increment of 100ft. We carefully reviewed the simulation animations of the early and late merges and observed long queues in the closed lane and fast-moving traffic in the open lane(s). In practice, vehicles in the open lane typically will also slow down due to vehicles in the closed lane trying to merge into the open lane(s). Therefore, we proposed a merge with priority rule strategy, which requires vehicles in the adjacent open lane to yield to vehicles in the closed lane when there are queues in the closed lane. We tested the performance of the above merge strategies under various traffic demands. We also considered two work zone scenarios: (1) two lane highway with the right lane closed, and (2) three lane highway with the right most lane closed. The detailed merge strategy evaluation results will be reported during the upcoming 7th quarterly meeting.

NETC 15-1,

NETC 15-2,

- We have completed the acquisition of the RID data and now have the complete data set from the Roadway

Information Database. We received the data set two weeks ago and it is inclusive of the latest version update (RID v2.0).

- We have complete Institutional Review Board approval in place for obtaining SHRP2 data from VTTI.
- We have completed a signed agreement with Miguel Perez at VTTI that gives VTTI until the end of August to provide us the data given that the Data User License is finalized and IRB approval is obtained.
- We have finalized the Purchase order with VTTI for the SHRP2 data.
- We are in the final stages of completing the Data User License (DUL) defining data security and management plans with VTTI for the SHRP2 data.
- As a part of the new data release of additional coded events in the SHRP2 database, we were able to obtain several more baseline, crash and near crash events to provide us better strength in our analysis.
- We have defined hypotheses pertaining to what we would initially test. And we will likely define several additional hypotheses to test as well.

NETC 15-3,
The main focus of work in this quarter was on collecting and analyzing the responses to the survey distributed to the six state agencies, preparing a laboratory testing plan on the basis of the survey responses, and sampling materials suggested by the agencies. All the results from the agency survey were collected, tabulated, and prepared in two forms. The first is a detailed report showing all the received responses to the various questions, and the second is a summarized version of the key points among the responses.

Based on the survey responses, the laboratory testing plan was developed with an emphasis on three conditioning methods (modified Lottman, MIST, multi-cycle freeze-thaw) and four laboratory tests (indirect tensile strength, dynamic modulus, Hamburg wheel tracker, and fracture tests). It was also decided that some mixes will be subject to more conditioning and test method combinations than other mixes so that the total amount of testing can be decreased while data for all possible combinations is obtained on select mixes. For example, only limited number of mixes will be conditioned using the modified Lottman procedure (4 out of 10) due to previous New England DOTs experience that this method does not discern good and poor performing mixtures. The testing plan has been compiled and summarized into a spreadsheet.

The researchers contacted staff from ConnDOT, MaineDOT and VTrans to discuss mixture sampling. Multiple candidate mixes were received, and six of these mixes (three from Vermont and three from Maine) were sampled by the research team. Two more mixtures will be sampled from Maine in the coming weeks, and two mixes are planning to be sampled from Connecticut. Once all of these mixes are sampled, the ten mix target set at the beginning of the project will be reached. The laboratory evaluation of these mixes has begun. For all sampled mixtures, compaction characteristics have been established to prepare laboratory test specimens. Researchers at UNH have started to conduct indirect tensile strength tests on unconditioned specimens as well as to compact Hamburg wheel tracking test specimens.

Anticipated work next quarter:

NETC 06-4, No work projected at this time.

NETC 07-1, No work projected at this time.

NETC 09-2, No work projected at this time.

NETC 09-3, No work projected at this time.

NETC 10-3, UMass Dartmouth will submit the final report for review and comment.

NETC 13-1, Conduct large-scale panel test joint using a closure pour fabrication with high-early strength concrete and conduct freeze-thaw conditioning tests.

NETC 13-2,
1. Hold project progress meeting with the technical committee and discuss utilizing laboratory samples for remainder of project.

2. If approved by the technical committee, produce samples using post-consumer asphalt shingles (PCAS) and a blend of MSW and PCAS in the laboratory and continue analysis.

NETC 13-3,
- Submission of the final report
- Selection of agencies and manufacturers for pilot implementation of common acceptance standards

NETC 14-1,
Complete the competency model framework for each of the NETC member states. Run a pilot program in Maine.

NETC 14-2, No work projected at this time.

NETC 14-4,
The project team will continue working on tasks 3) development of methodology for testing and analyzing TTCPs; 5) evaluation of new TTCPs through simulation; 6) project meetings; and 7) reporting.

NETC 15-1,

NETC 15-2,
The following activities are planned for the next quarter:

- Acquire requested data from the SHRP2 database
- Conduct additional data mining and data reduction to the acquired data
- Perform initial data analyses on the naturalistic study data to address study objectives in Task 2
- Continue to chart out analysis strategies and identify any critical challenges.

NETC 15-3,
The following activities are planned for the next quarter:

- Sample remaining four mixtures from Maine and Connecticut
- Continue the laboratory testing:
    - Conditioning: Modified Lottman, MiST and Multi-cycle Freeze-Thaw; Mechanical Characterization: Indirect tensile strength, complex modulus and fracture parameters from semi-circular bend (SCB) test
- Begin conducting data analysis on laboratory results to assess changes in mechanical characteristics of mixtures due to laboratory moisture conditioning.

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 06-4, None during the current period.

NETC 07-1, None during the current period.

NETC 09-2, None during the current period.

NETC 09-3, None during the current period.

NETC 10-3, The research team has been consistently making arrangements with contractors to provide plant produced mixtures as stated in the scope of work. UMass Dartmouth consistently followed up with the second contractor to produce more of the mixtures noted in the test matrix.

NETC 13-1, UMass Amherst presented the technical advisory committee a new project plan and requested an extension and a budget increase.

NETC 13-2,

1. UMass Dartmouth consistently contacted the contractor during the last quarter to discuss production of the mixtures for this study. No response was received from the contractor.

2. The contractor assisting producing the mixtures for this study only utilizes one source of RAS which is manufacturers shingle waste (MSW). The contractor does not utilize post-consumer asphalt shingles (PCAS) or a blend of MSW and PCAS.

3. The project PI has continued efforts to find a contractor willing to produce mixtures for this study, preferably one that utilizes other RAS sources. To date, the PI has only been able to get commitment from one local contactor which has not produced the mixtures yet.

NETC 13-3, None during the current period.

NETC 14-1, Working to resume project and get a team member back on salary.

NETC 14-2, None during the current period.

NETC 14-4, None during the current period.

NETC 15-1,

NETC 15-2, None during the current period.

NETC 15-3, None during the current period.

Potential Implementation:

The seven of the 13 research projects listed above are still in the research phase. Implementations of the results of those seven of projects are not anticipated in the near future. One research team (NETC 13-3) is in the process of drafting final reports and the technical advisory committees and researchers are considering options for pilot implementation projects. Five research projects (NETC 06-4, 07-1, 09-2, 09 -3 and 14-2) have or are completing their final reports and are continuing the technical transfer process. During these processes, the technical advisory committees and researchers will continue to work to identify strategies for implementing the results of this research.