

## TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Date: 10/31/2017

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

**INSTRUCTIONS:**

<b>Transportation Pooled Fund Program Project #</b>  TPF-5(222)		<b>Transportation Pooled Fund Program - Report Period:</b> <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input type="checkbox"/> Quarter 2 (April 1 – June 30) <input checked="" type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 1 – December 31)	
<b>Project Title:</b> New England Transportation Consortium (VI)			
<b>Name of Project Manager(s):</b> Emily Parkany		<b>Phone Number:</b> 802-272-6862	
<b>E-Mail:</b> emily.parkany@vermont.gov			
<b>Lead Agency Project ID:</b> CA0306		<b>Other Project ID (i.e., contract #):</b> NETC 06-4 NETC 07-1 NETC 09-2 NETC 09-3 NETC 10-3 NETC 13-1 NETC 13-2 NETC 13-3 NETC 14-1 NETC 14-2 NETC 14-4 NETC 15-1 NETC 15-2 NETC 15-3	
		<b>Project Start Date:</b> 9/16/13 7/1/13 9/1/13 9/1/13 9/16/13 9/1/14 6/1/14 12/1/14 3/1/15 2/1/15 7/06/15 12/1/16 1/1/2017 8/1/16	
<b>Original Project End Date:</b> 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 NETC 13-1 4/2/16 NETC 13-2 5/31/16 NETC 13-3 11/30/15 NETC 14-1 4/2/16 NETC 14-2 4/2/16 NETC 14-4 7/05/17 NETC 15-1 11/30/18 NETC 15-2 12/31/18 NETC 15-3 7/31/18		<b>Current Project End Date:</b> NCE to 9/15/16 NCE to 6/30/16 2/28/16 NCE to 12/31/15 NCE to 6/30/2016, NCE to 5/31/17 NCE to 8/31/16 (NETC), NCE to 1/14/17, Amd. to 1/12/18 NCE to 12/1/17 NCE to 3/31/16, 9/30/16, NCE to 4/2/17 NCE to 12/31/16 (NETC), NCE to 12/31/17 NCE to 4/2/17 (NETC), NCE to 5/31/17 NCE to 12/31/17 11/30/18 12/31/18 7/31/18	
		<b>Number of Extensions:</b> 1 1 0 1 2 2, 1 (for NETC) 1 3 1, 1 (for NETC) 1, 1 (for NETC) 1 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	\$77,283.20	100%
NETC 07-1	\$198,154	\$190,421.37	100%
NETC 09-2	\$80,000	\$78,811.11	100%
NETC 09-3	\$165,000	\$149,695.39	100%
NETC 10-3	\$150,158	\$65,317.38	100%
NETC 13-1	\$191,320	\$147,921.23	90%
NETC 13-2	\$249,785	\$55,042.07	70%
NETC 13-3	\$100,000	\$70,810.41	95%
NETC 14-1	\$100,000	\$47,531.84	40%
NETC 14-2	\$205,554	\$159,164.72	100%
NETC 14-4	\$200,000	\$85,066.22	75%
NETC 15-1	\$164,970	\$0.0	25%
NETC 15-2	\$150,000	\$0.0	10%
NETC 15-3	\$150,000	\$0.0	45%

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	204% (based on 24 months)
NETC 13-1	\$7,907.68	4.1%	\$6,742.37	154% (based on 24 months)
NETC 13-2	\$0.0	0%	\$0.0	167% (based on 24 months)
NETC 13-3	\$0.0	0%	\$0.0	283% (based on 12 months)
NETC 14-1	\$15,146.36	7.4%	\$26,729.02	141% (based on 22 months)
NETC 14-2	\$0.0	0%	\$20,502.93	123% (based on 26 months)
NETC 14-4	\$48,832.15	24.4%	\$0.0	113% (based on 24 months)
NETC 15-1	\$14,380.88	8.7%	\$0.0	42% (based on 24 months)
NETC 15-2	\$18,750.89	12.5%	\$0.0	38% (based on 24 months)
NETC 15-3	\$34,210.83	22.8%	\$0.0	58% (based on 24 months)

**Project Description:**

- 06-4 Preventative Maintenance and Timing of Applications, Completed June 2017:  
<http://netc.w3.uvm.edu/research/netc-research-projects/netc-06-4/>
- 07-1 In-Place Response Mechanisms of Recycled Layers Due to Temperature and Moisture Variations, Completed October 2016: <http://netc.w3.uvm.edu/research/netc-research-projects/netc-07-1/>
- 09-2 Effective Establishment of Native Grasses on Roadsides, Completed June 2016:  
<http://netc.w3.uvm.edu/research/netc-research-projects/netc-09-2/>
- 09-3 Advanced Composite Materials: Prototype Development and Demonstration, Completed January 2017:  
<http://netc.w3.uvm.edu/research/netc-research-projects/netc-09-3/>
- 10-3 Low Temperature and Moisture Susceptibility of RAP Mixtures with Warm Mix Technology, Completed November 2017: <http://netc.w3.uvm.edu/research/netc-research-projects/netc-10-3/>
- 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, Completed March 2017:  
<http://netc.w3.uvm.edu/research/netc-research-projects/netc-14-4/>
- 14-4 Optimizing Future Work Zones in New England for Safety and Mobility
- 15-1 Use of Forested Habitat Adjacent to Highways by Northern Long-Eared Bats

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 13-1, Task 1 (literature search) and Task 3 (develop mix design) have been completed. Task 4 (test mixture) has been mostly completed. Freeze-thaw testing and panel tests are the only two activities missing that will be conducted during the extension granted for this project.

NETC 13-2, No new updates have been reported for Quarter 3.

NETC 13-3, This project team is in the process of preparing the final report, poster, and fact sheet.

NETC 14-1, No new updates have been reported for Quarter 3.

NETC 14-4, The project team focused on Tasks 3, 5, 6, and 7 during this quarter. For Task 3, the no cost extension was approved. The remaining funds were used to purchase a motion simulator and an eye tracking device. Both devices arrived recently and have been tested. There is a power supply issue with the motion simulator but a representative of the vendor will fly to UMass Lowell on Oct. 30 to fix the problem. Once resolved, the team will be able to complete the remaining virtual reality (VR) driving simulation tests.

For Task 5, no VR driving simulations were conducted as the focus was on obtaining the eye tracking and motion simulator devices. Additionally, the team has been working on (1) summarizing and documenting previous VISSIM simulation results; (2) evaluating the safety performances of identified work zone merge control strategies; (3) further evaluating previously identified work zone control strategies using Aimsun; and (4) developing and evaluating a custom work zone control strategy considering vehicle connectivity and automation.

Previously, early merge, convention merge, and late merge strategies were identified. These three strategies were further modified by adding a priority rule to generate more realistic merging behaviors. In addition, a signalized merge control was considered. These seven strategies were coded and their mobility performances had been evaluated using VISSIM. In the 8th quarter, the VISSIM outputs were fed into a Surrogate Safety Assessment Model (SSAM) tool developed by the Federal Highway Administration (FHWA) to assess the safety performances of the seven merge control strategies.

The team also conducted Aimsun simulations to evaluate the mobility performances of early merge, conventional merge, late merge, and signalized merge strategies. We are in the process of fine-tuning some of the simulation parameters. We have identified some issues with Aimsun and have sent them to the Aimsun technical support team. Upon receiving their answers, we will finish the Aimsun simulations. The final Aimsun simulation results will be included in the second post-task report. Our plan is to submit this report by end of October 2017.

The team has developed a custom work zone control strategy (other than the previous identified seven strategies) considering vehicle connectivity and automation. This strategy has been coded in VISSIM and is being tested. Based on the preliminary results, an abstract entitled "Cooperative Merging in Highway Work Zone Enabled by Connected and Autonomous Vehicles" has been prepared and it has been accepted for presentation at the 2018 ASCE International Conference on Transportation & Development.

Task 6 progress involved holding the 7<sup>th</sup> quarterly meeting on July 24, 2017. The 8<sup>th</sup> quarterly meeting is scheduled to take place during the week of Oct. 23-27.

Task 7 progress involved submitting the quarterly report on October 15, 2017.

NETC 15-1, The project team has accomplished the following items this quarter:

- Completed literature review (Task 1). This compilation of papers can be found at: <https://unh.box.com/s/rrep5rctxsea4z5rjsvjdb4l1z0vclnf>
- In the previous quarterly report, we had outlined the overall findings of our Literature review. We now present a more detailed review. See attached literature review report.

- Identified the main stressors of roads on bats, which include direct mortality and movement barrier due to reduced landscape permeability and vehicle noise. See attached literature review report for more details (Task 2).
- Continued compilation of NLEB distribution data (Task 3).
- Presence/Absence data have been received from some transportation departments, such as MA (Task 4).
- We have collated landscape data including road variables such as the traffic level and width of nearest road (Task 5).
- Compiled Presence/Absence data; have very few presences, thus we may need to combine these data with presence-only data from other sources (Task 6).

NETC 15-2, No new updates have been reported for Quarter 3.

NETC 15-3, The main focus of work in this quarter was on conducting laboratory testing and sampling the final mixtures for the project. As of the writing of this report, nine out of the ten mixtures have been sampled and delivered to University of New Hampshire (UNH) and Worcester Polytechnic Institute (WPI). The tenth and final mix will be sampled in the coming weeks from NHDOT. These ten mixtures cover a broad spectrum of performance, mix designs, binder grades, modifiers, aggregate types, and geographical locations, giving the research team many potential parameters to investigate in terms of moisture susceptibility.

Significant progress was made on the laboratory testing plan this quarter. For a majority of the sampled mixtures, all of the indirect tensile strength (ITS) testing has been completed on specimens in the unconditioned state and specimens conditioned using methods in AASHTO T-283. MiST conditioning has also begun on ITS specimens, with three of the mixes being tested for ITS with MiST conditioning. It is expected that all of the ITS testing will be completed in the next quarter.

In addition to ITS, limited amounts of semi-circular bend (SCB) and dynamic modulus testing has been conducted. This includes unconditioned and MiST conditioned specimens for SCB testing, while dynamic modulus testing has only been conducted on unconditioned specimens. Significant progress is expected on SCB and dynamic modulus testing this upcoming quarter as most of the specimens have been produced. Also, Hamburg wheel track test specimens have been fabricated for the nine sampled mixtures. Five of these mixtures have been delivered to Maine DOT for testing, while the other five will be delivered in the coming weeks. Hamburg testing is expected to occur throughout the next quarter.

With results from SCB testing in mind, the laboratory testing and conditioning plan may be revised.

**Anticipated work next quarter:**

NETC 13-1, The project team will fabricate freeze-thaw specimens using concrete from trial batches to be sent to DOT lab to be tested (ASTM C666). They will also fabricate and test two panel tests in the laboratory.

NETC 13-2, No work projected at this time.

NETC 13-3, The final report is in the process of being written.

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

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, The project team will work on a complete compilation of all NLEB and other bat distribution data (Task 3), a complete dataset of NLEB and other bat presence/absence data from State DOTs and other sources (Task 4), and a complete Zone of Influence Matrix (Task 2) and building bat occupancy models (part of Task 5).

NETC 15-2, No work projected at this time.

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

- Sample the last mixture from NHDOT
- Continue the laboratory testing:

- Conditioning: MiST (at both 25 and 60°C) and Multi-cycle Freeze-Thaw; Mechanical Characterization: Indirect tensile strength, complex modulus and fracture parameters from semi-circular bend (SCB) test, and Hamburg wheel track test.

- Begin conducting data analysis on laboratory results

**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 13-1, The PI (Sergio F. Breña) and representatives from the Project Technical Advisory Committee had an online conference on 23 March 2017 to discuss the status of NETC 13-1. The PI presented the tasks conducted to date and explained the reasons for not being able to conduct three tasks listed in the original proposal (freeze-thaw testing, chloride ingress testing, and large-scale panel testing) within the contract time period that expired on 14 January 2017. The two primary reasons discussed during that conference call were: (1) larger number of trial concrete batches that had to be developed in order to achieve the desired performance objectives of the concrete mixture; and (2) the longer duration that shrinkage ring tests took (in general, over 3 weeks instead of the 10-14 days estimated from past literature) compared with traditional concrete mixtures. The Project Technical Advisory Committee requested that Prof. Breña provide them with three options to continue testing. Of these three options the Committee chose the option of continuing with freeze-thaw testing and testing of two panels using the selected concrete mixtures.

NETC 13-2, Update unavailable.

NETC 13-3, The final report is in the process of being written.

NETC 14-1, Update unavailable.

NETC 14-4, None during the current period.

NETC 15-1, None during the current period.

NETC 15-2, Update unavailable.

NETC 15-3, Minor lab equipment issues delayed lab testing for a few weeks in July, but no other significant problems were encountered. Testing is ahead of schedule at this point.

**Potential Implementation:**

The seven of the 13 research projects listed above are still in the research phase. Implementations of the results of projects 9-3 and 13-3 are being actively worked on. Project 14-1 is expected to be implemented as well. 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. Seven research projects (NETC 06-4, 07-1, 09-2, 09 -3, 10-3, 13-3, 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.