TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Date: 3/31/2017

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	98%
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	175% (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 worked to incorporate the feedback of the technical advisory committee into the final report.

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 continued analysis of the test data for all the mixtures tested to date.

2. UMass Dartmouth followed up with the second contractor producing mixtures for this study. No new mixtures were received this quarter even though the contractor had promised delivery of some mixtures in the fall. The contractor stated that the high RAP mixtures prepared using foaming as the WMA technology would be produced in the spring. The mixtures UMass is awaiting are high RAP mixtures prepared using foaming as the WMA technology.

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

NETC 13-1,
UMASS Amherst presented the technical advisory committee with a project update outlining the remaining tests (freeze-thaw testing, chloride penetration and large-scale component testing). UMass Amherst also presented 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. For blending analysis, Post Consumer Asphalt Shingles (PCAS) binder was extracted and recovered. The recovered binder was blended with virgin binder assuming three conditions: no blending, partial blending, and full blending. PG grading of the blended binders was completed for each condition as well as construction of partial binder master curves. These curves were used in an attempt to assess the degree of blending.

3. Since no plant produced mixtures had been received, UMass Dartmouth began development of mixture designs with a blend of RAS at a 50-50 ratio (i.e. 2.5% Post Consumer Asphalt Shingles blended with 2.5% Manufactures Shingle Waste for a total of 5% RAS in the mixture). Previous mixture work had been completed with and MSW and PCAS alone at a dose of 5% in the mixture.

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

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

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, UMASS Amherst reviewed the project plan and worked to revise and improve the project plan to facilitate completion of the project.

NETC 14-2
• Received results from guano ID

• Received acoustic analysis from consultants.
• Completed data analysis
• Completed inspection and data collection forms for report
• Delivered Draft Final Report to technical committee for comment
• Presentation at the Transportation Research Board 2017 Annual Meeting Workshop 114: Bats at the Crossroads: Regulatory Compliance for Program and Project Delivery and Approaches to Conserving Imperiled Species 1/11/17
• Presentation at the Northeastern Bat Working Group Annual Meeting 1/13/17
• Lunch and Learn and Project Summary Workshop for ME/VT/NH: Concord NH 3/13/17
• Project Summary Workshop for MA/CT/RI: Westborough MA 3/24/17
• Abstract accepted to 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 on April 7, 2017. Therefore, we were unable to finish the proposed NDS data analysis on time.

Smart Work Zone (SWZ) Data

The team has finished analyzing the data obtained from one SWZ in Massachusetts and reported the results during the 5th quarterly project meeting. We found some contradictory results from the SWZ data. Since there are no detailed information regarding the work zone configuration available, it is difficult to find out reasons for the contradictory results. Therefore, we have decided to focus on the NDS data analysis, the virtual reality simulation, and the VISSIM simulation.

Task 4 – Development of New TTCPs

In the 5th quarter, the team identified radar speed sign, variable message sign, tubular marker, and narrow lane for further consideration. In the 6th quarter, the team did not identify any new TTCPs.

Task 5 – Evaluation of New TTCPs

In the 6th quarter, the team evaluated the following speed control scenarios in a Virtual Reality (VR) environment:

1. ***Scenario 1*** considers a series of radar speed signs that are distributed evenly throughout a work zone. The distance between two consecutive radar speed signs is about 335 meters;
2. ***Scenario 2*** uses tubular markers that are evenly spaced for speed control. The distance between two adjacent tubular markers is 10 meters;
3. ***Scenario 3*** also uses evenly distributed radar speed signs. However, the distance between two adjacent radar speed signs is increased to 550 meters;
4. ***Scenario 4*** is similar to Scenario 2 but uses a reduced distance between two tubular markers. The new distance is set to 5 meter;
5. ***Scenario 5*** is based on Scenario 4. The only difference is that the original tubular markers are replaced by some wider tubular markers; and
6. ***Scenario 6*** uses the narrow lane strategy. It reduces the existing lane width from 3.66 meters (12 ft) down to 3.35 meters (11 ft). In the previous 5 scenarios, a lane width of 3.66 meters is used.

The VR simulation results have been summarized in a paper entitled "*Modelling Highway Work Zone Traffic Safety and Driver Behaviours Using a Virtual Reality Driving Simulator*". This paper has been submitted to the 2017 Road Safety & Simulation International Conference for presentation only and it is currently under review. So far, 21 participants have completed the VR test. We are still recruiting participants to obtain more simulation data. Our plan is to add additional analysis to this paper and resubmit it to a peer-reviewed journal for publication soon.

We initially considered evaluating late and early merge strategies in a virtual reality environment as well. However, merging behaviors are significantly affected by surrounding vehicles. The virtual reality tool we are using cannot accurately model vehicle behaviors. Therefore, we chose to model late and early merge strategies using VISSIM. We have obtained some preliminary results from four simulation scenarios: conventional merge, early merge, late merge, and signalized merge. These results will be reported during the upcoming 6th quarterly meeting.

NETC 15-2,

- Held Kickoff Meeting with Technical Committee.
- Completed the development of a comprehensive data plan to acquire relevant NDS data from the

- SHRP2 and
- RID databases

- Team has conducted preliminary querying of Insight database to identify the specific nature of the quantity and quality of data available for analyses.

NETC 15-3,
The main focus of work in this quarter was on expanding and completing review of literature on topics associated with this research study. This was done by continuing to review recently published literature pertaining to moisture-induced damage in asphalt mixtures and experimental procedures to assess extent of moisture-induced damage. The research team also collected and reviewed US state and Canadian province specifications to conduct a state of the practice review on moisture-induced testing methods. The research team has prepared an in-depth and detailed survey through a web-based software, Qualtrics that will be distributed to the six New England state transportation agencies. This survey covers the agency's current practices as well as experiences related to moisture-induced damage in asphalt mixtures. The project kick off meeting was also held during this quarter. During the kick-off meeting project goals, tasks and timeline were presented along with a summary of literature review. Preliminary testing plan as well as sampling requirements were also discussed during the kick-off meeting.

Anticipated work next quarter:

NETC 06-4, Incorporate comments and edits into the final report.

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 continue testing the plant produced mixtures as they are received.

NETC 13-1, Address concerns of the technical advisory committee and advisory committee regarding the new project plan.

NETC 13-2,
Meet with contractor to discuss production. Continue work with blended RAS mixtures.

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

NETC 14-1,
Present a new project plan to the technical advisory committee and request no-cost extension if needed.

NETC 14-2,
• Update Project Report to include guano ID and consultant species identification results (brief overview)
• Update and distribute Project Final Report.
• Presentation at 2017 International Conference on Ecology and Transportation, Salt Lake City, UT, May 2017

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

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

- A meeting with the Technical Committee is scheduled for April 20th, Thursday at 1 pm.
- Two additional meetings for next quarter will be scheduled in mid-May and likely mid to late June 2017.
- Acquire requested data from the SHRP2 database
- Acquire corresponding data from the RID database
- Complete any additional Institutional Review Board requirements for compliance purposes.

- 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.

NETC 15-3,
- Distribute survey to the six New England state transportation agencies.
- Collect and analyze survey responses. These responses will be used finalize testing and material sampling plans.
- Begin sampling plant-produced materials.
- Begin laboratory testing and conditioning per the final testing plan.

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 is consistently following up with the second contractor to produce more of the mixtures noted in the test matrix. No new mixtures were received this quarter even though the contractor had promised delivery of some mixtures in the fall. The mixtures UMass is awaiting are high RAP mixtures prepared using foaming as the WMA technology. The contractor stated that the high RAP mixtures prepared using foaming as the WMA technology would be produced in the spring.

NETC 13-1, The research team was unable to complete three tests: freeze-thaw testing, chloride penetration and large-scale component testing. 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, Reviewing project plan to request no-cost extension.

NETC 14-2, None during the current period.

NETC 14-4,
As mentioned above and in the 5th quarterly report, the team encountered significantly delay in obtaining the NDS data.

Therefore, we were unable to complete the proposed NDS data analysis on time. Due to this delay, we would like to request a no-cost extension for this project. We will bring this up at the upcoming 6th project quarterly meeting and provide justifications.

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. Two research teams (NETC 13-3 and 14-2) are in the process of drafting final reports and the technical advisory committees and researchers are considering options for pilot implementation projects. Four research projects (NETC 06-4, 07-1, 09-2 and 09 -3) 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.