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:

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:

2015 Quarter 4 – October through December

I. ACCOMPLISHMENTS THIS PERIOD:

1. The survey for Task 2 was distributed to the technical committee for comments. Comments were received and incorporated. The PI obtained a list of regional contacts consisting of both agency and industry members for distribution of the survey.

2. The participating contactor (Aggregate Industries Wrentham, MA) produced the mixtures for this study on 11-13-15. The following 12.5mm SSC (100 gyration) mixtures were produced using the contractors drum plant and a PG64-28 binder:

   - 12.5mm with 15% RAP (typical mixture) + 0.5% SonneWarmix (Liquid) WMA
   - 12.5mm with 27.8% RAP (1.5% binder replaced) + 0.5% SonneWarmix (Liquid) WMA
   - 12.5mm with 46.3% RAP (2.5% binder replaced) + 0.5% SonneWarmix (Liquid) WMA

   Please note that SonneWarmix was the only WMA technology utilized by the contractor at the time of production.

3. A loader bucket of each mixture was dropped in a safe location and mixture samples were appropriately collected. Temperature measurements were taken in the pile of each mixture.

4. The moisture contents of the aggregate and RAP stockpiles were measured by the contractor prior to production. The results are shown at the bottom of the attached table. It should be noted that these moisture contents were generally higher than those noted for the dry run trial performed in September 2015. A total rainfall of approximately 0.4 inches was noted in the three days prior to production at a weather station near the plant. The RAP stockpiles at the plant were covered and only a slight increase in moisture content from 1.4% to 1.6% was noted since the dry run trial in September 2015.

5. The moisture content of each mixture was tested immediately at the contractor's facility after sampling. Moisture content of each mixture was determined in accordance with AASHTO T329. The results are shown in the attached table. The total moisture content in the mixture was below 0.16% for all the mixtures.

6. Laboratory verification and testing of the plant produced mixtures commenced.

J. PROBLEMS ENCOUNTERED (If any):

The research team has still been making arrangements with contractors to provide plant produced mixtures as stated in the scope of work. However, only one contactor has committed to produce the mixtures. The research team is still searching for additional contractors.

The research team requested a no-cost project extension in September 2014. To date there has been no response to this request and the original project deadline has expired.

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 (80%)
Task 2: Determine Critical Information (70%)
Task 3: WMA Technologies Selection Process (50%)
Task 4: Identify Moisture Susceptibility Test (25%)
Task 5: Development of a Testing Matrix (60%)
Task 6: Obtain Plant Produced Samples (30%)
Task 7: Laboratory Testing of Plant Produced Samples (10%)
Task 8: Prepare a Final Report (0%)
Task 9: Execute Implementation Plan (0%)

M. PERCENT COMPLETION OF TOTAL PROJECT: 40%

N. ACTIVITIES PLANNED FOR NEXT QUARTER:

UMass Dartmouth will continue testing the plant produce mixtures.

O. FINANCIAL STATUS:
As of: *12/31/15*
Total Project Budget: $ 150,157.70
Total Expenditures: $ 61,881.00

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.

Al Wrentham 11-13-15 for NETC 10-3

Production Mixtures - 12.5mm 100G + 0.5% Sonnewarmix (Liquid)

			1.5% Binder Replaced		2.5% Binder Replaced	
RAP Content	15.0%		27.8%		46.3%	
Sample	#1	#2	#1	#2	#1	#2
Specimen Temperature at Discharge	240F	240F	287F	287F	262F	262F
Drying Temperature	325F	325F	325F	325F	325F	325F
Pan Mass (g)	1385.0	1388.8	1430.9	1479.3	1401.7	1339.7
Sample + Pan (g)	2725.1	2591.9	2752.2	2704.3	2867.1	2536.7
Initial Sample Mass (g)	1340.1	1203.1	1321.3	1225.0	1465.4	1197.0
Sample + Pan (g) after 90 Minutes	2723.1	2590.5	2751.2	2703.4	2866.3	2535.0
Change in Sample Mass (g)	2.0	1.4	1.0	0.9	0.8	1.7
Percent Change Since Last Measurement	0.149%	0.116%	0.076%	0.073%	0.055%	0.142%
Sample + Pan (g) after Additional 30 Minutes	2722.9	2590	2751.2	2703.4	2866.3	2535.0
Change in Sample Mass Since Last Measurement (g)	0.2	0.5	0.0	0.0	0.0	0.0
Percent Change Since Last Measurement	0.007%	0.042%	0.000%	0.000%	0.000%	0.000%
TOTAL Change in Sample Mass(g)	2.2	1.9	1.0	0.9	0.8	1.7
Total Mixture Moisture Content, %	0.16%	0.16%	0.08%	0.07%	0.05%	0.14%

Stockpile Moisture Contents	**From Contractor**
12.5mm	**0.9%**
9.5mm	**0.7%**
Stone Dust	**-**
Stone Sand	**7.5%**
RAP	**1.6%**
Natural Sand	**NOT USED**