TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Minnesota DOT

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)*	**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: Recycled Unbound Materials		
Name of Project Manager(s): Tuncer Edil	**Phone Number:** 608-262-3225	**E-Mail** edil@engr.wisc.edu
Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:** 6/4/2008
Original Project End Date: 6/30/2011	**Current Project End Date:** 11/30/2012	**Number of Extensions:** 1

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
$349,909	$220,500	75%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
$23,998; 6.8%	$23,998	58%

Project Description:

The objective of this project is to characterize the properties of crushed recycled concrete pavement (RCA) and asphalt (RAP) as unbound base without being treated or stabilized, to assess how RCA and RAP behave in the field and to determine how pavements can be designed using RCA and RAP. Issues to be considered include variability in material properties, purity of material and how to identify and control material quality. This project will include laboratory studies, examination of existing field sites and evaluation of data from MnROAD test sections. Anticipated results from this project include a suite of tests and/or protocols that may be used to identify the critical characteristics of these recycled materials, as well as optimum design criteria and best construction practices needed for a durable base that meets the properties proposed for layer design. The three cells will be constructed using recycled materials in the granular base layers at the MnROAD test facility. One test section will include 100% RAP, another 100% RCA and the third a 50/50 blend of RCA/natural aggregate. The material properties will be monitored during construction and throughout the pavement life by others, especially the variation with changing seasons and moisture regimes in order to determine their effects on pavement performance. The cost of the instruments and installation will be covered under a different program; however this project will analyze the data being generated from the test sections in conjunction with other data from the project.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Resilient modulus tests with varying temperature have been finished for 3 RCAs, 3 RAPs, and 2 natural aggregates. Tests were conducted on material at 50 C, 35 C, 23 C (room temperature), and 7 C. Data are currently being analyzed and a draft of the climate effects task report is being written.

Wet/dry cycling tests for 2 RAPs, 2 RCAs, and 2 natural aggregates has been finished. The testing was completed for 30, 10, and 5 cycles. The aggregates being used are California RCA, Texas RCA, Texas RAP, New Jersey RAP, Class 5, and a basalt from Senegal, Africa. The Class 5 and basalt are both natural aggregates available to UW-Madison and are used as control materials. Particle size distributions and micro-deval tests were completed on the materials to see the effects of wet/dry cycles on particle degradation. Data is being analyzed and the draft task report is being written.

The effect of brick content on resilient modulus and compaction of RCA has been investigated. A 15-year old clay brick has been acquired from a demolished building in Madison, WI. The brick was crushed and sieved to similar particle size distributions as the four RCAs used in this project: Texas, Ohio, New Jersey, and Minnesota. The brick was added and mixed in with the four different RCAs at varying percentages by mass. The percentages were 0, 10, 20, and 30 percent. Data from the resilient modulus and compaction tests are being analyzed and a draft task report for deleterious materials is being written.

Field sampling of MnRoad RCA leachate at the MnRoad facility and RCA leachate at Lot 60 of the University of Wisconsin- Madison have been undertaken on a monthly and weekly basis, repectively. The leachate samples were tested for pH, electrical conductivity and redox potential, and analyzed by ICP-OES for heavy metals as soon as they were collected. The stockpiled RCA showed an increasing pH trend from 7.2 to 11.9 and equilibrated at pH around 12.0,

Anticipated work next quarter:

All data associated with temperature effects on resilient modulus, wet/dry cycling, and brick content will be further analyzed. Task Reports ID and III will be finished.

The field sampling for MnRoad and Lot 60 leachates will be continued in this quarter. X-Ray powder diffraction analysis will be conducted on cement phase of RCA to determine the mineralogy of cement phase. Serial batch test on the Lot 60 RCAs will be conducted to characterize the leaching behavior under various leaching pH and rain event cycles.

Significant Results:

No trend was observed with respect to summary resilient modulus change with temperature. Permanent deformation of RAP occurred more quickly with increased temperature, but overall total plastic deformation for all materials stayed constant at varying temperatures.

The stockpiled RCA showed an increasing pH trend from 7.2 to 11.9 and equilibrated at pH around 12.0, while freshly crushed RCA still kept a steady leachate pH of 12.6 to 12.8.

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).

None.

Potential Implementation:

The results will provide basis for pending ASTM standards on recycled aggregates. Other DOTs contacted regarding high pH of RCA having conflicting results. Although, there seems to be no clear cut explanation at this point, this problem is being carefully studied.