

TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): WisDOT

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>(i.e., SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX))</i> TPF-5(352)	Transportation Pooled Fund Program - Report Period: <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)	
Project Title: Recycled Materials Resources Center- Fourth Generation (RMRC-4G)		
Name of Project Manager(s): Angela Pakes Ahlman and Tuncer B. Edil	Phone Number: 608-890-4966	E-Mail angela.pakes@wisc.edu
Lead Agency Project ID: TPF-5(352)	Other Project ID (i.e., contract #): AAC2312 Admin Contract	Project Start Date: January 1, 2017
Original Project End Date: February 28, 2022	Current Project End Date: February 28, 2022	Number of Extensions: 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
\$382,932	\$28,568.22	7.4%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
2,553.44; 0.9%	\$2,936.45	7.4%

Project Description:

The goal of RMRC-4G is to provide the resources and activities needed to break down barriers and increase utilization of recycled materials and industrial byproducts. This is being done through carefully integrated and orchestrated activities that include applied research in key areas relevant to transportation applications combined with outreach programs that provide the educational and technical resources needed to maximize the rate at which recycled materials and industrial byproducts are used in transportation applications.

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

In communication with North Carolina DOT (Alyson Tamer) with regards to state-wide LCA.

Initiated research on the environmental benefits of alkali activated ash paste versus clinker-based cement.

Contracted projects agreed upon with Executive Board members in the first cycle of funding.

Teleconference with Executive Board members to describe new RFPs and solicit their tendencies to support.

Refine the remaining budget and develop a funding plan that maximizes the funding of the RFPs that received significant support from the Executive Board.

Continued updates to the website to add user-friendly features.

Held weekly internal RMRC research administration meetings.

Outreach Activities:

- Approval was obtained after numerous balloting for ASTM standard D8012-18 (Standard Practice for Reclamation of Scrap and Waste Asphalt Shingles to Produce Reclaimed Asphalt Shingles (RAS) for Use in Roadway Applications).
- Responded to Iowa DOT regarding separation between the bottom of waste and the water table.
- Responded to Vermont DOT regarding the environmental impacts/effects of RAS.
- Continuing EVA the Engineer STEM program outreach for middle school students

Anticipated work next quarter:

Maintain communication with North Carolina DOT (Alyson Tamer) with regards to state-wide LCA. Establish contract work Obtain NCDOT's Recycled Products & Solid Waste Utilization in Construction & Maintenance Projects Data for fiscal year 2017-2018 and begin data analysis of Recycled Products & Solid Waste Usage LCA.

Continue research on the environmental benefits of alkali activated ash paste versus clinker-based cement.

Obtain Executive Board approval for the proposed second cycle funding of research projects.

Obtain proposals for second cycle approved RFPs. Review the proposals for addressing the RFP scope and appropriateness of the budgets.

Contract approved projects.

Continue outreach efforts.

Prepare presentation and present RMRC-4G program and projects at the November 8, 2018 Midwest Pavement Preservation Partnership Workshop in Madison, WI.

Significant Results:

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).

NA

Potential Implementation:

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Project Title: Physical and Chemical Factors Controlling pH and Alkalinity of RCA Leachate		
Name of Project Manager(s): Matthew Ginder-Vogel	Phone Number: (608) 262-0768	E-Mail matt.ginder-vogel@wisc.edu
Lead Agency Project ID:	Other Project ID (i.e., contract #):	Project Start Date: October 1, 2017
Original Project End Date: April 1, 2019	Current Project End Date: April 1, 2019	Number of Extensions: 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
\$125,000	\$ 55,000	35%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
\$ 15,000	\$ 15,000	50%

Project Description:

The goal of this project is to develop an understanding of long-term RCA leachate chemistry to enable optimal implementation of the material, thereby maximizing its life cycle benefits and limiting its environmental impacts when stockpiled or utilized in roadbeds. Concurrent geochemical modelling and laboratory studies will connect field measurements of RCA leachate pH to laboratory measurements of leachate pH in order to develop guidelines for RCA implementation.

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

Began batch reactor experiments on freshly-crushed RCA to measure pH, alkalinity, and calcium ion concentration with contact time.

Began batch reactor experiments on freshly-crushed RCA using 2 hour, 1 day, 1 week, and 1 month contact times based on AASHTO definitions for pavement drainage (Table 7-4 <https://www.fhwa.dot.gov/engineering/geotech/pubs/05037/07a.cfm>) to simulate field drainage conditions. After specified contact times, RCA sample is separated from leachate and pH, alkalinity, and calcium ion concentration are monitored until leachate pH neutralizes.

Completed geochemical model of portlandite and calcite dissolution using Geochemist's Workbench.

Continued work to model RCA leachate chemistry of recovered RCA using Geochemist's Workbench

Continued discussion to develop methodology and guidelines to advise stockpiling and road base construction using simple, inexpensive techniques.

Conducted extensive literature review.

Wrote "State-of-the-Art Review of Laboratory Methods to Determine pH and Alkalinity of Leachate from Recycled Concrete Aggregates" for submission to *Journal of Materials in Civil Engineering*, ASCE.

Held weekly meetings to coordinate laboratory and modelling components of the work.

Analyzed data and wrote "Assessing the Impact of Contact Time on Leachate Chemistry from Recycled Concrete Aggregates" for submission to TRB.

Submitted "Assessing the Impact of Contact Time on Leachate Chemistry from Recycled Concrete Aggregates" to 2019 TRB Annual Meeting.

Received comments regarding "Characterization of Recycled Concrete Aggregate After Eight Years of Field Deployment," from *Journal of Materials in Civil Engineering*, ASCE.

Completed edits and resubmitted "Characterization of Recycled Concrete Aggregate After Eight Years of Field Deployment," to *Journal of Materials in Civil Engineering*, ASCE.

Completed manuscript entitled "Neutralization of high pH and alkalinity effluent from recycled concrete aggregate (RCA) by common subgrade soil" for submission to *Journal of Materials in Civil Engineering*, ASCE.

Anticipated work next quarter:

Complete batch reactor experiments on freshly-crushed RCA to measure pH, alkalinity, and calcium ion concentration of RCA leachate.

Compare pH, alkalinity, and calcium ion concentration of RCA leachate from both recovered and freshly-crushed RCA.

Begin column experiments on compacted RCA using 2 hour, 1 day, 1 week, and 1 month contact times based on AASHTO definitions for pavement drainage (Table 7-4 <https://www.fhwa.dot.gov/engineering/geotech/pubs/05037/07a.cfm>) to

simulate field drainage conditions. RCA leachate pH, alkalinity, and calcium ion concentration will be monitored after leachate has been drained from column.

Complete model of recovered RCA leachate chemistry using Geochemist's Workbench.

Begin model of freshly-crushed RCA leachate chemistry using Geochemist's Workbench.

Continue discussion to develop methodology and guidelines to advise stockpiling and road base construction using simple, inexpensive techniques.

Hold weekly meetings to coordinate laboratory and modelling components of the work.

Prepare for presentation at 2019 TRB Annual Meeting

Submit "State-of-the-Art Review of Laboratory Methods to Determine pH and Alkalinity of Leachate from Recycled Concrete Aggregates" to *Journal of Materials in Civil Engineering*, ASCE.

Submit "Neutralization of high pH and alkalinity effluent from recycled concrete aggregate (RCA) by common subgrade soil" to *Journal of Materials in Civil Engineering*, ASCE.

Significant Results:

Submitted "Assessing the Impact of Contact Time on Leachate Chemistry from Recycled Concrete Aggregates" to 2019 TRB Annual Meeting.

Resubmitted "Characterization of Recycled Concrete Aggregate After Eight Years of Field Deployment," to *Journal of Materials in Civil Engineering*, ASCE.

Preliminary results from batch reactor experiments on freshly-crushed RCA using phase separation to simulate field drainage to conditions are demonstrating that RCA leachate pH neutralizes within 24 hours of phase separation. These results indicate that the environmental concerns associated with high pH RCA leachate may not persist in the environment, consistent with field pH measurements made in previous work (Chen et. al 2012, 2013).

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).

NA

Potential Implementation:

The outcomes of the modelling and laboratory studies will provide scientific guidance for the regulation of leachate from RCA in road construction and detailed information about the changes in leachate chemistry as they relate to pH and alkalinity. Additionally, the research will provide implementation recommendations for consideration by the States.

Project Description:

In this project, the research team will conduct laboratory and field tests to examine the impact of inclusion of waste quarry fines in granular aggregate materials used in unpaved road designs, using materials collected from various quarries. Based on the laboratory test results, field test sections will be constructed using materials with different quarries. The field performance (abrasion resistance, freeze/thaw resistance, density, material loss, modulus, gradation change) of sections built with different quarry fines will be compared. Then, a comprehensive cost-performance and life cycle cost analyses will be conducted to evaluate the cost effectiveness and sustainability of these unpaved roads to determine whether it is economically advantageous to add waste quarry fines into granular unpaved road materials.

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

- First TAC meeting was held. TAC includes Brian Moore, Vanessa Goetz, Nikki Stinn, Malcom Dawson, Brian Gossman, and Neal Tieck.
- A second meeting was held with Iowa DOT geologists to select quarry sites. Total of 17 quarry was selected to do preliminary lab analyses.

Anticipated work next quarter:

- Collection and testing of quarry fines materials
- Finalizing the material selection

Significant Results:

- No significant results were found in this quarter.

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).

Currently, there are no circumstances that affect the project.

Potential Implementation:

The results of this research will be summarized in a technology transfer brief, which will guide engineers and DOTs on how to apply the recommended methods and designs to improve the performance of unpaved roads. The final report will include an implementation section that will describe all methods, advantages and challenges that can be encountered during applications of the results of this research.