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.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* TPF-5(270)	**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 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	$24,414.53	6.4%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**
$4,813.27; 87%	$5,535.29	6.4%

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.):

Presented *Environmental Benefits of Cold-in-Place Recycling* at the Annual Meeting of the Transportation Research Board January 7-10, as well as the RMRC-3G poster at the AASHTO "Sweet 16 in Research" Projects Poster Session.

Met with the Portland Cement Association at TRB, and hosted RMRC Executive Committee meeting. Presented research ideas and voted on projects moving forward. The RMRC Executive Committee approved four projects.

Proposals were solicited from qualified investigators and the contracting process was completed.
Contracted three research projects involving UW-Madison, Iowa State University and the University of Alabama. The fourth project on MSE walls Phase II will be contracted soon; work cannot start until later this calendar year due to facilitiy availability.

Continued efforts to have more states join RMRC, specifically North Carolina and Missouri. Progress was made relative to NCDOT; the Admin team was asked to give a webinar about the RMRC program – this was setup for Monday, April 9, 2018.

Additional research ideas are being requested for consideration by the RMRC Executive Committee in 2nd quarter.

Continued work on LCA and LCCA for relating to Polyurethane Injection as a method of subgrade stabilization, as well as complementary work on LCA and LCCA Cement Slurry Injection as a method of subgrade stabilization for comparison. Funded currently by the Sophomore Undergraduate Research Fellowship with continued request additional funding from Uretek CRI.

Submitted proposal to NSF Graduate Research Fellowship Proposal on Comparative Life Cycle Assessments of Foundation Construction Methods for bridges.

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

Held weekly internal RMRC research administration meetings.

Submitted proposal for the Hilldale Undergraduate Research Fellowship and Holstrom Environmental Scholarship, as well as the undergraduate Holtz Fellowship on the environmental benefits of alkali activated ash paste versus clinker-based cement.

Presented at the Reid Bryson Poster 2018 Poster Competition on the environmental benefits of alkali activated ash paste versus clinker-based cement, and the environmental benefits of polyurethane injection versus cement slurry injection.

Prepared presentation on the environmental benefits of alkali activated ash paste versus clinker-based cement for the Undergraduate Research Symposium on April 13.

Anticipated work next quarter:

Continue discussions with MO and NC as potential partners.

Additional research ideas are being requested for consideration by the RMRC Executive Committee in 2nd quarter.

Complete contract for MSE wall Phase II project.

Initiate research on the environmental benefits of alkali activated ash paste versus clinker-based cement. Present this research at the Undergraduate Research Symposium on April 13.

Submit 500-1000 word paper on the environmental benefits of polyurethane injection versus cement slurry injection as required by the Sophomore Undergraduate Research Fellowship. Continue working on extended paper with further comparisons to traditional tamping and replacement.

Significant Results:

Recipient of an AASHTO "Sweet 16" High Value Research Award for RMRC-3G.

Environmental Benefits of Cold-in-Place Recycling available on TRB Website, soon to be published.

Awarded undergraduate Holtz Fellowship on the environmental benefits of alkali activated ash paste versus clinker-based cement.

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:

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): __ WisDOT_____

INSTRUCTIONS:

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Transportation Pooled Fund Program Project # MSN214029 RMRC 2017	**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: USE OF CONCRETE GRINDING RESIDUE AS CONCRETE AND SOIL AMENDMENT		
Name of Project Manager(s): Bora Cetin Halil Ceylan	**Phone Number:** 515-294-8158 515-294-3374	**E-Mail** bcetin@iastate.edu hceylan@iastate.edu
Lead Agency Project ID: 140926	**Other Project ID (i.e., contract #):**	**Project Start Date:** 01/01/2018
Original Project End Date: 06/30/2018	**Current Project End Date:** 08/30/2018	**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
$30,000	$807.88	3%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
807.88/3%	$807.88	3%

Project Description:

Concrete grinding residue (CGR) is a slurry byproduct created by concrete pavement maintenance operations. It is produced during concrete pavement maintenance operations carried out to extend the pavement service life. Typically CGRs possess a high alkaline characteristics with pH > 11 (DeSutter et al. 2010, Townsend et al. 2016). Current maintenance practice involves dumping of fresh CGR on the roadsides that results in some environmental concerns regarding plant and vegetation growth on the roadsides. This becomes more critical issue when disposal of these CGR slurries are nearby sensitive areas such as farmlands, lake, creeks, rivers, and high groundwater table presence. CGR disposal may lead to reduce density of vegetation which may yield to erosion problems in particular at the sensitive areas mentioned previously. However, CGR poses great potential to be used in concrete as an ingredient and as a soil stabilizing agent due to its high alkaline and rich CaO content.

The purpose of the current study is to conduct a detailed literature review and survey within Department of Transportations (DOTs) throughout US to understand the current issues regarding CGR and analyze interests of DOTs to recycle these materials in concrete and soil applications.

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

- Draft of the literature review task is in progress. Final draft will be sent to the committee by end of June 2018.
- Survey questionnaire is completed and sent to the interested stake holders including concrete industry and state DOTs.

Anticipated work next quarter:

- Results of survey and summary of literature review will be presented.

Significant Results:

- Draft literature review showed that CGR application on the roadsides is the most common technique. Studies showed that there is no adverse impact on vegetation.
- There are not studies thoroughly studied the reuse of CGR in soil and concrete. Preliminary tests conducted by ISU team showed that addition of CGR in two different fine-grained soils resulted in increases in UC strength of these soils.

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:
Tech transfer will be prepared based on the results of this study to summarize the potential environmental impacts of CGR, the state of practice, and its physicochemical and geo-engineering properties.

TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Wisconsin Department of Transportation

INSTRUCTIONS:

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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 Material Web Map: Connecting Consumers and Producers		
Name of Project Manager(s): Andrew J. Graettinger, Ph. D.	**Phone Number:** (205) 348-1707	**E-Mail** andrewg@eng.ua.edu
Lead Agency Project ID: 790K392	**Other Project ID (i.e., contract #):** UA Fund #26356-214231-200	**Project Start Date:** January 1, 2018
Original Project End Date: December 31, 2018	**Current Project End Date:** December 31, 2018	**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
$49,518	$1500	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
$1500	$1500	25%

Project Description:

An on-line Geographic Information System (GIS) web application that connects producers and consumers of recyclable material was developed to assist engineers and contractors in the beneficial reuse of nonhazardous recycled materials in transportation projects. The Recycled Material Network (RMN) is comprised of four core layers: providers, stockpiles, specifications, and case studies. Providers of recycled material can locate their facility and enter contact information. The stockpile layer, connected to the provider layer, allows facility managers to add or update information about their recycled material stockpiles including material type(s), application(s), availability, and cost information. Multiple stockpiles can be associated with each provider. The specification layer includes both Department of Transportation (DOT) specifications and environmental regulations pertaining to the beneficial reuse of recycled material based on specific location, material type, and application. The case study layer locates projects that successfully utilized recycled materials and includes information regarding the material type, application, volume data, and any additional documentation. The web map utilizes search capabilities to locate nearby stockpiles to minimize transportation costs that typically dictate the use of large volumes of materials. The RMN provides key information that engineers and contractors need to successfully utilize recycled materials, thereby preserving limited natural resources and benefiting the project and society as a whole.

The RMN is hosted at the Center for Advanced Public Safety (CAPS) at The University of Alabama and was funded through a pooled fund supporting the Recycled Materials Resource Center (RMRC) at the University of Wisconsin – Madison. During the first phase of this work, the RMN was designed, developed, and tested with preliminary data. A beta version of the web application has been demonstrated to be a useful tool, but there are several areas of the application that need to be addressed for widespread use of this web tool. To address these areas, The University of Alabama is partnering with the University of Wisconsin – Madison and proposing a second phase of the project.

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

The project contract was active as of January 1, 2018, and the grant was approved and established in the UA system on February 9, 2018. During January 7-11, 2018, Dr. Graettinger attended the TRB meeting in Washington, D.C. where he was present for the Recycled Material Resource Center meeting. The initial project kickoff meeting was held on March 21, 2018. The remaining weeks of March included establishing a project manager, hiring students, and reviewing project documents from RMWM Phase I. With the research team formed, an outline for the project schedule is in progress.

Anticipated work next quarter:

Finalize a project schedule, begin collecting stockpile, case study, and regulations/specifications data for Task 1, design the functionality of a link-check tool for Task 2, and check for consistency in existing stockpiles, facilities, and hyperlinks for Task 3. Once Tasks 1-3 are complete, then the focus will be directed to promoting the Recycled Material Network for Task 4 and expanding the Recycled Material Network to new members of RMRC-4G for Task 5.

Significant Results:

The project kickoff meeting was held on March 21, 2018, and the research team was created.

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).

The project initiation was delayed one month due to paperwork associated with setting up the grant account. This delay may affect the end date of the project.

Potential Implementation:

TRANSPORTATION POOLED FUND PROGRAM
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Lead Agency (FHWA or State DOT): _____WisDOT_____

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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: 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	$ 2983.00	10%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	**Total Amount of Funds Expended This Quarter**	**Total Percentage of Time Used to Date**
$ 2983.00	$ 2983	5%

Project Description:

The goal of this project is developing 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. Field and laboratory studies will be conducted in order to examine changes in the chemistry of RCA leachate as it relates to environmental concerns.

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

The contract was awarded at the beginning of this quarter.

Dr. Ginder-Vogel traveled to the annual Construction, Demolition and Recycling Association meeting in Nashville, TN to present his group's research on RCA chemistry, February 11-13, 2018.

Dr. Ginder-Vogel hired a Master's student and two undergraduate students to begin work on the project in May of 2018.

Weekly research meetings to bring the graduate and undergraduate students up to speed were initiated.

Initial geochemical modelling of RCA dissolution was begun.

With the addition of three students working on this project we are prepared to make significant progress on the project during the next quarter.

Anticipated work next quarter:

Conduct control reactor batch experiments on calcium carbonate and calcium hydroxide (portlandite).

Begin batch reactor experiments of RCA to measure pH, alkalinity, and calcium ion concentration with contact time.

Begin geochemical modelling of RCA leachate using Geochemist's Workbench.

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

Analyze laboratory data and write "Characterization of Recycled Concrete Aggregate After Eight Years of Field Deployment".

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

Significant Results:

Initial geochemical modelling indicates that the pH of water in contact with RCA is initially controlled by dissolution of Portlandite resulting in pH values close to 12. The precipitation of calcite then occurs resulting in a decrease in the solution's pH. Next quarter's efforts are designed to investigate these phenomena experimentally and construct computational models of the system's behavior.

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 proposed lab studies will provide scientific guidance for the regulation of leachate from RCA in road construction, additionally, detailed information about the changes in leachate chemistry as they relate to pH and tufa formation. Additionally, the research will provide implementation recommendations for consideration by the States.