**TRANSPORTATION POOLED FUND PROGRAM**

**QUARTERLY PROGRESS REPORT**

Date: \_\_November 1, 2011\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lead Agency (FHWA or State DOT): \_Missouri Department of Transportation\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**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.*

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| **Transportation Pooled Fund Program Project #**  **TPF-5(213)** | | **Transportation Pooled Fund Program - Report Period:**  □Quarter 1 (January 1 – March 31)  □Quarter 2 (April 1 – June 30)  X Quarter 3 (July 1 – September 30)  □Quarter 4 (October 1 – December 31) | |
| **Project Title:**  **Performance of Recycled Asphalt Shingles (RAS) in Hot Mix Asphalt** | | | |
| **Name of Project Manager(s):**  **Karmen Stockman** | **Phone Number:**  **573-526-5585** | | **E-Mail**  [karmen.stockman@modot.mo.gov](mailto:karmen.stockman@modot.mo.gov) |
| **Lead Agency Project ID:**  **TRyy0928** | **Other Project ID (i.e., contract #):** | | **Project Start Date:**  Oct 1,2009 |
| **Original Project End Date:**  **Oct 31, 2011** | **Current Project End Date:**  **Oct 31, 2012** | | **Number of Extensions:**  1 |

Project schedule status:

x On schedule □ On revised schedule □ Ahead of schedule □ Behind schedule

Overall Project Statistics:

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| **Total Project Budget** | **Total Cost to Date for Project** | **Percentage of Work**  **Completed to Date** |
| $ 765,000 | $ 467,500 | 61% |

***Quarterly*** Project Statistics:

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| **Total Project Expenses**  **and Percentage This Quarter** | **Total Amount of Funds**  **Expended This Quarter** | **Total Percentage of**  **Time Used to Date** |
| $441,507.47 | 85,016.12 | 50% |

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| **Project Description**:  The use of recycled asphalt shingles (RAS) in hot-mix asphalt (HMA) applications has  Grown across the US over the last 10 years. Although the majority of states are using manufacturers¿ RAS, there has been a rapidly growing interest in the use and  applications of tear-off RAS in hot-mix asphalt (HMA). Many states share common  concerns and questions in the use of tear-off shingles. Previous research has allowed  for only limited laboratory testing and field surveys. Researchers and bituminous/material engineers still require additional research to study the effects of tear-off RAS on the performance of HMA applications and their economic value. Multiple state demonstration projects would provide adequate laboratory and field test results to more comprehensively answer the design, performance and environmental questions/concerns remaining. These concerns include the qualification of tear-off RAS for use in HMA and utilization of tear-off RAS ensuring acceptable long-term HMA performance.   |  | | --- | | The primary goal of this study is to address research needs of state DOT and environmental officials to determine the best practices for the use of recycled asphalt shingles in hot-mix asphalt applications. The study will address the following research objectives:  1. To address the concerns of quality assurance (QA)/ quality control (QC) in the sourcing, processing and incorporation of the RAS to achieve a final product that would meet the requirements for use in state HMA applications. Create a specification that includes sufficient language to cover the QA/QC concerns.  2. To conduct demonstration projects to provide laboratory testing and field surveys to determine the behavior and performance of RAS in HMA at varying percentages, climates and traffic levels.  3.To create a comprehensive database on the performance of RAS in HMA applications. | |  | |

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| **Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**  During the eighth quarter, July 1, 2011 through September 30, 2011, the TPF-5(213) team achieved the following components on the project:   1. The Illinois DOT in partnership with the Illinois Tollway produced stone mastic asphalt (SMA) field trial sections on I-80 in District 1 near Joliet and on I-90 near Schaumburg, Illinois. The I-80 mixes included RAS only for a total of 20% binder replacement in the binder and surface mixes. The I-90 mixes included FRAP and RAS for a total of 35% binder replacement in the binder and surface mixes. Both field trials used a 70-28 performance grade binder and the RAS was used to replace 100% of the fibers, no fiber machines were used. The research team was not present during production. 2. The research team completed the four-point beam fatigue testing of asphalt mixtures from Missouri, Iowa, Indiana, and Minnesota. 3. A draft report of the dynamic modulus test results from Missouri, Iowa, Indiana, and Minnesota was completed. The report presented the results in the form of master curves and included statistical analysis of each state’s mixtures. 4. Samples of Colorado’s mixtures were compacted at Iowa State’s asphalt testing laboratory for the semi-circular bending (SCB) test. These samples were delivered to the University of Minnesota’s testing laboratory for subsequent SCB testing. 5. The research team completed the second condition survey for the Minnesota demonstration project. 6. Two of four Illinois DOT demonstration project plant and lab mix samples were received for testing. The Iowa State is currently waiting to receive the remaining two mixtures. 7. Analysis of the tests results achieved thus far has been done including dynamic modulus and beam fatigue. A modified Witczak model integrating RAS has been preliminarily developed. |
| **Anticipated work next quarter**:  Next steps for the study include:   1. Schedule and hold a TAC meeting in Ames; 2. Schedule a workshop with CalTrans; 3. Finalize 2011 demonstration projects with California and Wisconsin; 4. Complete draft reports on the binder characterization, beam fatigue test results, flow number test results, gradation and volumetric properties of all the mixes. 5. Complete the pre-winter condition survey's for Colorado, and Illinois DOT project demonstrations. 6. Continue mix and binder testing of materials received from Colorado as well as materials received from Illinois; and 7. Send out TPF member website link for state members to review state front pages and to review state draft reports.   The above accomplishments and future plans will be discussed at the next TAC meeting. |
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| **Significant Results:**   1. **RAS Mixes have been produced and tested in Colorado, Illinois, Iowa, Minnesota and Missouri.  Follow up field condition inspections have also been done on these pavements.** 2. **A draft report of the dynamic modulus test results from Missouri, Iowa, Indiana, and Minnesota was completed. The report presented the results in the form of master curves and included statistical analysis of each state’s mixtures.** 3. **A workshop on using RAS in HMA pavements has been done for Colorado DOT and two more are planned for California in 2012.** |
| **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).** |

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| **Potential Implementation:**  Several states in the study have already put RAS into their asphalt pavement specifications and have approved many job mixes containing either tear off shingle mixes and/or manufacturers waste shingles contained in various amounts.  The outcomes form this research will provide a method for characterizing shingles and provide Mix design  specifications.This research will allow other highway agencies the opportunity to utilize these mixes while reducing  the waste stream and gaining a source of a good percentage of useful asphalt binder as well as fiber filler for the  mixes. |