

**TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT**

Lead Agency (FHWA or State DOT): **FHWA Office of Technical Services Resource Center P&M TST**

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> <p align="center">TPF 5(063)</p> | | 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: “Improving the Quality of Pavement Profiler Measurement” | | | |
| Name of Project Manager(s): Robert L. Orthmeyer | | Phone Number: (708) 283-3533 | E-Mail robert.orthmeyer@dot.gov |
| Lead Agency Project ID: FHWA OTS RC P&M TST | Other Project ID (i.e., contract #): DTFH61-10-D-00013 DTFH6311P00082 DTFH6312P00049 | | Project Start Date: May 2003 |
| Original Project End Date: September 2008 | Current Project End Date: December 2016 | | Number of Extensions: Two |

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 |
|----------------------|--------------------------------|--------------------------------------|
| \$2,832,000 | \$1,643,222 | 90% |

Quarterly Project Statistics:

| Total Project Expenses and Percentage This Quarter | Total Amount of Funds Expended This Quarter | Total Percentage of Time Used to Date |
|---|---|---------------------------------------|
| Two ProVAL workshops, Benchmark Cart Laser Repairs | \$16,840 | 85% |

Project Description:

Participating Agencies: 22 SHAs: California, Colorado, Connecticut, Florida, Georgia, Illinois, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Nevada, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Texas and Wisconsin. FHWA offices include: Federal Lands, LTPP, the Office of Technical Services Resource Center and the Office of Asset Management/Pavement/and Construction.

1. Guiding Principles

The goal of the IPQ Pooled-Fund Study (IPQ Study) is to assemble states and the Federal Highway Administration (FHWA) to (1) identify data integrity and quality issues with inertial profilers; (2) suggest approaches to addressing identified problems; (3) initiate and monitor projects intended to address identified problems; (4) disseminate results; and (5) assist in solution deployment.

2. Scope

The IPQ Pooled-Fund Study is intended to serve as a forum for the participants to identify and address operational issues that are common among various inertial profilers. The Study will focus on quality of data issues that arise from the use and operation of inertial profilers. Within these broad topic areas, the following are offered as examples issues that might be addressed within the intended scope:

- Implementation of American Association of State and Highway Transportation Officials (AASHTO) Provision Protocols for Inertial Profilers.
- Inertial profiler certification procedures.
- Establishing a reference profile.
- Certification course(s).
- Operator procedures and training i.e. NHI Course 131100 "Pavement Smoothness: Factors Affecting Inertial Profiler Measurements Used For Construction Quality Control".
- Components: i.e. Accelerometers.
- Software i.e. FHWA ProVAL – "Profile Viewer and Analyzer Software".
- System performance monitoring, evaluation, and reporting.
- Contracting and procurement practices and issues.
- The use of inertial profilers for construction quality control and quality assurance as per Title 23 Code of Federal Regulations Section 637.205.
- Bridging Filters.

The following is a list of TAC approved priorities as of September 2013:

1. Reference Profile Device (development of)
 - a. Benchmark Testing – first round completed.
 - b. Reference Device – first round completed with a second round completed in May 2013.
2. Critical Profile Accuracy Requirements (definition) – Completed report is on the TPF 5(063) website.
3. Construction Acceptance and Correction Software (ProVAL: www.roadprofile.com) – Ongoing
4. Regional Validation Sites – Currently being undertaken by the TAC.
5. Evaluating Upper Limits of Single Accelerometer and Single Height Sensor –Phase II has been completed.
6. Emerging Technology That Enhances Profile Measurement
 - a. Automated Faulting Measurement – completed.
 - b. Low Speed and Urban IRI Measurement – contract has been awarded.**
 - c. Ride quality index at different speeds – being undertaken by NCHRP 10-93.**
7. Support for Road Profiler User's Group (RPUG).

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

FHWA conducted another round of potential reference device evaluations at the MnROAD facility during the last week of September 2015. There were four vendors participating with new devices from ARRB, Shima and ICC.

Anticipated work next quarter:

The TAC will be meeting face to face on Monday November 2nd in Raleigh, NC just prior to the start of RPUG Annual Mtg.

Priority One: Evaluation of the data collected at MnROAD will continue with final report posted on website.

Priority Three: Task Order has been awarded for additional ProVAL enhancements with anticipated release in March.

Priority Four: Regional Calibration/Verification Sites – completed but waiting to determine role of FHWA in assisting with establishing sites.

Priority Six: Review of FHWA Federal Lands study on measurement of ride quality for low volume and urban roads is due this quarter.

NCHRP 10-93 will conduct meeting next quarter to review interim report and discuss project status.

Significant Results: Accomplishments to Date:

Priority One: Benchmark testing tool to evaluate potential profiler reference devices. A third round of reference device testing was conducted in September 2015. Participating vendors included: ARRB with a new walking profiler; SSI with two versions of walking profiler; SHIMA from Japan with a walking profiler; and ICC with the SurPRO and the new automated Roadbot – a potential benchmark cart replacement. Initial report cards were provided to the TAC and the vendors at RPUG. Final report cards due by July 2016. See images below.

FHWA has scheduled an inertial profiler type test (mini-rodeo) at MnROAD the first week of October 2015. A type test is used in industry to conduct an independent evaluation of components and equipment being supplied by manufacturers and/or technology integrators. The objective of the type test is to provide an unbiased report of the equipment and it is essential that both manufacturers and owner/agencies can rely on the test reports from a fully independent testing operation.

Priority Two: Critical Profile Accuracy Requirements study and report (see website for CPAR report); <http://www.pooledfund.org/Details/Study/280>

Priority Three: ProVAL software and support (www.roadprofile.com) that includes grinding simulation. New version 3.5 was released November 2014. Version 3.6 enhancements scheduled for March 2016.

Priority Five: First phase of understanding the limitations of a single accelerometer. Second phase final report has been completed and is awaiting a tech brief.

Priority Six B & C: NCHRP Study 10-93 has been funded – the SOW was developed by this study TAC. UMTRI was awarded the contract and the anticipated completion is mid-2016.

UMTRI contract with FHWA for a study on how to measure ride at low speeds and in urban areas will be completed by February 29, 2016.

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).

Several delays have been encountered within FHWA processes involving contract awards.

No additional funds are being requested at this time.

Potential Implementation:

- 1. Provide a pavement profiler reference device that assists Agencies with profiler certification and validation that all inertial profilers are collecting correct pavement profiles that can be used for ride quality indices.**
- 2. Provide assistance with regional calibration/validation centers that would provide uniform quality data collection by inertial profilers. This would enhance confidence in nationwide reporting of ride quality for programs such as pavement management systems and FHWA Highway Performance Monitoring System (HPMS) and MAP-21 requirements.**
- 3. Providing a standardized engineering tool - the Profile Viewer and Analysis (ProVAL) software - that removes the "black box" concept of understanding pavement profiles collected by inertial profilers. Users can import profiles from various file formats and save them in the Pavement Profile standard file type. Entire analysis projects can be saved, which preserves user information and analysis inputs. After analyses have been performed, the user can print a report of the original profiles and the results of any analyses performed. ProVAL has been adapted by many agencies around the world. www.roadprofile.com**

Types of analyses that ProVAL can perform:

- **Profile Editing (to manipulate profile data in many aspects including cropping and filtering);**
 - **Standard Ride Statistics, such as International Roughness Index (IRI), Half-car Roughness Index (HRI), Mean Roughness Index (MRI), and Ride Number (RN);**
 - **Fixed-Interval Ride Statistics (to report roughness indexes at a fixed interval);**
 - **Continuous Ride Statistics (to report roughness continuously with a sliding interval);**
 - **Power Spectral Density (PSD) (to view the wavelength or frequency content of profiles);**
 - **Profilograph Simulation (to simulate Profilograph traces, report Profilograph Indices, etc.);**
 - **Rolling Straightedge Simulation (to simulate Rolling Straightedge traces);**
 - **Cross Correlation (a powerful tool to synchronize profiles and to determine their repeatability);**
 - **Profiler Certification (a tool to produce repeatability tests and accuracy tests for profiler certification programs);**
 - **ASTM E 950 Precision and Bias (for classification of profilers based on the ASTM E-950 Spec); and**
 - **Smoothness Assurance Module (SAM) (to provide ride quality reports and improve smoothness from pavement grinding simulation).**
- 4. Provide technical guidance on validity of using inertial profilers when using a single axis accelerometer.**



ARRB G3 Walking Profiler



ARRB G3 Uncovered



SSI with Laser mounted in front



SSI with added wheel



Shima from Japan walking profiler



ICC Roadbot shading tracking cameras



ICC Roadbot uncovered



ICC SurPRO 4000