TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): **FHWA OTS 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.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* **TPF 5(063)**	**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:
"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 X 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
$2,832,000 (includes FHWA funds not listed on TPF page)	**$ 1,794,762**	**98%**

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
ProVAL Support Contract	**$ 92,959**	**95%**

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.):

On April 21st, the SDDOT agreed to provide the leadership for continuation and completion of this study. The solicitation was published on June 7, 2016 for a five-year study seeking $1.5M. This is now an official pooled fund

study TPF 5(354) "Improving the Quality of Highway Profile Measurement" and can be found at: http://www.pooledfund.org/Details/Study/605

As of October 20, a total of 14 agencies have committed $1,220,000 to the new study: CT, FL, IL, KS, KY, LA, NC, NV, NY, OH, PA, TX, WI and SD. Thank you for your support!!

ProVAL 3.6 was released in April with several updates provided this quarter. FHWA will be parking a version on one of their websites without support.

There are now sufficient funds in the current study – TPF 5(063) to have our final face to face meeting the day prior to the start of this year's RPUG conference. Mark your calendars for Tuesday, November 1st for our final meeting. This will also serve as the hand-off to the new SDDOT led study.

RPUG will be held in San Diego, CA on November 2nd & 3rd. This will be part of the TPF 5(063) agenda. Travel days are Monday October 31st and Friday November 4th. http://www.rpug.org/

Anticipated work next quarter:
Final face to face meeting in San Diego, CA one day prior to RPUG.

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

Priority Three: Final workshops have been delivered. ProVAL version 3.6 will be parked on a FHWA website once the 508 compliance has been completed. New study will discuss how to best move forward.

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 has been extended to the end of September 2016.

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. Report cards due by July 2016.

FHWA conducted 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. Participating vendors included: Ames Engineering; ARRB Hawkeye Survey Vehicle; ARAN – Fugro; Mandli – brought Kansas vehicle and uses Dynatest Inertial Profiler; Pathways Services; ICC; and SSI. See images below. Report cards due by March 2017.

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 3.6 was released April 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 late 2016.

UMTRI contract for a study on how to measure ride at low speeds and in urban areas will be completed by December 31, 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.

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.**
