

SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

BACKGROUND

Four LTPP FWD Calibration Centers have been in existence for over a decade, and have been widely used by both public and private agencies in calibrating deflection-testing equipment. Contact information can be found at <http://www.tfhr.gov/pavement/ltp/fwdcont.htm>. The calibration centers have provided a service that gives FWD owners and operators the best possible assurance that data collected by their equipment is as accurate as possible. Demand for calibration center services is on the rise, and in August 2001, the American Association of State Highway and Transportation Officials (AASHTO) adopted a resolution in support of continued operation of the calibration centers. Therefore, the importance of the calibration centers to the transportation infrastructure community is clear. However, the computer software and hardware originally developed for the centers is obsolete due to subsequent changes in technology.

The FWDREFCL software used to calibrate the FWDs is a DOS-based program developed before the advent of the Windows operating system software. FWDREFCL utilizes a MetraByte DAS-16G board for data acquisition. This board requires an ISA slot in the computer in order to function. After January 1, 2000, the computer manufacturing industry adopted the PCI slot as the industry standard, and computers with ISA slots are becoming increasingly difficult to obtain.

Continued operation of the calibration centers requires an upgrade of the FWDREFCL software to be compatible with the Windows operating system, and allows use of data acquisition hardware compatible with modern computers.

Based on experience gained from hundreds of FWD calibrations, it is anticipated that the current calibration process can be improved by taking advantage of lower cost, high technology hardware. These improvements, along with timesavings resulting from a streamlined calibration process will reduce the staffing burden of the host State Highway Agency (SHA). Because of the modifications required to streamline the existing calibration process, FHWA anticipates that a contractor will need to perform either an upgrade to the existing software or redevelop software.

Therefore, in 2002, a pooled-fund study was proposed and SHAs were solicited for participation. Results of the first study participant meeting, held in May 2003, are posted on the Transportation Pooled-Fund website at <http://www.pooledfund.org>, under study number TPF-5(039).

SCOPE OF WORK

The contractor shall develop new software for calibrating FWDs and provide new hardware to be used in conjunction with the software. Provision of new hardware will likely include design, fabrication and testing of mechanical devices to be used in

conjunction with commercial hardware and the new software. The contractor shall provide drawings and specifications for the calibration hardware.

The contractor shall provide upgraded calibration system hardware and software to equip the existing four LTPP FWD Calibration Centers. The contractor shall thoroughly test the resulting calibration system and report on its performance relative to the current calibration procedure, demonstrating that it meets or exceeds current calibration system quality. The contractor shall install the hardware and software on-site in the existing LTPP FWD Calibration Centers, and provide accompanying calibration protocol, manuals, and on-site training for the calibration center operator. On a task order basis, the contractor may install the upgraded calibration system in existing non-LTPP calibration centers and new calibration centers as well as perform other support tasks as needed.

OBJECTIVES

1. Modify the existing calibration procedure to be compatible with all FWD equipment on the market and in use by state highway agencies (i.e., FWDs able to impart a load of at least 6000 pounds). The contractor shall evaluate the feasibility of streamlining the calibration process without reducing the accuracy and precision of the results obtained, and implement the streamlined process. The contractor shall evaluate the feasibility of automatic data acquisition triggering and automated reference deflection system movement compensation without reducing the accuracy and precision of the calibration results obtained. If feasible, these features will be implemented.
2. Upgrade calibration hardware and software to be compatible with operating systems and computers that are current at the time of delivery. The new software shall work with both SI and U.S. Customary units.
3. Produce an upgraded and tested calibration system for use in the existing LTPP FWD Calibration Centers and non-LTPP calibration centers, and provide accompanying documentation and training to calibration center operators.

DELINEATION OF CONTRACTOR TASKS

To accomplish the objectives of this contract, the Contractor shall perform at a minimum, the following tasks:

Task 1. Communication, Coordination and Reference Resources

Task 1a. FHWA will provide the contractor literature pertaining to the most current SHRP FWD Calibration Protocol as well as reference and relative deflection sensor calibration software executables and source code. The contractor shall review this material and use it as a reference.

Task 1b. Communicate and coordinate with current LTPP and non-LTPP FWD Calibration Center operators and FWD manufacturers to gain information crucial to achieve standardized calibration data formats and procedures. Obtain and review FWD

manufacturer literature pertaining to all equipment currently on the market and FWD equipment currently being used by state highway agencies (i.e., FWDs able to impart a load of at least 6000 pounds). The contractor shall provide one copy of the literature to the COTR with a synopsis of fundamental differences affecting the effort to produce standardized calibration data formats and procedures.

Task 2. Modify Calibration Process – Because of the modifications required to streamline the existing calibration process, FHWA anticipates that a contractor will need to perform either an upgrade to the existing software or redevelop the software.

Task 2a. The contractor shall evaluate the feasibility of streamlining the existing calibration process, including any required hardware, and as a minimum, the following modifications shall be explored:

- Concurrent reference calibration of up to 12 FWD deflection sensors
- Simultaneous reference and relative calibration of up to 12 FWD deflection sensors (to eliminate the need for relative calibration as a separate step)
- The ability to conduct concurrent, or separate reference calibration of the FWD deflection sensors and FWD load cell
- Automatic data acquisition triggering
- Automatic compensation for movement in the reference deflection system, or replacement of the reference deflection system.

These modifications may require fabrication of mechanical hardware devices. The contractor shall provide drawings and specifications for the calibration hardware to the COTR.

Confirm and demonstrate to the COTR that the streamlined calibration procedure meets or exceeds the accuracy precision requirements of the current protocol and repeatability achieved with the current calibration procedure. The contractor shall submit documentation of calibration results, and the COTR will visit the contractor site during calibration for demonstration and acceptance.

Task 2b. Establish an automated mechanism to trigger data acquisition at the release of the mass.

The contractor shall make the time base among data acquisition for other channels consistent with this trigger.

Task 2c. The contractor shall evaluate the feasibility of compensating for movement in the existing reference deflection system, or replacing the current system with one that is self-referencing. The contractor shall document the technical characteristics and performance of the new system, relative to the existing system, and submit well-supported recommendations as to its suitability for inclusion in the final FWD calibration procedure. The contractor shall submit this documentation to the COTR, who will visit the contract site for demonstration and acceptance.

Task 3. Hardware and Software Upgrades and/or Development

Task 3a. The contractor shall upgrade and/or develop reference and relative calibration software for the deflection sensors and load cell to be compatible with all calibration process modifications in task 2. The contractor shall develop software using source code executable on the most current MS Windows operating system at the time of delivery. The contractor shall choose a source code and compiling application with known vendor support for the foreseeable future to facilitate upgrades and/or enhancements. Software shall exhibit the following features:

- a graphical user interface (GUI)
- ability to document pre-calibration maintenance and troubleshooting activities
- ability to detect, notify and monitor any movement of the reference-deflection-sensor-system in real time
- ability to automatically compensate for the effects of this movement to peak deflections as described by the process modification in task 2, if applicable
- ability to record and display history of calibration factors for sensors from FWD units
- the calibration output file shall serve as a calibration report; and be readable by spreadsheet applications
- wireless data transfer capability

Task 3b. The contractor shall purchase/fabricate and configure hardware (computers, data acquisition cards, sensors, sensor holders, etc.) sufficient to equip the four existing LTPP FWD Calibration Centers. In purchasing equipment, the Contractor shall maintain consistency among equipment (i.e., same specifications, memory, processor, ports, etc.). Contractor shall demonstrate to COTR (or designated representative) the ability of hardware to meet the calibration process modifications requirements in task 2, and work effectively with the upgraded software and the computers used in task 3a. The contractor shall submit documentation of calibration results and provide a demonstration to the COTR during a site visit at the contractor site during calibration.

Task 4. Calibration System Testing, Installation and Operator Materials/Training

Task 4a. The contractor shall thoroughly test the modified calibration system and process, demonstrating that it: reduces time required to perform calibration relative to the existing calibration process; meets or exceeds requirements of accuracy and precision specified by the existing protocol; and is resistant to interference from electromagnetic fields (EMFs) and radio frequencies (RFs).

Task 4b. The contractor shall prepare documentation of the software executables, hardware, calibration process and protocol in the form of a manual for calibration center operators. As an appendix to this manual, the contractor shall document the source code with embedded non-executable lines that describe the function of code blocks and algorithms, as well as provide a flow chart of code processes consistent and referenced to the code documentation.

Task 4c. Install modified software (task 3a) and hardware (task 3b) in one of the existing LTPP FWD Calibration Centers (to be determined by COTR) and provide on-site training and training materials described in task 4b to enable calibration center operators to implement the modified calibration process. FHWA anticipates that training will be necessary for one person for three days. Upon receipt of COTR's written approval, install modified software (task 3a) and hardware (task 3b) in remaining three LTPP FWD Calibration Centers and provide on-site training and training materials described in task 4b to enable calibration center operators to implement the modified calibration process.

Task 5. Presentation and Reporting

Coordinate travel for and participate in meetings and teleconferences with the TPF-5(039) technical advisory panel (TAP), not to exceed three (3) meetings estimated at two (2) days each. Make a presentation at the annual FWD Users Group meeting as directed. Visual aids shall be developed in Microsoft PowerPoint (.ppt). Submit draft to FHWA at least 4 weeks prior to the meeting for review and comment. The contractor shall incorporate all FHWA comments before making the presentation.

The contractor shall prepare a final report at the end of the contract base period that contains all aspects of work completed under tasks 1-4. Content shall include the technical investigation, results, conclusions and recommendations, as well as the executable software, documented source code, hardware schematics and specifications, calibration protocol and manuals. The draft final report shall be delivered at least 4 months prior to the end of the base period. The contractor shall incorporate FHWA feedback and deliver the final report at the end of the base period.

Task 6 – Miscellaneous Support for TPF-5(039)

The Contractor shall perform work under this Task only after receipt of a Task Order authorized by the Contracting Officer. All work under this Task shall be conducted through individual Task Orders negotiated by the parties and authorized in writing by the Contracting Officer. The Government will issue Task Orders for specific work as needed in accordance with the procedure contained in Section G. The cumulative amount of task orders shall not exceed the level of effort delineated in Section F.

Under this Task, the Contracting Officer may issue Task Orders on an as needed basis from the following task areas. Work to be performed under this task cannot be defined prior to award but may be necessary during contract performance. Many of these task orders are directly related to work identified under tasks 2-4, and are intended to provide the opportunity for further enhancements or modification, if needed. The FHWA anticipates that work under these task orders will be carried out during option years.

1. Coordinate travel and meeting arrangements for the Technical Advisory Panel (TAP)
2. Technical Support for calibration centers
3. Design and modification of equipment, software, facility or calibration process

4. Equipment and software purchase and installation
5. Training and training materials for calibration center personnel
6. Preparation of guidelines and protocols related to equipment calibration
7. Data processing and analysis
8. Produce marketing materials
9. Investigate/make recommendations/implement a mechanism to make certifications of calibration center reference equipment traceable to the National Institute of Standards and Technology (NIST), or similar entity