
Standard Practice for Calibrating the Reference Load Cell Used for Reference Calibrations for a Falling Weight Deflectometer

AASHTO Designation: R 33-20 (2024)¹

Technically Revised: 2020

Reviewed but Not Updated: 2024

Technical Subcommittee: 5a, Pavement Measurement



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Calibrating the Reference Load Cell
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a Falling Weight Deflectometer

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1. SCOPE
- 1.1.

This practice covers the calibration of the reference load cell that is used for calibration of a Falling Weight Deflectometer (FWD) in R 32. It is used to establish calibration coefficients for the reference load cell.
- 1.2.

This procedure has been automated in a software package named *RefLCCal*. It is required that the computer program be used to carry out the procedure.
- 1.3.

Reference load cell calibration is performed at least once per year, or immediately after the reference load cell fails to pass certain quality assurance checks in the R 32 software (*WinFWDCal*).
- 1.4.

The reference load cell, the cables, the associated signal conditioner, and the data acquisition system are considered a system of instruments that shall be calibrated together and used together.
- 1.5.

This procedure results in load cell calibration coefficients that are entered into the R 32 software. These factors are used in *WinFWDCal* to convert analog voltage readings from the reference load cell to engineering units.
- 1.6.

The values stated in SI units are to be regarded as standard. U.S. Customary units given in parentheses are for information purposes only.
- 1.7.

This standard practice may involve hazardous materials, operations, and equipment. It does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard practice to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. REFERENCED DOCUMENTS
- 2.1.

AASHTO Standard:
 - R 32, Calibrating the Load Cell and Deflection Sensors for a Falling Weight Deflectometer
- 2.2.

ASTM Standard:
 - E4, Standard Practices for Force Verification of Testing Machines

3. TERMINOLOGY

3.1. *Description of Terms Specific to This Standard:*

- 3.1.1. *reference load cell*—custom-built calibration device used to calibrate the FWD load cell.
- 3.1.2. *reference load cell system*—system composed of the reference load cell and the associated data acquisition system. This system is used in the FWD load cell calibrations in R 32.
- 3.1.3. *data acquisition system*—the signal conditioner, data acquisition board, data acquisition software, computer, and cabling. The reference load cell is connected to the signal conditioner.
- 3.1.4. *RefLCCal*—the software required for data acquisition and data analysis for reference load cell calibration.²
- 3.1.5. *WinFWDCal*—the software required for data acquisition and data analysis for FWD calibration in R 32.
- 3.1.6. *FWD load cell*—device located on the loading mechanism of an FWD that measures the load response of the FWD system.
- 3.1.7. *FWD load cell final gain factor*—calibration factor for the load sensor on the FWD determined by the R 32 FWD calibration procedure.

4. SUMMARY OF METHOD

- 4.1. The reference load cell system shall be calibrated using a universal testing machine or deadweight testing machine, herein referred to as testing machine.
- 4.2. The same equipment set used in R 32 shall be used in this procedure.
- 4.3. For each trial run, the load shall be applied slowly and continuously to a maximum of 100 kN (24,000 lb). Readings shall be taken using the *RefLCCal* software during loading at each 5.0 kN (1,000 lb) increment.
- 4.4. A minimum of three trials shall be carried out. The adjusted load data for three or more acceptable trials shall be combined using the *RefLCCal* software.
- 4.5. The *RefLCCal* software will provide the statistically significant coefficients for a second- to fifth-order polynomial regression equation.
- 4.6. The coefficients shall be evaluated in accordance with the acceptance criteria in Section 9.2 of this procedure. If they are found to be acceptable, a calibration certificate shall be issued for the load cell.
- 4.7. The coefficients from the certificate should be entered into the *WinFWDCal* data acquisition software used with the reference load cell system in R 32.

5. SIGNIFICANCE AND USE

- 5.1. In order to be confident in the FWD load cell final gain factor determined in the FWD load cell calibration procedure, the reference load cell must be calibrated against highly accurate, known loads.