**FLORIDA DEPARTMENT OF TRANSPORTATION**
State Materials Office
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# Florida Method of Test for California Profilograph

## Designation: FM 5-558

## 1. Scope

1.1 This method describes the operation of a 25-foot California type Profilograph machine (Computerized Data Analyses) used to measure surface deviations.

1.2. These tests are to be made according to Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction **Articles 352-5** and **400-15**.

## 2. Reference Documents

FDOT Standard Specifications for Road and Bridge Construction **Articles 352-5 & 400-15**

**ASTM E1274** - Standard Test Method for Measuring Pavement Roughness Using Profilograph

## 3. Definitions

3.1. Profilograph – A longitudinal profile testing apparatus used to measure a pavement's surface profile deviations.

3.2. Profilogram – A surface profile record generated along the individual wheel paths using a profilograph. Such a record is analyzed to determine the rate of roughness (or smoothness) and to identify changes in the longitudinal pavement surface elevation that exceed a specified threshold along the pavement length traversed by the profilograph.

3.3. Profile Index - A profile measurement is a series of numbers representing elevation relative to a specified reference. A Profile Index (PI) is a summary value.

3.4. Blanking Band – A band of 0.2 inch uniform height with its longitudinal center positioned optimally between the highs and the lows of the profilogram depicting at least 100 ft of pavement.

## 4. Apparatus

A list of the equipment used for daily testing operations includes:

A) California Type Profilograph meeting the requirements of **ASTM E1274**.

B) Tape Measure, Minimum 50 feet.

C) Tire pressure gauge

D) Vertical calibration blocks according to the operator's manual.

## 5. Calibration

5.1. Calibration and/or systems checks should be performed once each month during operations or more often during heavy or rough use, or when test results are questionable.

5.2. Check odometer measurement monthly. Use a flat, straight surveyed distance of 528 feet or greater and if error is greater than 0.5 feet per 528 feet recalibrate according to the operator's manual.

5.3. Odometer calibration (horizontal calibration) should be made according to the operator's manual at a tire pressure (measuring wheel) set in the manual. The profilograph uses the 528 feet surveyed traverse and computer calibration sequence described in the operator's manual.

5.4. A vertical measurement check should be made according to the manufacturer's manual. If the difference in the readings is not within the limits given by the operator's manual, the machine should not be used until corrected (See manufacturer's operators manual for additional information).

## 6. Setup

6.1. Assemble and start up machine according to the operator's manual.

6.2. Perform maintenance at intervals based on usage, conditions, and manufacturer's instructions.

6.3. Check the parameters for the following values:

| | |
|---|---|
| Low Pass Filter Type | Butterworth or Manufacturer Equivalent |
| Low Pass Filter Cutoff | 2 ft |
| Filter Gain | 1.00 |
| Interval Length | See Note 1 |
| Cutoff (Bump) Height | 0.3 in |
| Cord (Bump) Width | 25 ft |
| Blanking Band Width | 0.2 in |
| Defect Detection (Bumps and Dips) | On (See Note 2) |

**Note 1:** Analysis distance to be determined according to specification being applied to project.

**Note 2:** The equipment setup should be able to identify both bumps and dips.

## 7. Procedure

7.1. A Profilograph Test Section is defined as a width of mainline pavement placed in a single paving operation (pass) of pavement. The test section length is defined according to the specification applied to the area being tested. Partial sections may exist at either end or at an exception within the project. Should this occur the Profile Index (P.I.) for the length of pavement shall be combined with the preceding test section. If a test section is isolated where neither end joins another section (examples: between bridges or between a bridge end and the end of the project) and is less than minimum test section length defined according to the specification applied, it shall be tested with a 10 foot rolling straightedge. Start and terminate the profile 15 feet from each bridge approach or existing pavement which is being joined.

7.2. The paved surfaces to be tested shall be cleaned by the contractor of all foreign materials before testing begins.

7.3. The operator will monitor the build-up of any material (curing agent, asphalt, etc.) on the profilograph's wheels and will delay testing or clean the wheels as appropriate to assure smooth operation of the machine.

7.4. Test runs made for initial paving operations, either when starting up or after a long shut-down period, will be used to aid the contractor and the engineer to evaluate the paving methods and equipment.

7.5. Test runs for initial paving operations that do not meet the definition of **Section 7.1** and test runs made to verify corrective actions to the pavement will not be used to determine daily average P.I. or pay adjustments as defined in **Section 352-8** of the FDOT Specifications for Road and Bridge Construction. The test runs are provided as aids to the engineer to evaluate the methods and equipment used.

7.6. The testing of initial paving operations will be performed as soon as possible after construction at the direction of the engineer and prior to opening to traffic.

7.7. Pavement profiles will be taken in the traffic wheel paths (approximately 3 feet from the outside edges of each traffic lane) placed in single pass. When pavement is placed at a width greater than 12 feet additional profiles will be taken 3 feet from the approximate location of each planned lane marking or longitudinal joint.

DO NOT run the pavement profile directly on or with the wheels of the profilograph on a longitudinal joint.

7.8 The profilograph will be operated at a maximum speed of 3 miles per hour. The profilograph must be manually pushed unless it comes with a manufacturer's propulsion device.

7.9. The profilograph will be aligned so that no visible crabbing occurs, which may cause side slippage of the measuring wheel. This may require adjustment to the alignment of the rear wheel assembly when entering or leaving a horizontal curve.

7.10. Individual profiles will be produced with the parameters set according to **Sections 6.2 and 6.3**.

7.11. Additional profiles may be necessary, as directed by the engineer, to fully define the limits of an out-of-tolerance surface variation.

## 8. Calculations

8.1. The Profilograph can automatically calculate the P.I. and locate high and low points having deviations in excess of 0.3 inch in 25 feet.

8.2. A weighted average Profile Index will be calculated for each Test Section (defined in **Section 7**). A simple mathematical average of individual runs of the same length will be made. For example, a 12-foot pavement width will be the average of two test runs (wheel paths), a 24-foot pavement width will be the average of two test runs per travel lane.

8.3. Calculations for partial section P.I.:

| | Test Section Length | Profile Index (Average of both wheel paths) | Length Weighted Profile Index |
|---|---|---|---|
| | 0.10 mi | 7.0 in/mi | 0.70 in |
| | 0.04 mi | 9.0 in/mi | 0.36 in |
| **Total** | **0.14 mi** | | **1.06 in** |
| **P.I. = 1.06 in / 0.14 mi = 7.57 in/mi** | | | |

## 9. Report

9.1. A report should be provided to the engineer with the following information for each set of tests:

A) Date

B) Financial Project Number

C) Roadway ID or Bridge ID

D) District

9.2 Test section: identification should include as a minimum:

A) Lane Tested

B) Wheel Path Tested

C) Operators

D) Starting Point

E) Ending Point

F) Direction of Travel

## 10. Repeatability

The profilograph must be able to demonstrate acceptable repeatability, defined as the difference in the measured P.I. must not exceed 1 in/mi between any 2 tests out of 3 tests on a 528 feet test section.