

Florida Method of Test  
for  
COX's CALIFORNIA PROFILOGRAPH  
(Model C8200 Electronic)

Designation: FM 5-558

1. SCOPE

- 1.1 This method describes the operation of a 25 foot (7.6 meters) wheelbase California type Profilograph machine (Computerized Data Analyses) used to measure surface deviations.
- 1.2 These tests are to be made according to Florida (FDOT) Specifications for Cement Concrete Pavement "Pavement Smoothness and Surface Requirements".

2. APPLICABLE DOCUMENTS

2.1 Standards:

ASTM E 1274 -Standard Test Method For Measuring Pavement Roughness Using A Profilograph.

2.2 Operators Manual -California Profilograph.

3. DEFINITIONS

- 3.1 Profile Index - Inches/Mile (mm/Kilometer) in excess of the blanking band.
- 3.2 Blanking Band - A band of uniform height with its longitudinal center positioned optimally between the highs and lows of the surface record depicting at least 100 feet (30.48 meters) of pavement.

4. EQUIPMENT

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

James Cox and Sons' Profilograph Model CS 8200 or equivalent, with operators manual,(California Type).

Type TP-4 Thermal Paper (1 roll for each 3 miles)(1 roll for each 5 kilometers).

Tape Measure, Minimum 50 feet (15 meters).

Notebook, pens, pencils, etc.

Tire pressure gauge capable of measuring 30 psi  $\pm$  1 psi. (200KPa  $\pm$  7 Kpa)

Gasoline (for generator) 2 gallon (8 Liters) or more in approved container.

Paint (spray or can) to mark pavement.

4.2 Additional requirements for calibration and checking profilograph include:

Surveyed, 528 feet or 100 meters on straight traverse on smooth paved surface. 0.50 inch (12.7 mm) thick, flat material, recommended minimum 4 inch X 4 inch (100 mm x 100 mm).

5. CALIBRATION and SYSTEM CHECK:

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 (100 meters) or greater and if error greater than 0.5 feet (0.1 meter) per 528 feet (100meters) recalibrate according to Section 10.55.5.3 and 10.55.5.4.

5.3 Horizontal calibration (Odometer Calibration) should be made according to the operators manual at a tire pressure (measuring wheel) of 25 psi  $\pm$  1 psi (170 Kpa  $\pm$  7 KPa). The Profilograph Model CS 8200 uses the 528 feet (100 meters) surveyed traverse and computer calibration sequence described in the operators manual.

5.4 A record of changes in the Odometer Factor (Model CS 8200 only) should be maintained with the machine.

5.5 A Vertical Measurement Check should be made by noting the vertical reading of the measurement wheel (digital display on Model CS 8200) with the machine in a flat, stationary position. Manually raise the measuring

wheel and place the 0.5 inch (12.7 mm) thick material under the wheel.

Compare the vertical reading of the measurement wheel. If difference in the readings are not 0.50 inch  $\pm$  0.02 inch (12.7 mm  $\pm$  0.5 mm) the machine should not be used for any test runs on any pavement until corrected (See manufacturer's operators manual for additional information).

- 5.6 Program Memory should be checked according to the operators manual (CHECKSUM).

## 6. NORMAL OPERATIONS, GENERAL

- 6.1 Assemble and start up machine according to operators manual. Important - CAUTION MODEL CS 8200 - COMPUTER MUST BE OFF BEFORE STARTING GENERATOR.

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

Check oil in generator daily, change to manufacturer's instructions. Clean printer head once a week during heavy use. Check and replace or clean air filters on computer and generator at least every two weeks during use. Grease fittings on wheel assemblies at least once a year. Clean and lubricate wheel bearings at least once a year. Change 4 AA alkaline batteries in computer yearly.

- 6.3 Check reduction parameters by printing parameters for the following values:

ODOMETER (COUNTS/see note<sup>(1)</sup>) - As determined by calibration (counts/ see note<sup>(1)</sup>)

DATA FILTER LO (CYC/FT)	- 2.00	2.00 (CYC/FT)
DATA FILTER HI (CYC/FT)	- 0.00	0.00 (CYC/FT)
REDUCT LEN (FT)	- see note <sup>(1)</sup>	see note <sup>(1)</sup>
BUMP HEIGHT (INCH)	- 0.30	7.62 (mm)
BUMP WIDTH (FT)	- 25	7.62 (m)
NULL BAND WIDTH (INCH)	- 0.20	5.00 (mm)
FLASH STORAGE	- ON	
BUMP LOCATOR	- ON	
BUMP BOTTOM	- ON (see note <sup>(2)</sup> )	

Note<sup>(1)</sup> : Analysis Distance to be determined according to specification being applied to project.

Note<sup>(2)</sup> : When bump bottom is “on” low spots will be located

Important - THE NULL BAND SWITCH ON THE FRONT OF THE CONTROL PANEL MUST BE IN THE “FIXED DISTANCE” POSITION.

- 6.4 A print of the Model CS 8200 Profilograph Parameter report should be provided to the Engineer with proper Date, Route, Pavement and District entries\* for each set of tests (multiple runs on project pavements).

Additional written notes should be made on each report to adequately define the set of tests.

\*(Test section identification should include as a minimum, Job Number, lane tested, wheel path tested, operators, starting point, ending point, direction of travel, information can be placed in header of report or hand recorded).

## 7. TEST SECTION:

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 for the length of pavement shall be combined with the preceding test section. If a test section is isolated where neither end joints another section (examples: between bridges or between a bridge end and the end of the project) and is less than 250 feet (75 meters) in length, it shall be tested with a 10 foot (3.05 meters) rolling straightedge.

## 8. INITIAL PAVING and CORRECTIVE ACTION TESTING:

8.1 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.

8.2 Test runs for initial paving operations that do not meet the definition of Section 7 and test runs made to verify corrective actions to the pavement will not be used to determine daily average profile index (P.I.) or pay adjustments as defined in “pavement smoothness” specifications. The test runs are provided as aids to the Engineer to evaluate the methods and equipment used.

8.3 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.

9. SURFACE PREPARATION:

- 9.1 The paved surfaces to be tested shall be reasonably cleaned by the Contractor of all foreign materials that might affect the results before testing begins.
- 9.2 The operator will monitor build-up of any material (curing agent, asphalt, etc.) on the Profilograph's wheels and will delay test or clean the wheels as appropriate, to assure smooth operation of the machine.

10. PAVEMENT TEST RUN:

- 10.1 Pavement profiles will be taken in the traffic wheel paths (approximately 3 feet or 1 meter from and parallel to each edge of pavement) placed in single pass. When pavement is placed at a width greater than 12 feet (3.6 meters), additional profiles will be taken 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.

- 10.2 The Profilograph will be operated at a maximum speed of 3 miles per hour (5 Kilometers per hour).
- 10.3 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.

11. INDIVIDUAL PROFILES:

- 11.1 Individual profiles will be produced with the parameters set according to Section 6.2 and 6.3. Begin station, end station, pass number and document point number must be input for proper running of Model CS 8200. Notes should be made in a testing notebook and/or directly on the graph (profilogram) as necessary to assure proper documentation of the test run.

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

12. DETERMINATION of PROFILE INDEX (P.I.):

12.1 The Profilograph Model CS 8200 can automatically calculate the P.I. and locate high and low points having deviations in excess of 0.3 inch in 25 feet (7.5 mm in 7.62 meters). Follow the Profilograph operators manual for proper print-out of results.

13 AVERAGE PROFILE INDEX:

13.1 An 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 (3.7 meter) 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.

13.2 Calculations for partial section (English):

	Profile Index	Test Section Index (P.I.) length	Weighted Profile
	<u>Section Length</u>	<u>(average of both wheel paths)</u>	
	0.10	7.0 inch/mile	0.70 inch
	<u>0.04</u>	9.0 inch/mile	<u>0.36 inch</u>
Total =	0.14 miles		1.06 inch

$$1.06 \div 0.14 = 7.57 \text{ inches per mile}$$

13.3 Calculations for partial section (Metric):

	Profile Index	Test Section Index (P.I.) length	Weighted Profile
	<u>Section Length</u>	<u>(average of both wheel paths)</u>	
	0.10	92.0 mm/km	9.2 mm
	<u>0.04</u>	9.0 mm/km	<u>4.4 mm</u>
Total =	0.14 kilometers		13.6 mm

$$13.6 \div 0.14 = 97 \text{ mm per kilometer}$$