

Standard Method of Test for
**Operation of the Cox Model CS8500 Electronic Profilograph
for Surface Measurement**

SC Designation: SC-T-124 (04/12)

1. **SCOPE**

- 1.1. This method describes the operation of a 25-foot wheelbase California-type profilograph with computerized data collection used to measure surface deviations on bridges and pavements. The minimum section length for this procedure is 300 feet.

2. **REFERENCED DOCUMENTS**

2.1. *ASTM Standards:*

- E 1274, Standard Test Method for Measuring Pavement Roughness Using a Profilograph

2.2. *SCDOT Standards:*

- SC-M-501, Portland Cement Concrete (PCC) Rideability for Pavement
- SC-M-701, Bridge Deck Smoothness and Surface Requirements

2.3. *Operators Manual:*

- Cox Profilograph Model CS8500 or equivalent

2.4. **DEFINITIONS**

- 2.5. *Profile Index* – Inches per Mile in excess of the blanking band

- 2.6. *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 of pavement.

3. **APPARATUS**

- 3.1. *Profilograph* – James Cox and Sons' Profilograph Model CS8500 or equivalent, with operator's manual (California Type).

- 3.2. *Graph Paper* – Type TP-4 Thermal Paper (1 roll per 3 miles).

- 3.3. *Tape Measure* – Minimum 50 feet marked in tenths of feet.

- 3.4. *Tire Pressure Gauge* – Digital display capable of measuring 25 psi \pm 1 psi.

- 3.5. *Gasoline* – Two gallons or more in approved safety container for generator.

- 3.6. *Pavement Marking Paint* – Spray can in orange, yellow, or white.

- 3.7. *Test Section* – A surveyed 500-foot long section with a smooth, paved surface for calibration of distance.

3.8. *Calibration Block* – A block, 0.50 inches thick, made of a hard, durable, stable material with a minimum dimension of 4 inches by 4 inches.

3.9. *Notation Accessories* – Notebook, pens, pencils, etc.

4. **CALIBRATION AND SYSTEM CHECK:**

4.1. Calibration and/or systems checks should be performed at least once each month during operations. Calibrations should be performed more often during heavy or rough use, when the unit has been modified or repaired, or anytime when test results are questionable. Keep a calibration notebook for each profilograph unit indicating the date of calibration, whether the unit was in or out of calibration, and what corrective measures were taken, if out of calibration. This notebook should be stored with the unit

4.2. *Odometer calibration*

4.2.3. Use a flat, straight, surveyed distance of 500 feet or greater. If, when the unit is moved over the test section, the error is greater than 0.5 feet per 500 feet, recalibrate according to the operator's manual.

4.2.4. Odometer calibration should be made according to the operator's manual at a tire pressure of 25 psi \pm 1 psi.

4.2.5. A record of changes to the odometer factor should be noted in the calibration notebook.

4.3. *Vertical Calibration*

4.3.3. To perform a Vertical Measurement Check, start by noting the vertical reading of the measurement wheel with the unit in a flat, stationary position. Manually raise the measuring wheel and place the 0.50-inch calibration block under it.

4.3.4. Compare the vertical reading of the measurement wheel with the starting value. If the difference in the readings is not 0.50 inches \pm 0.02 inches, then the unit should be taken out of service until corrected as given in the operator's manual.

4.4. *Computer Check*

4.4.3. Program Memory should be checked according to the operator's manual (CHECKSUM).

5. **TEST SECTION**

5.1. Profilograph test sections consist of a lane width and having a length of either 300 feet for bridges or 1000 feet for pavement, except as otherwise described in this section. A test section is to begin and end at a point 15 feet from pavement structure for which the Contractor is not responsible or according to the specifications, plans, or contract.

5.2. *Partial Sections*

5.2.3. Partial sections may exist at either end of a project or at an exception within the project. Should this occur, the Profile Index for the length of the partial section will be combined

with the preceding section if the partial section is 100 feet or less in length. Sections greater than 100 feet will be reported separately.

5.2.4. If a partial section is isolated by features or otherwise unable to join a full-length section, the Profile Index for the section will be prorated according to its length.

6. PRE-TESTING PROCEDURE

6.1. Assemble and start up the unit according to the operator’s manual. **IMPORTANT: COMPUTER MUST BE OFF BEFORE STARTING GENERATOR.**

6.2. Perform maintenance at intervals based on usage, conditions, and manufacturer’s instruction.

- Check oil in generator daily when in use, change according to manufacturer’s instructions.
- Check tire pressure daily prior to use, preferably using the same gauge used to perform the odometer calibration, to confirm an inflation pressure of 25 psi.
- 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 bearings at least annually.
- Change 4 AA batteries in computer annually.

6.3. Check reduction parameters by printing them out and confirming that they are set to the following:

Reduction Parameter	Setting
ODOMETER (COUNTS/528 FT)	Determined by calibration
DATA FILTER LO (CYC/FT)	2.00
DATA FILTER HI (CYC/FT)	0.00
REDUCT LEN (FT)	300 (Bridge) 1000 (Pavement)
BUMP HEIGHT (INCH)	Check Proposal
BUMP WIDTH (FT)	Check Proposal
NULL BAND WIDTH (INCH)	Check Proposal
FLASH STORAGE	ON
BUMP LOCATOR	ON
BUMP BOTTOM	ON
MINIMUM SCALLOP HEIGHT (IN.)	0.035
MINIMUM SCALLOP WIDTH (FT.)	2.0
SCALLOP RESOLUTION (IN.)	0.010
FILTER TYPE	BUTTERWORTH
FILTER LENGTH (FT.)	1.90
FILTER GAIN	1.0
BUMPS	<input checked="" type="checkbox"/>
DIPS	<input checked="" type="checkbox"/>

- 6.4. Ensure that the Null Band switch on the front of the control panel is in the “Fixed Distance” position.
- 6.5. *Surface Preparation*
- 6.5.3. The surfaces to be tested shall be reasonably cleaned of all foreign materials that might affect the results before commencement of testing.
- 6.5.4. 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 unit.

7. **PAVEMENT TEST PROCEDURE**

- 7.1. Pavement profiles will be taken in the traffic wheel paths (approximately 3 feet from and parallel to each edge of pavement). When the pavement is placed in a width greater than 12 feet, additional profiles will be taken from the approximate location of each planned lane marking or longitudinal joint. Do not test directly on longitudinal joints.
- 7.2. Operate the profilograph at 3 miles per hour or less. The profilograph may be pushed by hand or towed using a utility vehicle.
- 7.3. Align the profilograph so that no visible “crabbing” occurs, which may cause side slippage of the measuring wheel. If this occurs, align the rear wheel assembly as necessary when entering or leaving a horizontal curve.

8. **PROFILE CALCULATION**

- 8.1. Produce individual profiles with the parameters set in Section 6.3 using the profilograph’s software. The profiles will indicate beginning station, ending station, and pass number. Notes should be made in a testing notebook and/or directly on the graph as necessary to ensure proper documentation of the test run.
- 8.2. Additional profiles may be necessary to fully define the limits of an out-of-tolerance surface variation.
- 8.3. *Determination of Profile Index (PI)*
- 8.3.3. The profilograph can automatically calculate the PI and locate high and low points having deviations in excess of the set parameters. Follow the Profilograph operator’s manual for proper printout of results.

9. **REPORT**

- 9.1. Report the results of the testing indicating the Project Number, PIN, File Number, Route Number, Reduction Parameters, and PI for each wheelpath in each test section. Indicate any sections that have bumps in excess of the maximum value.