



**INDIANA DEPARTMENT OF TRANSPORTATION  
DIVISION OF MATERIALS AND TESTS**

**PROFILOGRAPHS  
ITM No. 912-15**

**1.0 SCOPE.**

- 1.1 This test method covers the certification and operation of a computerized profilograph to evaluate the smoothness of HMA and PCC pavements for specifications requiring a zero blanking band.
- 1.2 This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

**2.0 TERMINOLOGY.** Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101 and as follows.

- 2.1 Profile Index. The profile index is the total of the scallops for a given section.
- 2.2 Profilogram. The profilogram is a paper chart of a scaled representation of the pavement profile established by a profilograph.
- 2.3 Profilograph. The profilograph is an instrument used to provide a scaled surface trace of the pavement along a designated line.
- 2.4 Scallop. A scallop is a vertical deviation recorded on the profilogram.
- 2.5 Section. A section is a length of pavement lane. A complete section is equal to 0.1 mi. A partial section is a length of pavement lane less than 0.1 mi.

**3.0 SIGNIFICANCE AND USE.** A profile index for a section of pavement is obtained from the profilograph and used to assess pay factors for smoothness of HMA and PCCP pavements. Areas of pavement that are required to be corrected to comply with specification smoothness requirements are also determined.

**4.0 APPARATUS.**

- 4.1 Profilograph. The profilograph is a Department approved computerized device used to provide a continuously recorded paper scaled surface trace of the pavement along a designated line generated at the time of operation. The profilograph shall be a wheel mounted rigid frame with an effective length of 25 ft and be equipped with a sensing wheel and recorder that provides a scaled surface trace with a 1:300 horizontal scale and 1:1 vertical scale. The profilograph shall

provide an average profile index for each 0.1 mi section and indicate the bumps and dips of the pavement.

## **5.0 PROCEDURE FOR CALIBRATION OF PROFILOGRAPHS.**

- 5.1** The profilograph shall be calibrated prior to use for both horizontal and vertical scales once each day on each contract.
- 5.2** The horizontal scale is calibrated as follows:
  - 5.2.1** The horizontal scale of the profilogram shall be 1 in. = 25 ft.
  - 5.2.2** The calibration of the horizontal scale is checked by operating the profilograph a distance of 528 ft and comparing that known distance to the length of the profilogram.
  - 5.2.3** The length of the profilogram shall be  $21.12 \pm 0.42$  in.
  - 5.2.4** If the profilogram does not meet the required length, the profilograph may not be used until corrective action has been taken and the profilograph has been recalibrated.
- 5.3** The vertical scale is calibrated as follows:
  - 5.3.1** The vertical scale on the profilogram shall be 1.0 in. = 1.0 in.
  - 5.3.2** The calibration of the vertical scale is checked by operating the profilograph across two plates of known thickness supplied by the Contractor and by comparing that known height to the height indicated by the profilograph.
  - 5.3.3** The display measurement height shall be accurate to within  $\pm 0.01$  in. of the thickness of the plates.
  - 5.3.4** If the profilogram does not meet the required height, the profilograph may not be used until corrective action has been taken and the profilograph has been recalibrated.

## **6.0 PROCEDURE FOR CERTIFICATION OF PROFILOGRAPHS.**

- 6.1** The Division of Materials and Tests will certify all profilographs used on Department contracts.
- 6.2** The profilograph will be certified once per calendar year and prior to use on a contract in the same year.

- 6.3 The profilograph will be inspected to ensure that the device is operationally sound.
- 6.4 The calibration of the horizontal scale in accordance with 5.2 will be verified.
- 6.5 The calibration of the vertical scale in accordance with 5.3 will be verified.
- 6.6 The repeatability of the horizontal and vertical scales will be verified. The profilograph will be operated over a paved section twice, once in each direction. The profilograms will be placed on each other and a visual comparison of the two profiles will be made. Profiles that are similar will be acceptable.
- 6.7 The Division of Materials and Tests will provide a certificate of compliance for each profilograph that meets the above requirements. The certification of compliance will include the following information:
  - 6.7.1 Manufacturer Name
  - 6.7.2 Serial Number
  - 6.7.3 Owner Identification
  - 6.7.4 Inspection Date
  - 6.7.5 Inactive Date
  - 6.7.6 Equipment Owner Information
  - 6.7.7 Contact Person and Phone Number
  - 6.7.8 Certifying Person
  - 6.7.9 Notes
  - 6.7.10 Tire Pressure
  - 6.7.11 Computerized Profilograph Settings
- 6.8 Modifications to the profilograph will require a recertification in accordance with 6.0.

## **7.0 PROCEDURE FOR OPERATION OF PROFILOGRAPHS.**

- 7.1 The profilograph shall be operated by a Contractor Technician monitored by a Department Qualified Technician.

- 7.2 The profilograph shall be certified and calibrated in accordance with sections 5.0 and 6.0.
- 7.3 The certificate of compliance shall be presented to the Engineer prior to use of the profilograph on the contract.
- 7.4 The profilograph will be checked by the Engineer to verify that the band width, bump height, low pass filter, and the short segment settings on the profilograph and the tire pressure correspond with the requirements indicated on the certificate of compliance.
- 7.5 The profilograph shall be operated in an area safe from traffic hazards, protected by traffic control, and in an area approved by the Engineer.
- 7.6 The profilograph shall be operated in accordance with the manufacturer operating instructions.
- 7.7 The profilograph shall be operated manually at speeds less than or equal to 4 mph.
- 7.8 Prior to the operation of the profilograph, the operator shall enter the following information into the profilograph.
  - 7.8.1 Company
  - 7.8.2 Operator
  - 7.8.3 Contract Number
  - 7.8.4 Route
  - 7.8.5 Lane
  - 7.8.6 Lane Direction
  - 7.8.7 Collection Time and Date
  - 7.8.8 Pavement Course (Surface, Intermediate or Base)
  - 7.8.9 Pavement Type (HMA or PCC)
  - 7.8.10 English or Metric Measurement
- 7.9 For lanes less than or equal to 12 ft wide, the profilograph shall be operated in the direction of traffic and  $3.0 \pm 0.5$  ft from and parallel to the right edge of the lane. If the lane may be utilized by traffic in either direction, the profilograph shall be

operated in the direction of increasing station numbers and  $3.0 \pm 0.5$  ft from and parallel to the right edge of the lane.

- 7.10** For lanes greater than 12 ft wide, the profilograph shall be operated in the direction of traffic and  $3.0 \pm 0.5$  ft from and parallel to both the left and the right edge of each lane. If the lane may be utilized by traffic in either direction, the profilograph shall be operated in the direction of increasing stations and  $3.0 \pm 0.5$  ft from and parallel to both the left and the right edge of each lane
- 7.11** The Contractor shall provide the profilogram to the Department Qualified Technician at the completion of each trace. The Qualified Technician will sign and date each trace at the time of receipt.
- 7.12** The areas exempt from measurement are as follows:
- 7.12.1** The first and last 50 ft within the paving limits
  - 7.12.2** From 50 ft before through 50 ft after each paving exception
  - 7.12.3** From 50 ft before through 50 ft after each curve with a centerline radius of less than 75 ft
  - 7.12.4** Vertical curves that exceed the 2 1/2 in. vertical scale measuring capacity of the profilograph
  - 7.12.5** From 50 ft before through 50 ft after each at-grade railroad crossing
  - 7.12.6** From 50 ft before through 50 ft after each casting located within 1.0 ft measured laterally from the required location for profilograph operation. The tolerances indicated in 7.9 or 7.10 for the location of the profilograph operation shall be excluded.
- 7.13** The profile index from the profilogram will be used for acceptance of the pavement smoothness for the section represented by the profilogram. If more than one trace is required in accordance with 7.10, the profile index will be the average of the two traces.
- 7.14** Partial sections that occur at the end of a run or prior to an area exempt from measurement in accordance with 7.12 will be prorated as follows:
- 7.14.1** If the length of the partial section is less than 250 ft, the profile index calculation for the section will be averaged into the previous 0.1 mile section.

**7.14.2** If the length of the partial section is equal to or greater than 250 ft, the profile index calculation for the section will be prorated to a 0.1 mile section.

## **8.0 REPORTS.**

- 8.1** The Engineer will report the profile index for each section to the Contractor within seven calendar days from the date the profilogram was received.
- 8.2** The Engineer will notify the Contractor of the sections that do not comply with the smoothness specifications and require correction.
- 8.3** The profilogram(s) will be maintained with the final construction file.

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### CHECKLIST FOR CERTIFICATION OF PROFILOGRAPHS

- Frame** -- rigid and of the proper length
- Frame pins/clamps** -- tight and secure
- Profile wheel** -- round and without excessive wear
- Cable** -- straight and free of kinks and makeshift repairs
- Chains** -- free of kinks and makeshift repairs
- Steering rod** -- straight and all joints are tight
- Carriage wheels** -- round and without excessive wear
- Tracking** -- rear wheels follow the same path as the front wheels within  $\pm 4.0$  in.  
(101.6 mm)
- Printer** -- operates smoothly and provides a clear trace