
Standard Practice for

**Assessment of Navigation
Drift Mitigation in Transverse
Pavement Profiling Systems**

AASHTO Designation: PP 108-24¹

Technically Revised: 2024

Technical Subcommittee: 5a, Pavement Measurement



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1. SCOPE

- 1.1. Transverse pavement profiling (TPP) systems that provide global positions of road surfaces are often susceptible to drift in the estimate of the global position over time. This practice describes the procedure to assess the amount of drift present in localization systems used in TPPs.
- 1.2. The minimum requirements stipulated herein are intended to focus on the need for accurate and repeatable transverse measurements for network and project level data collection.
- 1.3. If any part of this practice is in conflict with referenced documents, such as ASTM Standards, this practice takes precedence for its purposes.
- 1.4. This standard practice is intended to be conducted in conjunction with three other standard practices to fully assess and certify the TPP in typical operating conditions. For static assessment, see PP 106; for body motion assessment, see PP 107; and for typical dynamic operation, see PP 109.
- 1.5. *This practice does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this practice to establish appropriate safety and health practices and determine the applicability of regulatory limitations related to and prior to its use.*

2. REFERENCED STANDARDS

- 2.1. *AASHTO Standards:*
 - PP 106, Assessment of Static Performance in Transverse Pavement Profiling Systems
 - PP 107, Assessment of Body Motion Cancellation in Transverse Pavement Profiling Systems
 - PP 109, Assessment of Highway Performance of Transverse Pavement Profiling Systems
 - PP 111, Definition of Terms Related to Transverse Pavement Profiling Systems and Ground Reference Equipment
- 2.2. *Federal Highway Administration:*
 - FHWA. *Calibration, Certification, and Verification of Transverse Pavement Profile Measurements*. FHWA-RC-20-004. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 2020.

3. TERMINOLOGY

- 3.1. See PP 111 for definition of terms used in this standard practice.
- 3.2. Table 1 provides the physical parameter definitions, symbols, and default values to be used when administering this standard.

Table 1—Physical Parameter Definitions and Default Values

Physical Parameter	Symbol	Default Value(s)
Minimum Length for the Test Section	L_T	54 m (178 ft)
Minimum Width for the Test Section	W_T	24 m (79 ft)
Radius of Inside Edge of Figure-Eight Turn	R	9.1 ± 0.3 m (30 ± 1 ft)
Distance between Center of Turns	D	30.5 ± 0.3 m (100 ± 1 ft)
Target Forward Speed	v	13 kph (8 mph)
Maximum Completion Time (per Lap)	t	39 s
Minimum Number of Complete Figure-Eight Laps to Be Collected	n_p	5
Horizontal Width/Length of the Reference Object	w_{obj}	540 ± 70 mm (21.25 ± 2.75 in.)
Vertical Height of the Reference Object	h_{obj}	75 ± 25 mm (3.0 ± 1.0 in.)

4. SIGNIFICANCE AND USE

- 4.1. Measured transverse profiles of road surfaces are used to extract pavement deformation parameters such as rut depth, cross slope, and edge/curb drop-off. The accuracy of the estimated pavement deformation parameters depends on the measured transverse profile accurately representing a transverse section of the road surface.
- 4.2. Requirements on the allowable drift in the location sensors ensures that the measured profile accurately represents the road surface.
- 4.3. This practice outlines standard procedures for certifying and verifying the operational accuracy and precision of transverse pavement profilers while undergoing lateral acceleration. The test requires the equipment to be driven in a figure eight over a reference object with a known global position. By making multiple passes while collecting transverse profile measurements (TPP data) over the object, the test prescribes how to determine the position of the object in the global reference frame for each pass. The identified position of the reference object is compared to the known global position to determine the resulting error in the northing, easting, and elevation directions. Because the data are used for subsequent calculations for rut depth, cross slope, and edge/curb drop-off, tables of the necessary accuracy and precision are provided in the form of confidence intervals for each use.

5. EQUIPMENT

- 5.1. The TPP must be able to collect transverse profiles at a minimum sampling rate of 100 complete transverse profile scans per second.
- Note 1**—To cancel the body motion (which is critical in obtaining accurate profiles), ride frequencies must be accounted for and a minimum sample rate of 100 samples/s must be used for all measurements. This minimum sampling rate is for all mapping and localization sensors with the exception of GPS or GNSS measurements.

- 5.2. Provide all collected transverse profiles of the test section in electronic text files following the format prescribed by Annex A.

6. DATA COLLECTION AND REPORTING

- 6.1. A test section of size L_T by W_T shall be selected to set up a figure-eight course for conducting the drift test. The test section shall contain minimal obstructions (e.g., poles, light posts, signs). If any obstructions are present in the test area, care should be taken to ensure they are not in the figure-eight path and that the TPP can safely navigate around them when traveling at a speed of v around the path. Follow TPP manufacturer recommendations for adequate lead-in distance/warm-up time for the sensors/data fusion/data filtering. All settings shall remain the TPP settings used during typical network-level data collection.
- 6.2. The figure eight shall be marked out in the test region using any desired method (e.g., cones, paint, reflective markers). The markings indicate the inner radius and the TPP must drive outside the markings. The figure eight is formed using two partial circles (each $\frac{3}{4}$ of a circle) with a radius for the inner guiding markings of R and centers separated by a distance D , the certification object is located halfway between the centers so that the TPP passes the reference object 90 degrees. Figure 1 provides a schematic of the test region and the figure-eight layout.

Note 2—The drift test is designed such that a target lateral acceleration of 0.13 g occurs when a TPP drives along a curve of radius, R , at a target speed of v . In conjunction, the number of passes over the stationary object is defined to allow enough time for a significant amount of drift to occur in the global measurements of the object of interest. If the TPP is unable to perform the test at the default radius, then the radius of the figure-eight can be increased along with the target speed to maintain the target lateral acceleration of 0.13 g. When the radius and speed are adjusted, the number of passes over the stationary object may change to ensure the duration of the test is consistent. See FHWA-RC-20-004 for the connection between the figure-eight radius, target TPP speed, and number of passes.

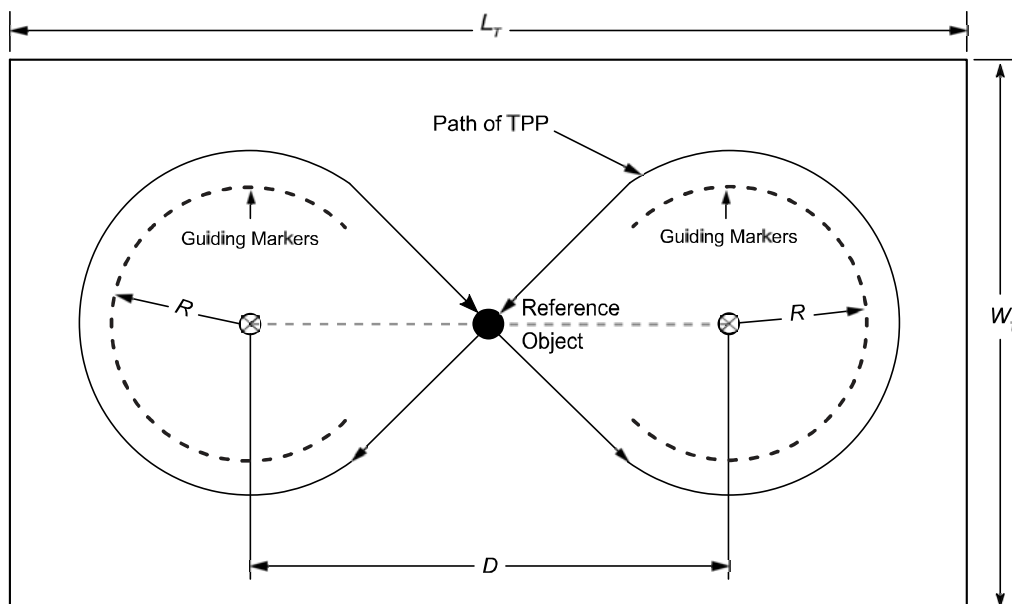


Figure 1—TPP Drift Test Schematic