

State of Nevada
Department of Transportation
Materials Division

METHOD OF TEST FOR EVALUATION OF PAVEMENT PROFILES - ENGLISH

SCOPE

This test method describes the procedure used for determination and verification of the Profile Index from a pavement profile made with the California type profilograph (See Figure 8). This method also describes the procedure used to locate individual high points (must grinds).

The profile trace is recorded on a scale of 1 in. is equal to 25 ft longitudinally and 1 in. is equal to 1 in. (full scale) vertically. Determination of the Profile Index involves measuring scallops that appear outside a 0.2 in. wide shaded area of a blanking band. Determination of individual high points involves the use of a bump template as described in Section II of this test method.

EQUIPMENT

Profilograph, California type 25 ft wheel base. (Refer to Subsection 402.03.03 of the specifications for equipment requirements). Alternative equipment may be allowed if approved by the Engineer.

EQUIPMENT CALIBRATION

The profilograph should be checked for calibration of longitudinal distance and vertical height each time the profilograph is assembled, or at any time the Engineer deems necessary. The longitudinal distance calibration is to be performed by operating the profilograph at walking speed (approximately 3 mph) over a measured distance of 528 ft. The actual distance shown by the computer display must be within 0.5 ft. The vertical height calibration is to be performed by placing the center recording wheel of the profilograph on a flat surface. Two plates, each measuring 0.5 in. thick, are then placed under the center recording wheel, one at a time and the change in height noted. The two plates are then removed, one at a time and the change in height noted. Each step in this process shall show a change in height of 0.5 in. +/- 0.01 in. If the longitudinal distance or vertical height calibration is out of specification tolerance, follow the manufacturer's instructions to adjust the profilograph settings and recalibrate until the profilograph meets the specified tolerances. Provide the Engineer with a computerized printout to verify the profilograph calibration and parameter settings before testing pavement smoothness (See Figure 7). The tire pressure of the center recording wheel must be set and maintained at 25 psi unless the manufacturer specifies a different tire pressure setting. The tire pressure must be checked prior to the start of calibration.

SECTION 1 - VERIFICATION OF THE PROFILE INDEX

PROCEDURE

The pavement profile trace is produced and calculated by a computerized profilograph. The pavement profile trace shall be checked for accuracy using a plastic blanking band, 1.70 in. wide and 21.12 in. long (See Figure 1). The blanking band represents a pavement length of 528 ft or 0.1 mi at a scale of 1 in. = 25 ft.

At the center of the blanking band is a 0.2 in. wide shaded area that extends the entire length of the blanking band. Each side of the 0.2 in. shaded area has scribed lines 0.1 in. apart and parallel to the 0.2 in. shaded area. These lines serve as a convenient scale to measure deviations of the graph above or below the 0.2 in. shaded area. These are called scallops (See Figure 4). A blanking band may be obtained from the Construction Division, Quality Assurance Section.

Place the blanking band over the profile in such a way as to “blank out” as much of the profile as possible. Usually when this is done, scallops above and below the 0.2 in. shaded area are equally balanced (See Figure 2). Starting at the left end of the blanking band, measure and total the height of all the scallops appearing both above and below the 0.2 in. shaded area. Measure each scallop to the nearest 0.01 in. Write this total on the profile sheet near the left end of the blanking band. Mark the right end of the blanking band in the center of the 0.2 in. shaded area. This will align the scale when moving onto the next 0.1 mi, or fraction thereof.

When scallops occurring in the first 0.1 mi are totaled, slide the blanking band to the right, aligning the left side of the blanking band with the small mark previously made and proceed with counting in the same manner. The last section counted may or may not be an even 0.1 mi. If not, its length in miles needs to be calculated. The readings should be rounded to the nearest 0.001 mi. Each 0.1 mi section, or portion thereof, must be recorded on Form No. 040-073 and checked for conformance with the specifications. The specifications indicate which pavement smoothness type to use when computing the Profile Index.

The computerized profile trace may move from a generally horizontal appearance when going around super elevated curves and through rapid changes in elevation such as dips or humps. These changes will make it nearly impossible to blank out the middle portion of the trace without shifting the scale. When these changing conditions occur, the computerized profile trace should break into short sections to balance the scallops (See Figure 3).

LIMITATION OF MEASUREMENT

When counting profiles, a day’s production of pavement surface is considered to include the last portion of the previous work, which includes the take off joint. The last 30 ft of pavement surface cannot usually be obtained until the following day. If a line break, station equation, or exception (bridge deck, cattleguard, etc.) is encountered, the profilograph should be stopped at the point of the line break, station equation, or exception so that the ending station can be recorded. The profilograph should resume the run using the new station as the beginning point of the next section.

Example for in./0.1 mi Index:

Section length, miles	in./0.1 mi
0.100-----0.21 + 0.03 + 0.01 + 0.26 + 0.13 =	0.64
0.100-----0.11 + 0.02 + 0.01 + 0.12 =	0.26
* 0.071-----0.03 + 0.41 + 0.21 + 0.37 + 0.08 =	<u>1.10</u>
Totals <u>0.271</u>	<u>2.00</u>

* A calculation will need to be made to determine a corrected measurement for short sections less than a 0.1 mi. This amount of roughness in each “one-tenth mile section” is converted to a relative profile. This calculation should be recorded in the remarks area on Form No. 040-073 “Report of Profilograph Test”, but should not be used for the overall Profile Index.

Using the example above:

$$\begin{aligned} \text{Short Section: Station } 111+08 - 107+32 &= 376 \text{ ft} \div 5280 \text{ ft} = 0.071 \text{ mi} \\ \text{Total count must be based on 0.1 mile section: } &0.1/.071 \times 1.10 = 1.55 \text{ in./0.1 mi} \end{aligned}$$

Each section must be “weighted” according to its length. This is most easily done by totaling the tenths of an inch for each 0.1 mi section of a given line or lines and using the total length of the line (up to 1 mi) in the computation for determining the Profile Index for a mile.

Example for in./mi Index:

Using the 0.271 and 2.00 totals from the above example:

$$\text{Inch Per Mile Index} = (1 \div 0.271) \times 2.00 = 7.380$$

REPORT

Report each in./0.1 mi to the nearest 0.01 in. and each 0.1 mi section to the nearest 0.001.

SECTION II - VERIFICATION OF HIGH POINTS (MUST GRINDS)

EQUIPMENT

Special equipment needed includes a plastic bump template, having a line 1 in. long scribed on one face with a small hole at either end, and a slot 0.3 in. (PCCP), 0.25 in. (Bridge Decks), 0.3 in. (Dense Graded Plantmix) or 0.4 in. (Open-Graded Plantmix) from and parallel to the scribed line (See Figure 5).

PROCEDURE

At each prominent peak or high point (must grinds) of the profile trace, place the template so that the small holes at each end of the scribed line intersect the profile trace to form a chord across the base of the peak or indicated bump. The line on the template does not need to be longitudinal. With a sharp pen or pencil, draw a line using the narrow slot in the template as a guide. Any portion of the trace extending above this line will indicate the approximate length and height of the deviation in excess of the specification value. Do not subtract the 0.2 in. wide shaded area when measuring high points. There may be instances where the distance between easily recognizable low points is less than 1 in. (25 ft). For such cases, a shorter chord length shall be used in making the scribed line on the template tangent to the trace at the low points (See Figure 6). However, it is the intent of this requirement that the baseline for measuring the height of bumps will be as nearly 1 in. (25 ft) as possible, but in no case shall exceed this value. When the distance between prominent low points is greater than 1 in. (25 ft), make the ends of the scribed line intersect the profile trace when the template is in a near horizontal position. The location of any high point that exceeds specification limits for bump height should be marked on the pavement. The station of that bump must be recorded on Form No. 040-073 in the remarks section so that the bump can be located for possible remediation at a later date.

SECTION III – FIGURES

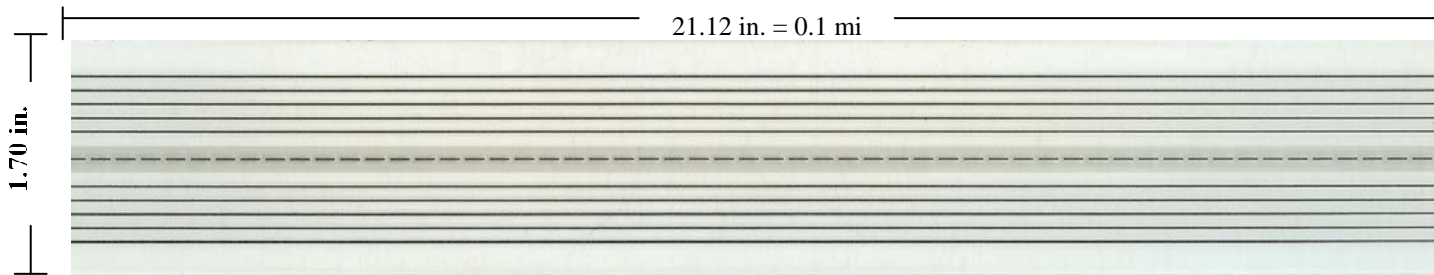


Figure 1: Plastic Scale (Blanking Band)

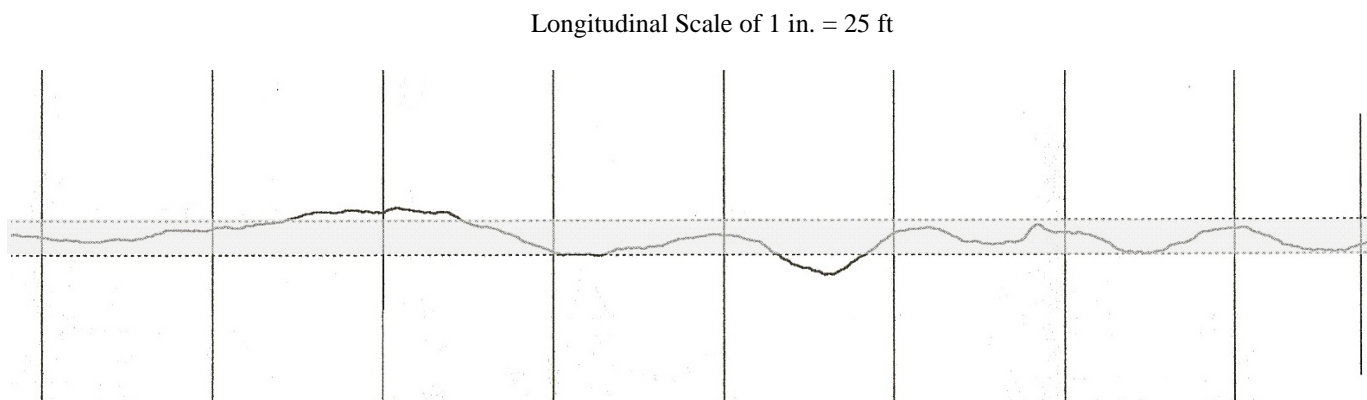


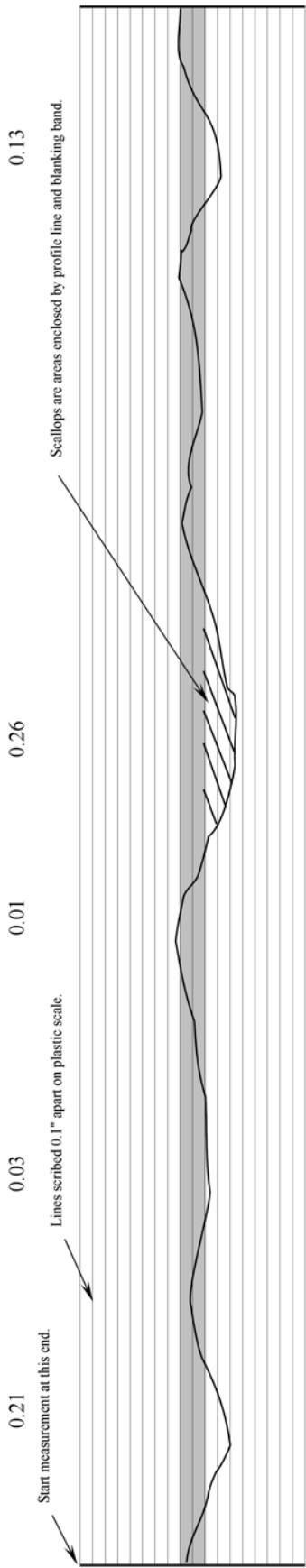
Figure 2: Balanced Blanking Band



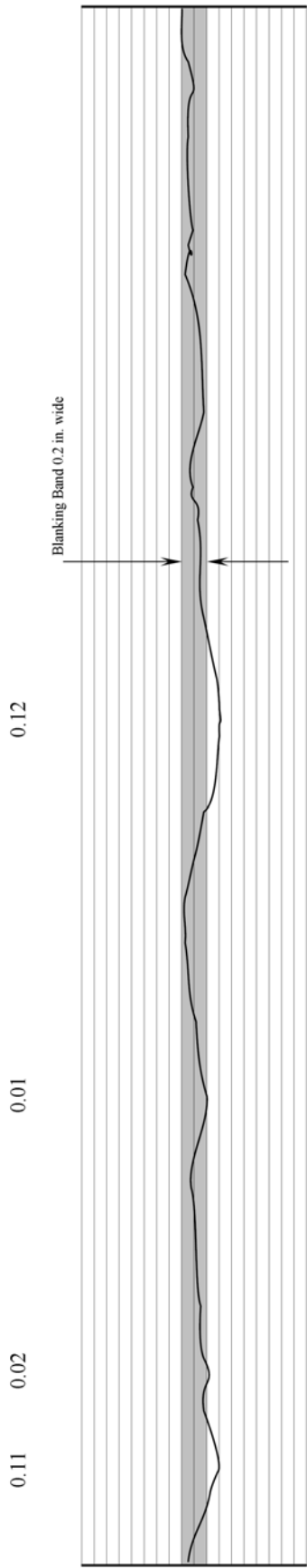
Incorrect placement of blanking band for shifting profile



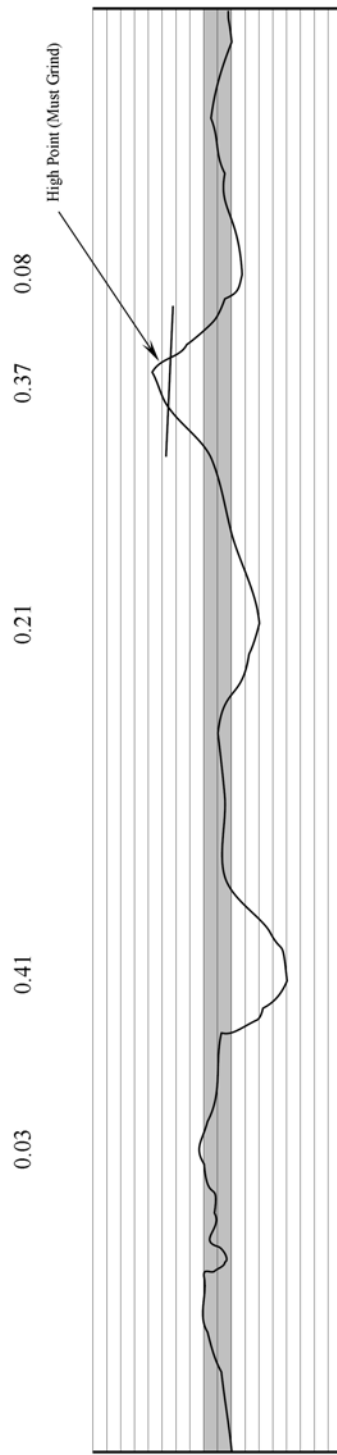
Figure 3: Correct placement of blanking band for shifting profile



Total measurement for this 0.1 mi section is 0.64 tenths of an in.

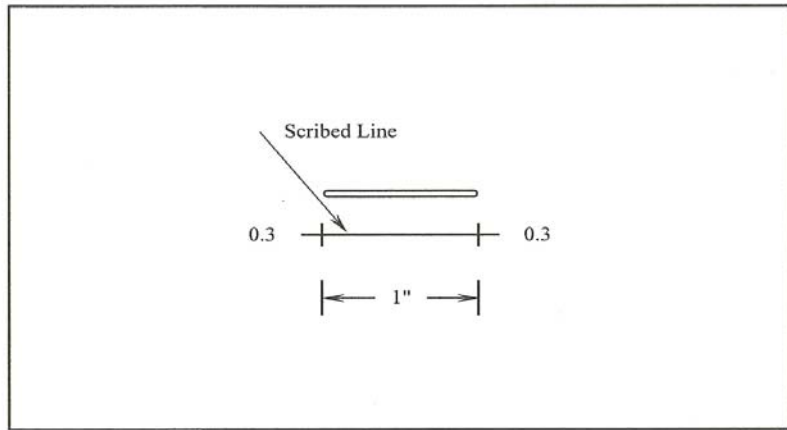


Total measurement for this 0.1 mi section is 0.26 tenths of an in.



Total measurement for this 0.071 mi section is 1.55 tenths of an in. Total count must be based on 0.1 mile section. $.1/071 \times 1.1 = 1.55$

Figure 4: Typical 0.1 (tenth) mi sections



BUMP TEMPLATE

Figure 5: A typical 0.3 in. bump template

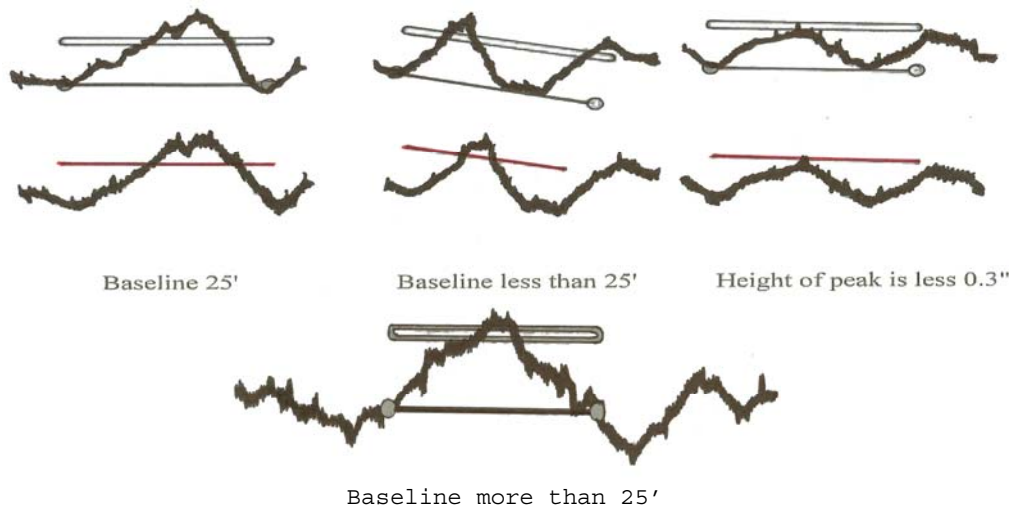


Figure 6: Bump template positions for varying conditions

Profiler System V1.53
Licensed to: Joe Contractor
Date Paved: 6/01/08 6:00 AM
Date Tested: 6/01/08 2:00 PM
File C:\My Documents\3400
1 Seg 1 Stn: 620 + 00 to 625 + 28
Height Cal – 109 counts in 1.00 in
Distance Cal – 119 counts per ft
Filter (Moving Average, Width = 1.90, Gain = 1.000)
Scallop:
 minimum height 0.01 in.
 minimum width (300:1) 2.00 ft
 resolution 0.01 in.
 blanking band 0.20 in.
 defect bump template height 0.40 in.
 defect bump template length 25.0 ft

 Track 1
PRI (in./mi/0.1mi) 0.00
No Defects Found: 0.00

Figure 7: Parameters for a California type profilograph



Figure 8: California type profilograph