

EVALUATION OF PROFILES

(A Modification of California Test 526)

SCOPE

1. This method describes the procedure for determining the Profile Index from profilograms of pavements made with a California type profilograph. Also described is the procedure used to locate individual high areas when their reduction is required by the contract documents. The same requirements apply to both the mechanical and the electronic profilograph, except that the electronic type will compute the profile index and high points directly, in lieu of manual reduction, and will print a summary of data for the test section.

SUMMARY OF METHOD

2. The profilogram is recorded on a scale of one inch equal to 25 feet longitudinally and one inch equal to one inch, or full scale, vertically. The determination of the Profile Index involves measuring "scallop" that appear outside a "blanking band". The determination of individual high areas involves the use of a special template.

PART I DETERMINATION OF PROFILE INDEX

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APPARATUS

3. The only special equipment needed to determine the Profile Index is a plastic scale 1.70 inches wide and 21.12 inches long representing a pavement length of 528 feet, or one tenth of a mile, at a scale of 1 inch = 25 feet. Near the center of the scale is an opaque band 0.2 inch wide extending the entire length of 21.12 inches. On either side of this band are scribed lines 0.1 inch apart parallel to the opaque band. These lines serve as a convenient scale to measure deviations or excursions of the graph above or below the blanking band. These are called "scallop".

METHOD OF COUNTING

4. The methodology described below pertains to the use a mechanical profilograph. If an electronic profilograph is used, this counting is performed automatically (see Part III).

(a) Place the plastic scale over the profile in such a way as to "blank out" as much of the profile as possible. When this is done, scallops above and below the blanking band usually will be approximately balanced. (See Figure 1)

(b) The profile trace will move from a generally horizontal position when going around superelevated curves, making it impossible to blank out the central portion of the trace without shifting the scale. The profile under such conditions should be broken in short sections and the blanking band repositioned on each section while counting. (See Figure 2A)

(c) Starting at the right end of the scale, measure and total the height of all the scallops appearing both above and below the blanking band, measuring each scallop to the nearest 0.05 inch. Write this total on the profile sheet near the left end of the scale together with a small mark to align the scale when moving to the next section. Short portions of the profile line may be visible outside the blanking band, but unless they project 0.03 inch or more, and extend longitudinally for two feet (0.08 inch on the profilogram) or more, they are not included in the count. (See Figure 1 for illustration of these special conditions.)

(d) When scallops occurring in the first 0.1 mile are totaled, slide the scale to the left, aligning the right end of the scale with the small mark previously made, and proceed with the counting in the same manner. The last section counted may or may not be an even 0.1 mile. If not, its length should be scaled to determine its length in miles.

CALCULATIONS

5. The Profile Index, "PrI", is determined as "inches per mile in excess of the 0.2 inch blanking band", but is simply called the Profile Index.

(a) The procedure for converting counts to Profile Index is given below. If an electronic profilograph is used, this calculation is performed automatically (see Part III).

$$\text{PrI} = \frac{1}{\text{Length of profile (miles)}} \times \frac{\text{Total count (Tenths of an Inch)}}{10}$$

(b) Profile Indexes may be averaged for two or more profiles of the same section of road if the profiles are the same length. Generally the same profiles shall be taken along the path of the wheel tracks within each lane, or at 3 ft. from the edge of the pavement and at every 6-ft. interval after that across the pavement.

EXAMPLE

6. The following is an illustration of the calculations:

Section Length (Miles)	Counts (Tenths of an inch)
0.10	5.0
0.10	4.0
0.10	3.5
400 ft. = 0.076	2.0
<div style="border-top: 1px solid black; margin-top: 5px;">Total = 0.376</div>	<div style="border-top: 1px solid black; margin-top: 5px;">Total = 14.5</div>
$\text{PrI} = \frac{1}{0.376} \times \frac{14.5}{10} = 3.9$	

LIMITATIONS OF COUNT IN 0.1 MILE SECTIONS

7. When the specifications limit the amount of roughness in any one-tenth mile section, the scale is moved along the profile and counts made at various intervals to find those sections that do not conform to specifications.

LIMITS OF COUNTS - JOINTS

8. When counting profiles, a day's paving is considered to include the last portion of the previous day's work, which includes the daily joint. The last 15 to 30 feet of a day's paving cannot usually be obtained until the following day. In general, the paving contractor is responsible for the smoothness of joints if he places the concrete pavement on both sides of the joint. On the other hand, the contractor is responsible only for the pavement placed by him if the work abuts a bridge or a pavement placed under another contract. Profilograph readings when approaching such joints should be taken in conformance with the contract documents.

AVERAGE PROFILE INDEX FOR THE WHOLE JOB

9. When averaging Profile Indexes to obtain an average for the job, the average for each day must be "weighted" according to its length. This is most easily done by totaling the counts for the 0.1-mile sections of a given line or lines and using the total length of the line in the computation for determining the Profile Index.

PART II
DETERMINATION OF HIGH POINTS
IN EXCESS OF 0.3 INCH

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APPARATUS

10. The only special equipment needed is a plastic template having a line one inch long scribed on one face with a small hole or scribed mark at either end, and a slot 0.3 inch from the parallel to the scribed line (see Figure 2). The one-inch line corresponds to a horizontal distance of 25 feet on the horizontal scale of the profilogram.

LOCATING HIGH POINTS IN EXCESS OF 0.3 INCH

11. The procedure for locating high points in excess of 0.3 inch is given below. If an electronic profilograph is used, these locations are determined automatically (see Part III).

(a) At each prominent peak or high point on the profile trace, place the template so that the small holes or scribe marks 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 need not be horizontal. With a sharp 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 0.3 inch.

(b) There may be instances where the distance between easily recognizable low points is less than one inch (25 feet). In 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. It is the intent however, of this requirement that the baseline for measuring the height of bumps will be as nearly 25 feet (1 inch) as possible, but in no case to exceed this value. When the distance between prominent low points is greater than 25 feet (1 inch) make the ends of the scribed line intersect the profile trace when the template is in a nearly horizontal position. A few examples of the procedure are shown in the lower portion of Figure 2.

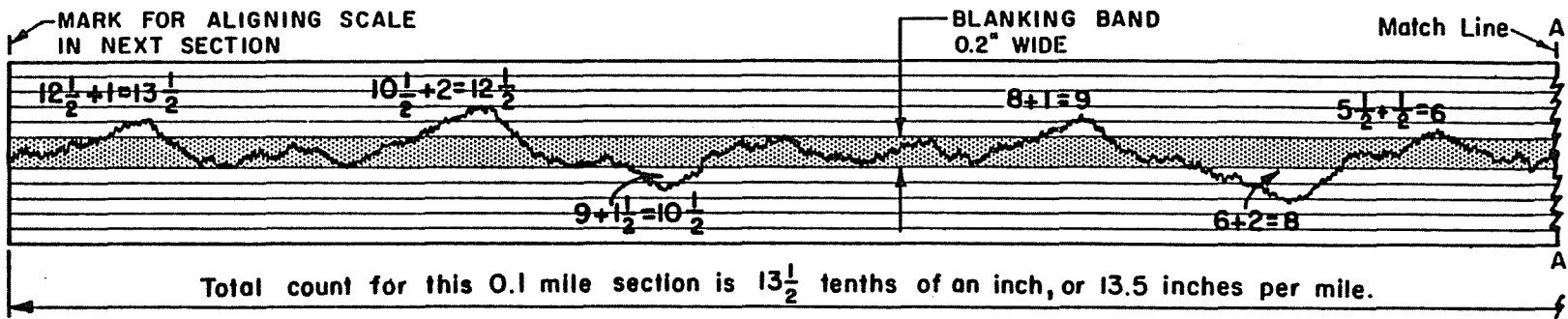
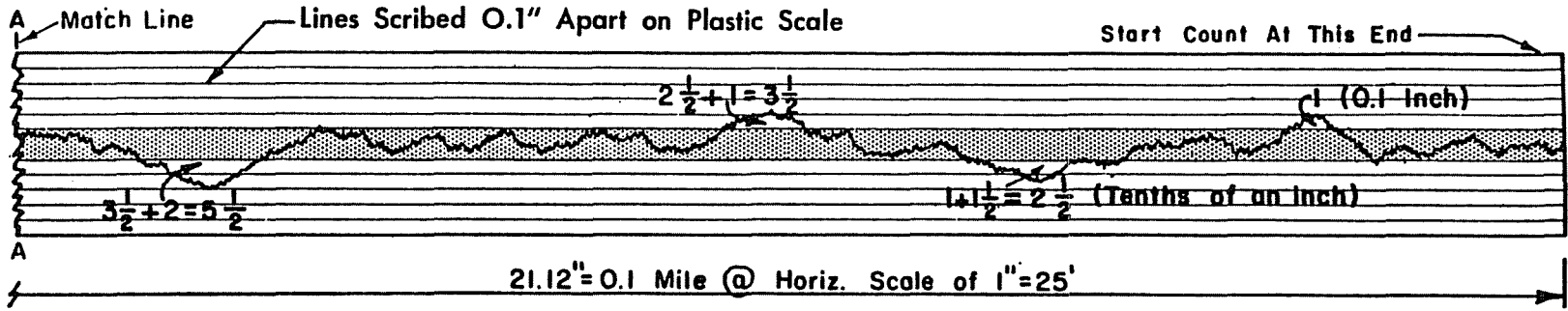
PART III
SPECIAL REQUIREMENTS FOR
ELECTRONIC TYPE PROFILOGRAPH
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APPARATUS

12. The Cox electronic profilograph is the only brand approved for use on Arizona Department of Transportation projects. This apparatus shall be operated in accordance with the manufacturers instructions. The use of the manufacturers recommended settings of 80 for the null band filter, and 8000 for the data filter are mandatory.

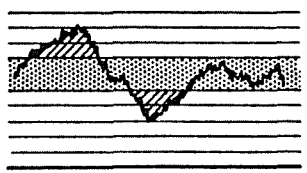
EXAMPLE SHOWING METHOD OF DERIVING PROFILE INDEX FROM PROFILOGRAMS

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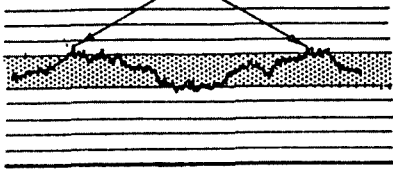
TYPICAL CONDITIONS

Scallops are areas enclosed by profile line and blanking band. (Shown crosshatched in this sketch)



A

Small projections which are not included in the count.



B

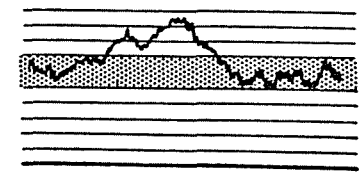
SPECIAL CONDITIONS

Rock or dirt on the Pavement. (Not counted)



C

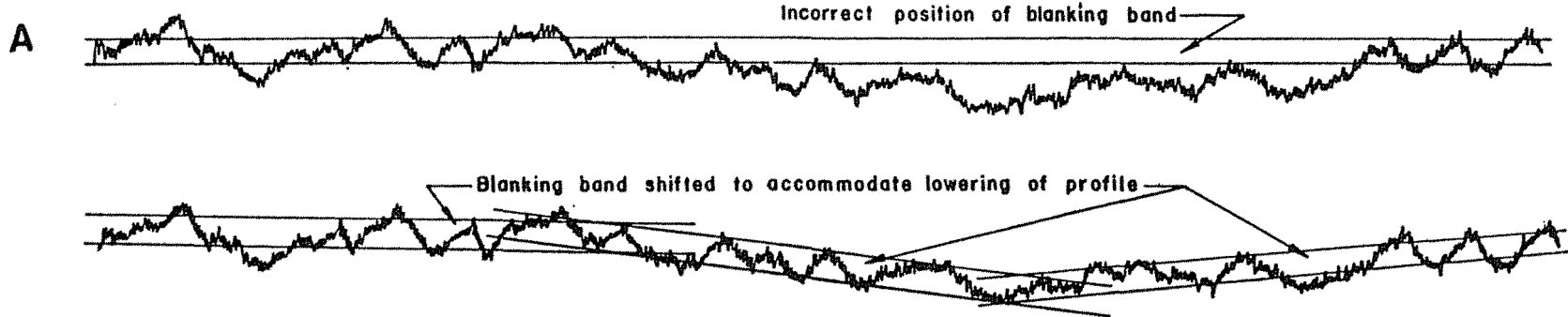
Double peaked scallop. (Only highest part counted)



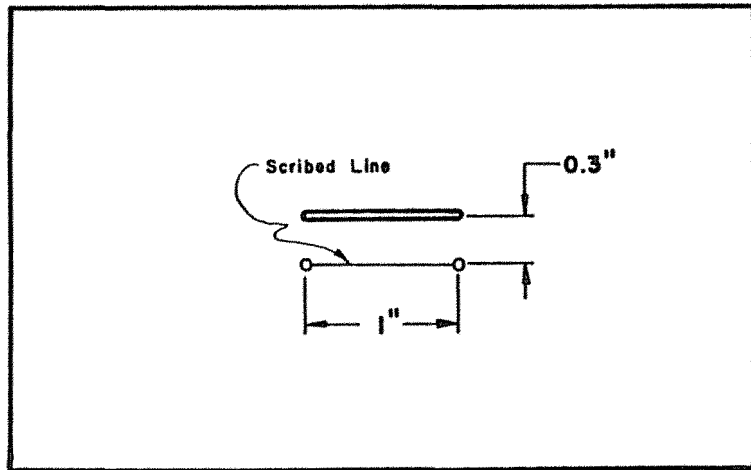
D

FIGURE 1

METHOD OF COUNTING WHEN POSITION OF PROFILE SHIFTS AS IT MAY
WHEN ROUNDING SHORT RADIUS CURVES WITH SUPERELEVATION



B METHOD OF PLACING TEMPLATE WHEN LOCATING BUMPS TO BE REDUCED



BUMP TEMPLATE

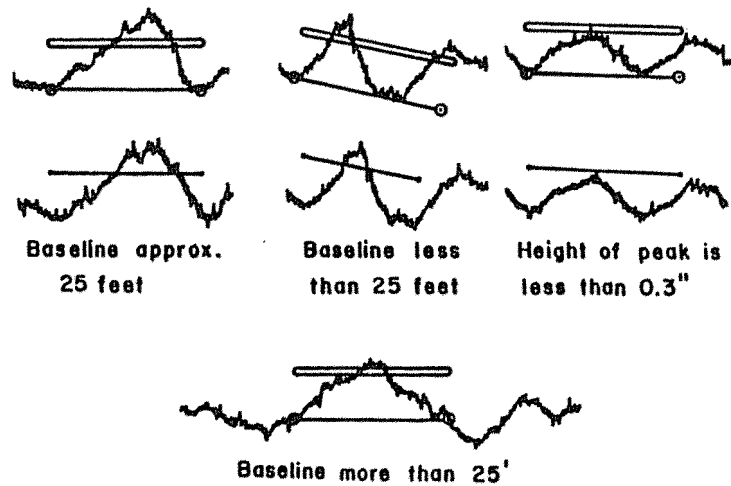


FIGURE 2