Method of Test for Determining Surface Smoothness Deviations of PCC Pavement and Bridge Decks

1. Scope:

This test is for determining longitudinal and transverse surface deviations of PCC Pavement and bridge decks.

2. Apparatus:

2.1 10’ straightedge.

2.2 Steel shims of 1/16”, 1/8”, 3/16”, and 1/4” with an allowable tolerance of ±0.010” in thickness. The shims shall be a minimum size of approximately 1 1/4” wide and 3” long.

2.3 Viking 10' Hi-Lo detector.

3. Procedure:

Determine if High-Lo detector will be used or if only the straightedge will be used. If only the straightedge is to be used, follow section 3.3.

NOTE: The Hi-Lo detector is used to determine the location of possible deficient areas (bumps/dips) to be checked with a 10’ straightedge. If the area to be checked is small the location of deficient areas may be determined with the straightedge without first identifying areas using the hi-lo machine.

3.1 Calibration of the Hi-Lo detector.

A. Prior to moving to the work site, the Hi-Lo detector shall be checked in accordance with the manufacturer’s instructions.

B. On the project prior to use.

(1) Place the detector on a flat, straight metal reference beam. The beam should be checked with the 10’ straightedge prior to calibration.

(2) Verify the machine using shims of 1/16”, 1/8”, 3/16”, and 1/4” or a combination of 1/16” and 1/8” shims. Place these shims longitudinally under the wheels.
The machine should be verified through the entire range of 1/16”, 1/8”, 3/16”, and 1/4” for both the high and low positions.

(3) Mark the new height and depths accurately on the indicator plate of the detector. Narrow strips of colored adhesive tape are suggested for use in making the marks, as they can readily be removed and replaced when further verification requires slight changes on the indicator plate. The verification should be done each time the machine is unloaded, after moving it from one place to another.

3.2 Operation of the Hi-Lo detector.

A. The Hi-Lo detector should be pushed in a longitudinal direction over the approximate center of the wheel paths in each traffic lane. The detector should be kept in an erect position, approximately perpendicular to the pavement surface.

B. A deviation of 1/8” is where the needle of the Hi-Lo detector swings just past the 1/8” mark of the indicator plate on either the high or low side. Also, when the indicator needle is riding on the high side and swings to the low side (or vice versa) with a total movement indicating a change of 1/8” or more, within a longitudinal distance of less than 10’, the questionable areas should be marked for checking with the 10’ straightedge.

3.3 Straightedging.

A. A surface deviation is considered to exist when the gauge resting on the surface of the concrete can be freely passed under the straightedge.

B. Locating an amount of surface deviation for either longitudinal or transverse direction.

(1) The areas in question shall be checked with a 10’ straightedge laid either parallel or perpendicular to the centerline of the roadway. Lay shim flat on the pavement surface approximately perpendicular to the straightedge.

During the checking operation, the straightedge shall be at rest and supported by only its own weight.

A surface deviation amount is determined by the largest shim or combination of shims that can pass freely under the
straightedge. Mark the areas where the surface deviation exceeds the permissible deviation.

3.4 Determining the limits of deficient areas.

A. The longitudinal pavement surface test shall be completed on each wheel pass on driving lanes and on at least one pass on shoulders, acceleration lanes, etc.

The length of the deviation will be the length out of specification tolerance at the location of the surface test as checked with a 10 foot straightedge and a 1/8 inch shim, or a 1/4 inch shim as specified for rest areas, weigh stations, ramp entrances, shoulders and other similar areas. Where two surface tests vary within a particular site within a driving lane or passing lane, the length used for computation of the area will be the average of the two tests. The width will be the total width of the driving lane or shoulder. The depth of the deviation will be the maximum depth of the test(s) at a particular site as checked with the shims.

B. Where the transverse surface test is out of specification, the maximum length and maximum width at a particular site will be used in computation of the deficient area.

NOTE: Refer to examples in Figures 1a, 1b and 2 to determine length and depth of deviation

4. Report:

Document the general location of the entire area represented. Document all specific locations where a surface deviation exists on a DOT-29 form. The Depth of Deviation reported will be the "Depth of Deviation (Max)", as shown in the figures. Report "Depth of Deviation" to nearest 1/16".

Example: If the Permissible Deviation is 1/8" and a 1/8" shim will freely slide under the straightedge, but 3/16" shim will not, then report as 1/8" (2/16") under "Depth of Deviation".

4.1 Calculate the "Deficient Area" of longitudinal surface deviation.

\[
\text{Deficient Area} = \frac{1/2(Ll+LO)W}{9}
\]

\[
Ll = \text{Length of deviation inner wheel pass (Nearest 0.1')}
\]

\[
LO = \text{Length of deviation outer wheel pass (Nearest 0.1')}
\]

\[
W = \text{Width of lane (Nearest 0.5')}
\]
Report the deficient area to the nearest 0.1 yd² on the DOT-29

4.2 Calculate the "Deficient Area" of transverse surface deviation.

\[
\text{Deficient Area} = \frac{\text{LO} \times \text{W}}{9}
\]

\[
\begin{align*}
\text{LO} & = \text{Length of deviation (Nearest 0.1 ft.)} \\
\text{W} & = \text{Width of lane (Nearest foot)}
\end{align*}
\]

Report the deficient area to the nearest 0.1 yd² on the DOT-29.

5. References:

DOT-29
## Longitudinal Surface Deviation

<table>
<thead>
<tr>
<th>Station</th>
<th>Direction Tested</th>
<th>Lane Width</th>
<th>Length of Deviation</th>
<th>Depth of Deviation</th>
<th>Deficient Area (Sq. Yd.)</th>
<th>Remarks</th>
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<tbody>
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<tr>
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<td>1/8</td>
<td>1/16</td>
<td>2.7  Inside WP&gt;1/16&quot; price adjust</td>
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</table>

**Direction Tested** = longitudinal (L) or transverse (T)  
**Lane or Shoulder Width** = affected width to nearest 0.5"  
**Length Deviation** = nearest 0.5"  
**Depth of Deviation Total** = max measured under straightedge to nearest 1/16"  
**Depth of Deviated Permissible = specification**

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**Comments**

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**Figure 1**

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**SD 417**  
**Page 5**  
**Sample ID 2229835**  
**File No.**
LONGITUDINAL SURFACE DEVIATION

Figure 1A

Figure 1B

Figure 2