Evaluating Pavement Markings on Portland Cement Concrete (PCC) & Various Asphalt Surfaces

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Illinois Department of Transportation

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Why Study Pavement Markings?

- Premature Failures
- Inadequate Return on Investment
- Safety Concerns
- Limited Maintenance Resources
Premature Failures

- Installation Issues
- Snow Plow Damage
- Traffic Wear
- Pavement Deterioration Leading to Marking Loss
Research Objectives

- Quantify Durability of Pavement Markings
- Identify Application and Installation Problems
- Identify Long Term Cost Effective Pavement Markings for Various Pavement Types
- Develop a Pavement Marking Selection and Installation Guide
Quantifying Durability

- Measure Retroreflectivity
- Perform Presence Measurements
- Analyze Collected Data
  - New-Pavement Marking Index
Installation and Application

- Identify Issues?
  - Surface Cleanliness
  - Temperature and Moisture
  - Pavement Conditions
  - Pavement Marking Thickness
  - Pavement Marking Chemistry/Mixing
  - Retroreflective Media Application
Installation and Inspection

- Pavement Marking Requirements
  - Material Application Details
  - Film Thickness
  - Reflective Media Application Rates and Distribution

- Pavement Preparation
  - Pavement Condition and Cleanliness
  - Pavement Temperature and Moisture
Create a Pavement Marking Selection and Installation Guide

- Provide Guidance for Designers, Contractors, and Construction Personnel
- Installation and Inspection Worksheets
## Paint

<table>
<thead>
<tr>
<th>Contract No:</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Pay Item No:</th>
<th>Route</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>Date:</th>
<th>Beg/End</th>
</tr>
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<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Inspector:</th>
<th>Lines (Circle All That Apply)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L Edge</td>
</tr>
<tr>
<td></td>
<td>Note:</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Site Notes:</th>
<th>Symbols Present?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

### I. SURFACE PREPARATION

#### 1. Groove Cutting

Is the surface to be groove cut to recess the markings? (yes/no)
- If yes, answer parts A. through C.
- If no, proceed to inspection item 2.

#### Directions for Measurements:

At the beginning of the grooving process, take 5 measurements at 5-ft intervals.

- **A. Depth**
  - Place a 40 mil thick measuring plate in groove and lay straight edge over plate. Plate should be approximately flush* with pavement. If straight edge rests on pavement and there is a gap between plate and straight edge, then groove is too deep. If straight edge rests on plate and doesn’t touch pavement, then groove is too shallow. (Note: If ridges inside groove are high enough to prevent plate from laying inside groove, then saw blades need to be replaced.) Respond “yes” if plate is flush.

  *Approximately Flush: Groove Depth = 40 +/- 10 mils

<table>
<thead>
<tr>
<th>Measurement</th>
<th>A. Depth</th>
<th>B. Width</th>
<th>C. Distance from Long, Joint or Edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>(yes/no)</td>
<td>(in)</td>
<td>(in)</td>
</tr>
<tr>
<td>#2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#3</td>
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<td>#4</td>
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<tr>
<td>#5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pass/Fail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requirement</td>
<td></td>
<td>All 5 Responses =</td>
<td>Average ≥ Marking Width + 1”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
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</tbody>
</table>

#### 2. Surface Cleaning

**A. Visual Verification**

Was surface cleaned to remove dirt, grease, and debris? (yes/no)

**B. Surface Wetting Test**

**Directions:**

Using an eye dropper, place a drop of clean drinking water on the groove surface.

- If the drop forms a bead, the surface may need to be re-cleaned.
- If the drop spreads (wets), the surface is ready to accept application of marking.

Does the drop of water spread? (yes/no)
# Installation Worksheet-Paint (2)

## Paint

### I. SURFACE PREPARATION, continued

#### 3. Surface Moisture

<table>
<thead>
<tr>
<th>Has it rained in the past 24 hours? (yes/no)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- If yes, perform &quot;Surface Moisture Test&quot;.</td>
<td></td>
</tr>
<tr>
<td>- If no, proceed to inspection item 4.</td>
<td></td>
</tr>
</tbody>
</table>

**Surface Moisture Test**

<table>
<thead>
<tr>
<th>Directions:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Place a 12&quot;x12&quot; piece of plastic wrap on the pavement surface and tape edges.</td>
<td></td>
</tr>
<tr>
<td>2. Let stand for approximately 15 minutes.</td>
<td></td>
</tr>
<tr>
<td>3. Check for moisture bubbles on the inside surface of the plastic.</td>
<td></td>
</tr>
<tr>
<td>4. If moisture bubbles are larger than a pencil eraser, then pavement has too much water.</td>
<td></td>
</tr>
</tbody>
</table>

**Are moisture bubbles larger than pencil eraser?** (yes/no)

#### 4. Pavement Temperature

| Measured Temp = |   |

### II. PAVEMENT MARKING APPLICATION

#### 1. Ambient Temperature

| Required Temp: | ≥ 50°F | Measured Temp = |

#### 2. Wet Film Thickness

| Required Thickness: | ≥ 16 mils | Average of 5 Measured Thicknesses = |

#### 3. Small Glass Bead Application Rate

| Required Rate = | 6.0 lb/gal | Measured Rate = |

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# Installation Worksheet-Paint (3)

## Paint

### II. PAVEMENT MARKING APPLICATION, continued

#### 4. Bead Dispersion / Retroreflectivity

**“Sun Over Shoulder” Test**

**Directions:**
1. When the sun is 20 to 80 degrees above the horizon, position yourself so that the sun is behind you.
2. View the stripe in front of you along a plane parallel to your shadow.
3. Adjust your distance from the stripe to where the shadow of your head touches the stripe area being observed.
4. From this position, evaluate bead dispersion and retroreflective qualities of the stripe.

<table>
<thead>
<tr>
<th>Are beads well dispersed? (yes/no)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is marking retroreflective? (yes/no)</td>
</tr>
</tbody>
</table>

#### 5. Bead Embedment

**Directions:**
Using a small magnifying lens, closely examine the beads’ depth of embedment in the marking material.

**Optimum embedment:** 50-60% of bead diameter is below surface of marking material.

| Are most beads at optimum embedment? (yes/no) |

#### 6. Distance from Longitudinal Joint or Pavement Edge

**Required Distance:**

| ≥ 2” |
| Average of 5 Measured Distances = |

#### 7. Marking Width

**Required Width =

| Specified Width ± 1/4” |
| Average of 5 Measured Widths = |
Research Extension into 2013

- Applied Research Associates Request:
  - Additional Year of Data Collection Spring 2013
  - Delayed Final Completion Date for Guide
    - Work Completed Except for Final Decision Making Tables
  - Paperwork, Justification and Budget Supplied to ICT and IDOT for approval
  - Approved by Pavement TAG
  - Executive Committee Meeting Nov. 2012
Mild Winter 2011-2012

Accumulated Snowfall (in)
September 1, 2010 to May 31, 2011

Accumulated Snowfall (in)
September 1, 2011 to May 31, 2012

Midwestern Regional Climate Center
Illinois State Water Survey, Prairie Research Institute
University of Illinois at Urbana-Champaign
Observations After 3 Years

- Mild Winter = Performance Effected?
  - Limited Snowplow Damage
  - Recessing Still Advantageous
Technical Review Panel

- Kyle Armstrong – Operations
- John Benda – IL Tollway
- Mike Fassero – District 6
- Tim Kell – Construction
- Filiberto Sotelo - Safety Engineering
- Marshall Metcalf – District 6
- Kelly Morse – Materials and Physical Research
- Brian Pfeifer – FHWA
- Kurt Schuldt – Maintenance Coatings