

# MnDOT Pavement Surface Smoothness Specification



**23<sup>rd</sup> Annual RPUG Meeting  
September 29, 2011**

# Key Components of Spec.

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1. Inertial Profiler (IP) Certification
2. Operator Certification
3. Smoothness
4. Areas of Localized Roughness (ALR)

# 1. IP Certification



MnROAD Research Facility  
( $\approx$  40 miles west of Minneapolis/St. Paul)

# IP Certification Objectives

1. To provide a calibration standard against which all inertial profilers can be tested
2. To verify the reliability and validity of data collected by inertial profilers



Neither reliable, nor valid

Reliable, but not valid

Both reliable and valid



ICC SurPRO

# IP Certification Procedure

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1. Calibrate IP (check tire pressure, accelerometers, vertical height sensors, DMI, etc.).
2. Collect six profiles on each test section (one bituminous, one concrete).
3. Submit hard copies and ERD files of the five “best” runs for each test section.

# Bituminous Test Section



# IP Certification Acceptance Criteria

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1. The distance of each contractor run must be within 0.2% of the actual length of the test section.
2. On each test section, the average contractor IRI must be within 5% of the reference IRI.
3. On each test section, the coefficient of variation of the five contractor IRI values must be no larger than 3%.
4. On each test section, the average of the five contractor correlations must be at least 90%.

# 2011 IP Certification Decal

## 2011 Inertial Profiler Certificate

Date: \_\_\_\_\_

Serial #: \_\_\_\_\_

VIN: \_\_\_\_\_

Manufacturer: \_\_\_\_\_

Software: \_\_\_\_\_

Signature: \_\_\_\_\_

Minnesota Dept. of Transportation



## 2. Operator Certification

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- All contractors who operate an IP on a MnDOT project must have completed a training course and passed an operator certification exam (70% correct required).
- The training and exam are available on the MnDOT Smoothness Program website:  
<http://www.dot.state.mn.us/materials/profilercertification.html>

# Operator Training Screenshot #1

MENU Mn/DOT's Pavement Surface Smoothness Specification - Operator Certification Overview

Welcome to Mn/DOT's Pavement Surface Smoothness Specification Operator Certification e-Learning course.

This course is targeted for contractors doing road construction for Mn/DOT whose personnel are responsible for submitting documentation from pavement surface testing. Contractors are expected to complete the course and pass the proficiency test to obtain certification and recertification. Mn/DOT employees who review pavement profile documentation and/or data will also benefit from this course.

**This course will cover the following topics.**

- Topic 1 - Pavement Roughness and Profile Data Collection
- Topic 2 - Smoothness and Areas of Localized Roughness
- Topic 3 - Pavement Surface Smoothness Specification
- Topic 4 - Using ProVAL

This training should take approximately 90 minutes.

Click Next to continue.

V 1.0

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# Operator Training Screenshot #2

MENU Mn/DOT's Pavement Surface Smoothness Specification - Operator Certification  
Topic 1: Pavement Roughness and Profile Data Collection

**General Operation Principles**  
During the profiling process, be sure to follow these principles to maintain proper and consistent data collection.

Click on each box to learn more.

The diagram shows a white SUV on a road. Above the road, a green box labeled 'Operating Speed' is positioned over the vehicle. Below the road, a green box labeled 'Lateral Position' is positioned between two orange traffic cones. Further down, a green box labeled 'Lead-In' is on the left, a green box labeled 'Longitudinal Position' is in the center, and a green box labeled 'Lead-Out' is on the right. The words 'Start' and 'Stop' are placed between the traffic cones.

Operating Speed

Lateral Position

Start Stop

Lead-In Longitudinal Position Lead-Out

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GLOSSARY

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# Operator Certificate of Training

## Certificate of Training

This certifies that

**Joe Profiler**

has successfully completed the Mn/DOT Training course for the  
Combined Smoothness Specification and ProVAL software.



Certification Date: \_\_\_\_\_

Expiration Date: \_\_\_\_\_

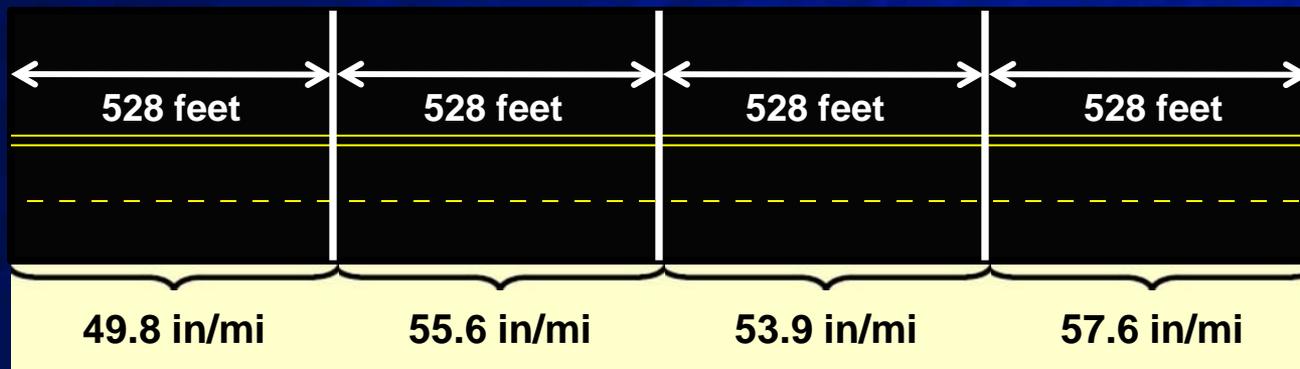
Applicant's Signature: \_\_\_\_\_

Authorized Signature: \_\_\_\_\_

Tom Nordstrom, Pavement Management Analyst

# 3. Smoothness

- “Smoothness” is a single IRI value that represents the overall roughness of an entire 528-ft pavement segment.



- Smoothness is calculated with ProVAL’s “Ride Quality: Fixed Interval” for both the left and right wheel paths.

# Pay Adjustment Equations

| Pay Adjustments for Bituminous Pavements |             |                                     |
|--|-------------|-------------------------------------|
| Equation                                 | IRI (in/mi) | Pay Adjustment (\$/0.1 mi)          |
| HMA-A                                    | < 30.0      | 400.00                              |
|  | 30.0 – 75.0 | $850.00 - 15.000 \times \text{IRI}$ |
|  | > 75.0      | Corrective Work to $\leq 56.7$      |
| HMA-B                                    | < 33.0      | 270.00                              |
|  | 33.0 – 85.0 | $600.00 - 10.000 \times \text{IRI}$ |
|  | > 85.0      | Corrective Work to $\leq 60.0$      |
| HMA-C                                    | < 36.0      | 180.00                              |
|  | 36.0 – 95.0 | $414.00 - 6.500 \times \text{IRI}$  |
|  | > 95.0      | Corrective Work to $\leq 63.7$      |

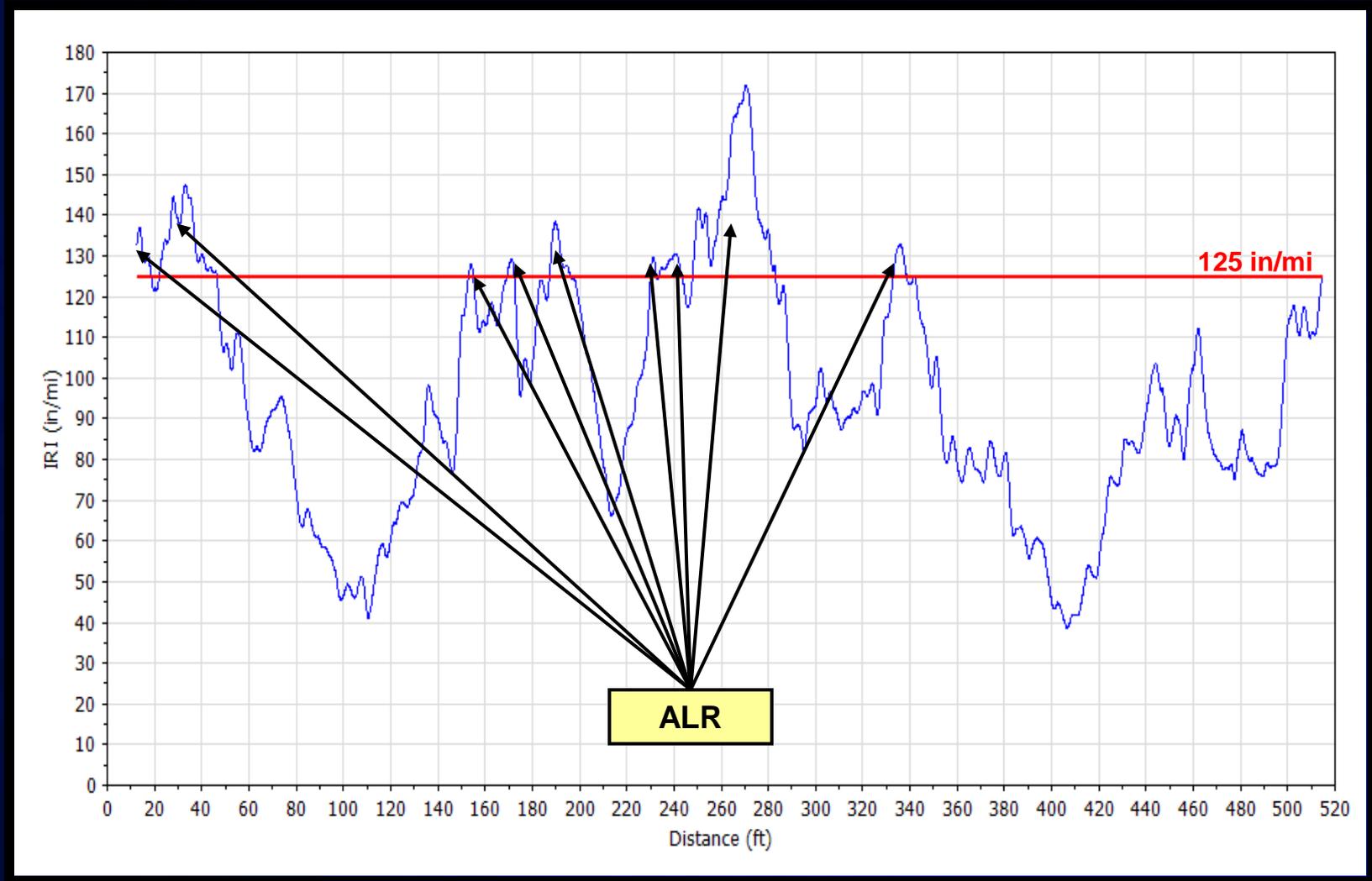
| Pay Adjustments for Concrete Pavements |             |                                      |
|--|-------------|--------------------------------------|
| Equation                               | IRI (in/mi) | Pay Adjustment (\$/0.1 mi)           |
| PCC-A                                  | < 50.0      | 890.00                               |
|  | 50.0 – 90.0 | $2940.00 - 41.000 \times \text{IRI}$ |
|  | > 90.0      | Corrective Work to $\leq 71.7$       |
| PCC-B                                  | < 50.0      | 450.00                               |
|  | 50.0 – 71.2 | $1511.30 - 21.226 \times \text{IRI}$ |
|  | 71.3 – 90.0 | 0.00                                 |
|  | > 90.0      | Corrective Work to $\leq 71.3$       |

## 4. ALR

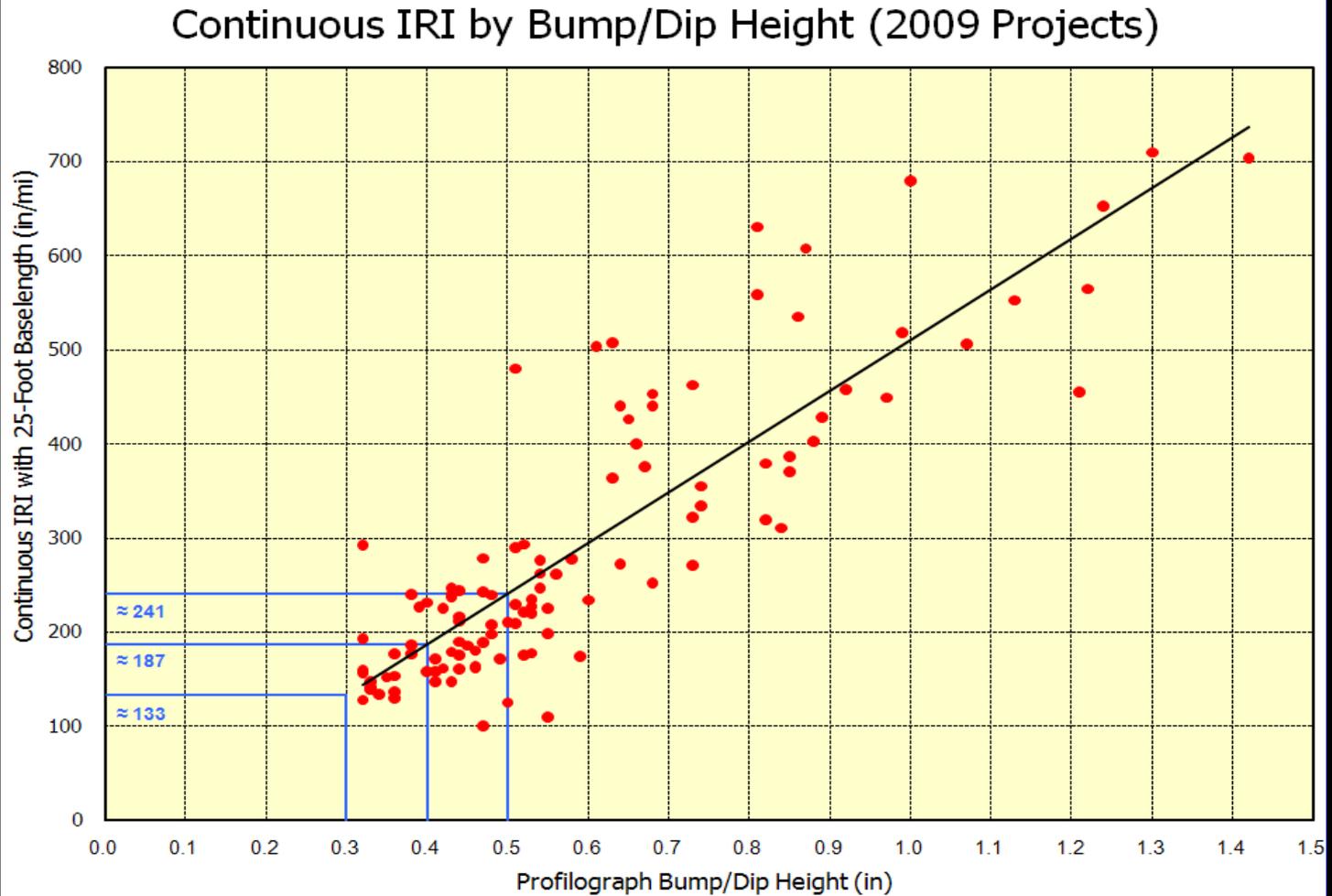
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- “ALR” are 25-ft continuous IRI values that equal or exceed 125.0 inches/mile
- ALR is computed for the right wheel path only.
- ALR are determined with ProVAL’s “Smoothness Assurance: Short/Long Continuous Histogram.”
- ALR monetary deductions depend on the type of paving and posted vehicle speed on a project.

# ALR Graph



# ALR Graph



# ALR Monetary Deductions

| ALR Monetary Deductions and Corrective Work Requirements                   |                            |  |
|--|----------------------------|--|
| Equation   | 25ft Continuous IRI, in/mi | Corrective Work or Monetary Deduction, per linear 1.0 ft   |
| HMA-A or HMA-B,<br>and a posted vehicle<br>speed > 45 mph                  | < 125.0                    | Acceptable   |
|  | $\geq 125.0$ and < 175.0   | Corrective work or \$10.00,<br>as directed by the Engineer |
|  | $\geq 175.0$ and < 250.0   | Corrective work or \$25.00,<br>as directed by the Engineer |
|  | $\geq 250.0$               | Corrective work or \$50.00,<br>as directed by the Engineer |
| PCC-A or PCC-B,<br>and a posted vehicle<br>speed > 45 mph                  | < 125.0                    | Acceptable   |
|  | $\geq 125.0$ and < 175.0   | Corrective work or \$10.00,<br>as directed by the Engineer |
|  | $\geq 175.0$ and < 250.0   | Corrective work or \$25.00,<br>as directed by the Engineer |
|  | $\geq 250.0$               | Corrective work as directed by Engineer                    |
| HMA-C, PI-A, or any<br>paving with a posted<br>vehicle speed $\leq 45$ mph | < 175.0                    | Acceptable   |
|  | $\geq 175.0$ and < 250.0   | \$10.00  |
|  | $\geq 250.0$               | \$25.00  |

A large, powerful ocean wave is crashing, creating a massive wall of white foam. The water is a deep blue, and the sky is a clear, bright blue. The wave is the central focus of the image, with its crest curling over. The text "Thank You!" is overlaid in the center of the image.

**Thank You!**