

# Minnesota Department of Transportation



## 2006 Road Profiler Certification Program

# Certification Site and Dates

***Location:*** MnRoad  
Research Facility  
(roughly 40 miles from  
Minneapolis/St. Paul)



***Dates:*** May 8-11 & May 15-18, 2006

# Certification Objectives

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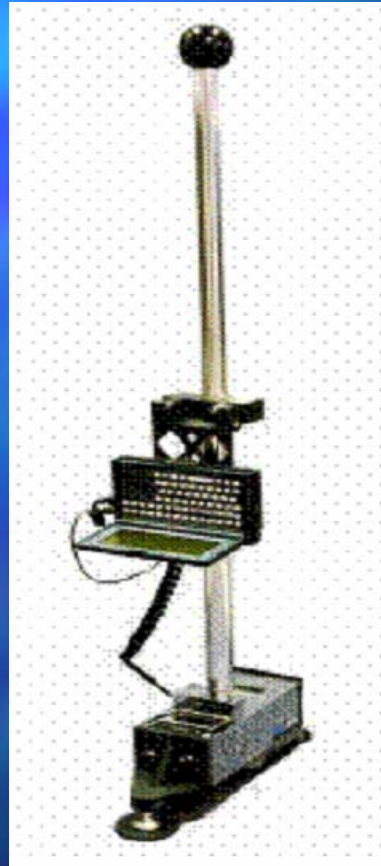
1. To provide a calibration standard against which all smoothness measuring devices can be tested
2. To verify the validity and reliability of data collected by profilers
3. To level the playing field for all contractors

# Calibration Standard



Rod & Level

VS.



The Dipstick

VS. ???



What is it?

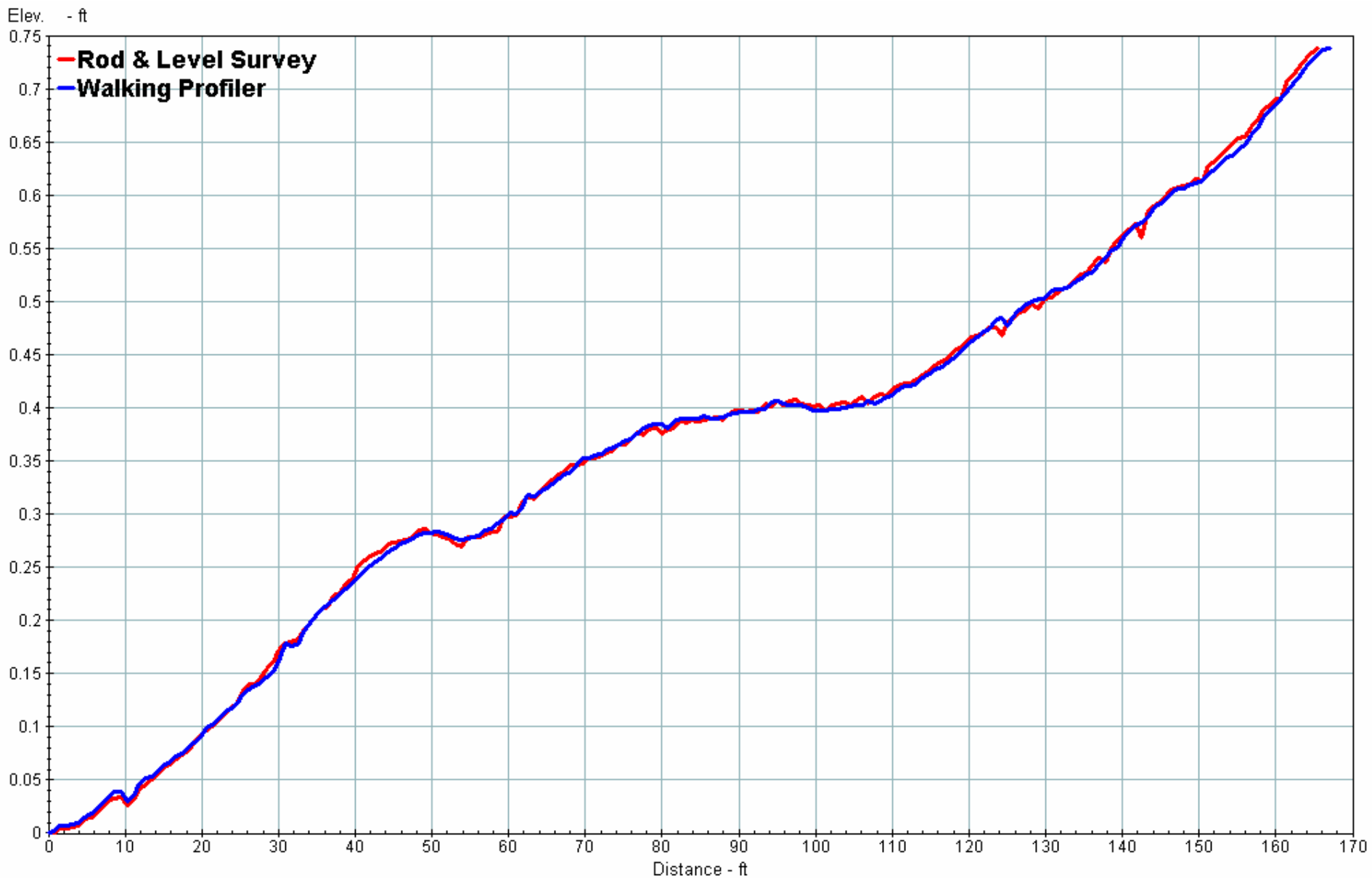


ARRB Walking Profiler



Walking Profiler without cowl

# Rod & Level vs. Walking Profiler



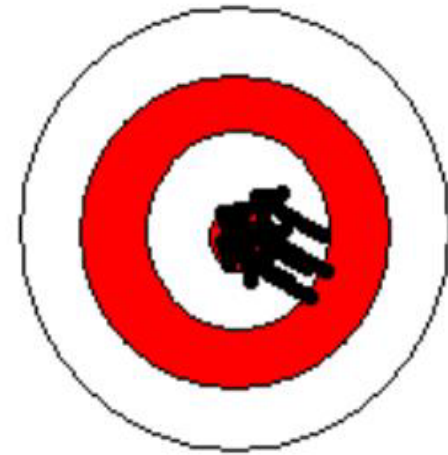
# Reliability and Validity



**Neither reliable,  
nor valid**



**Reliable, but  
not valid**



**Both reliable  
and valid**



# IRI Certification Procedure

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1. Calibrate smoothness measuring device. Check tire pressure, accelerometers, vertical height sensors, filter settings, etc.
2. Verify the accuracy of equipment's Distance Measuring Instrument (DMI) on 528-foot calibration section.

# MnRoad Calibration Section



# IRI Certification Procedure

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3. Place cones at starting and ending points of test sections to trigger device's autostart/stop mechanism.
4. Collect six profiles on each test section.
5. Submit hard copies and ERD files of the five "best" runs for each test section.

# IRI 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.

# IRI Acceptance Criteria

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3. On each test section, the standard deviation of the five contractor IRI values must be no larger than 3% of the average contractor IRI.

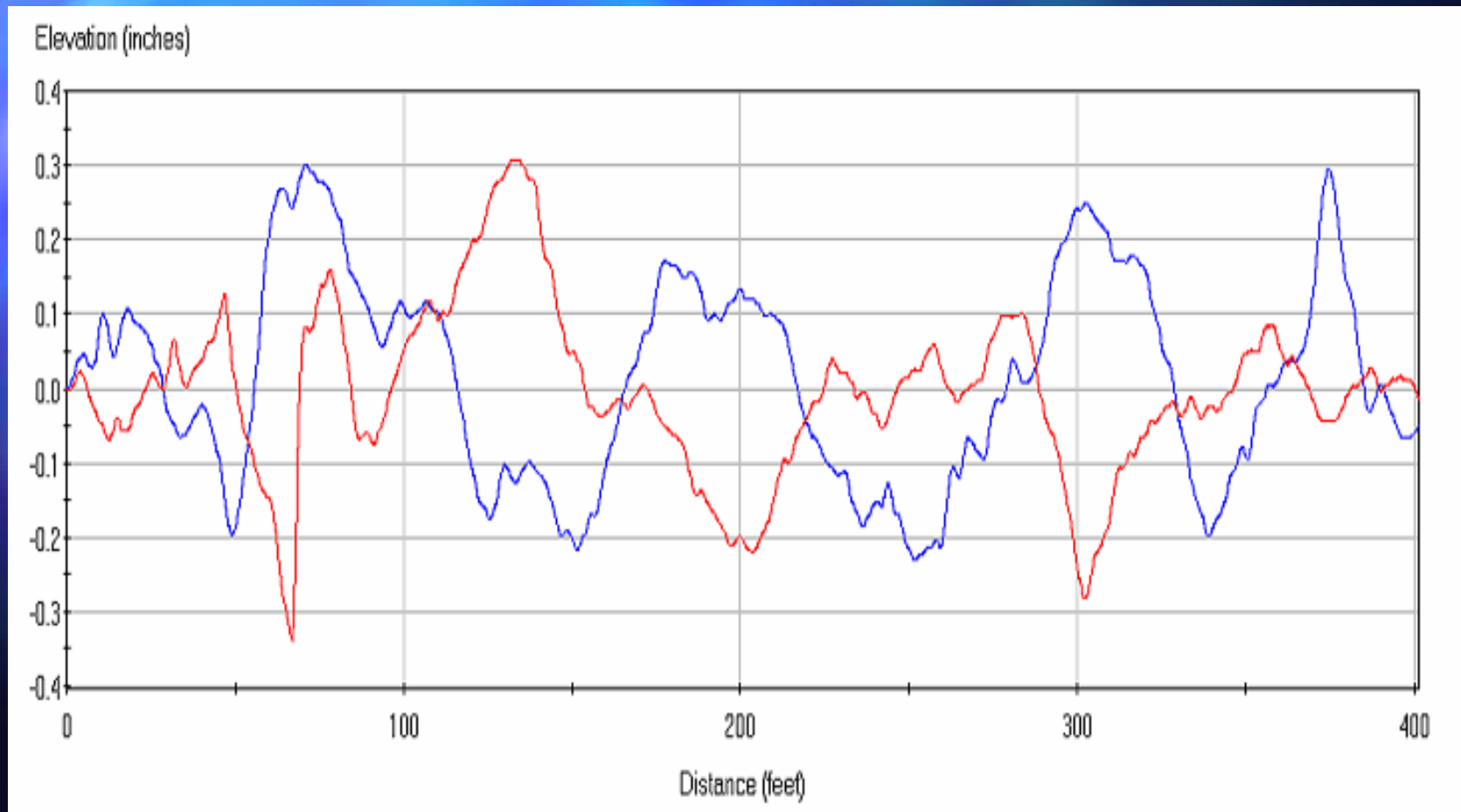
$$\frac{\text{Std. Dev. of IRIs}}{\text{Avg. IRI}} \leq 3.0\%$$

# IRI Acceptance Criteria

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4. On each test section, all five contractor profiles must correlate with the reference profile at a level of 85% or higher. In addition, the average of the five contractor correlations must be at least 90%.

# Why Correlation?



- Run 1
  - LElev.
- Run 2
  - LElev.

### Cross-Correlation

Pre-Processor Filter  
IRI

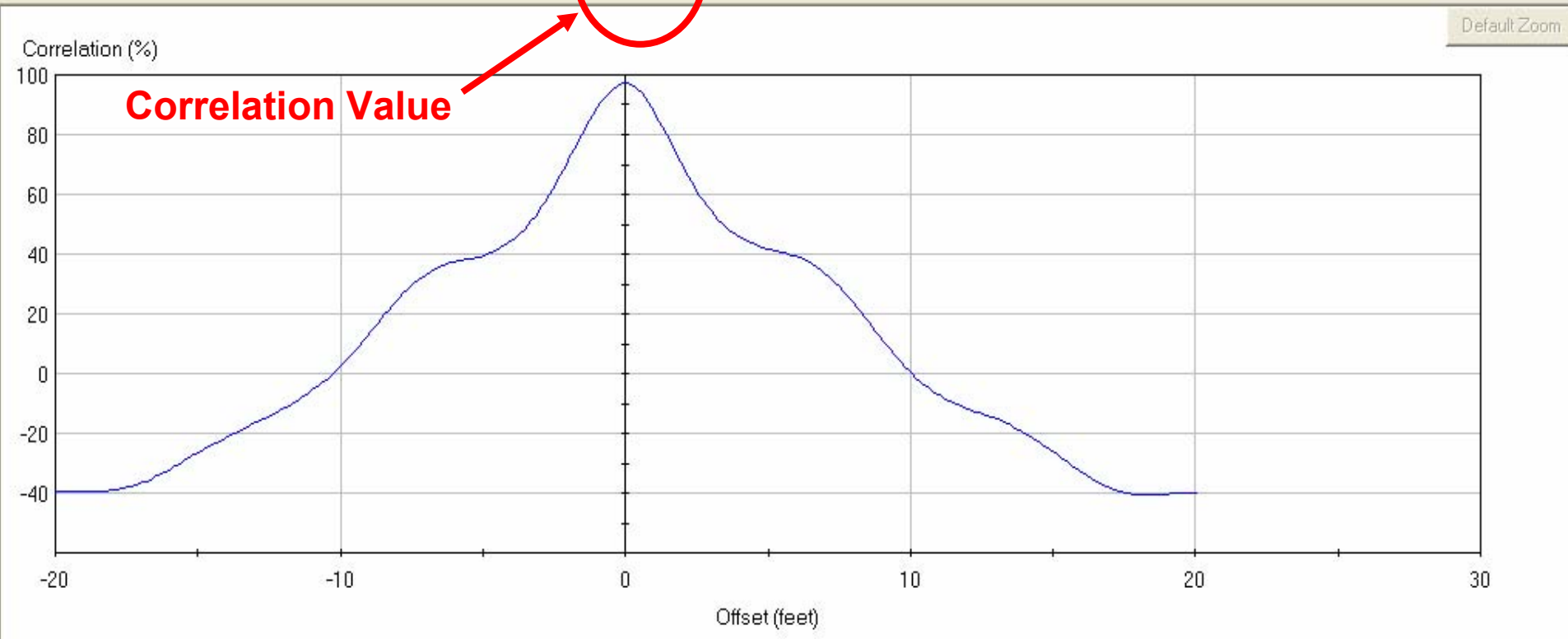
Apply 250mm Filter

Input	Value	Unit
Max Offset	20	feet

Set Reference Profile Analyze

Plot Type: Correlation

	Offset (feet)	Value (%)
Maximum Correlation	0.0458	97.2



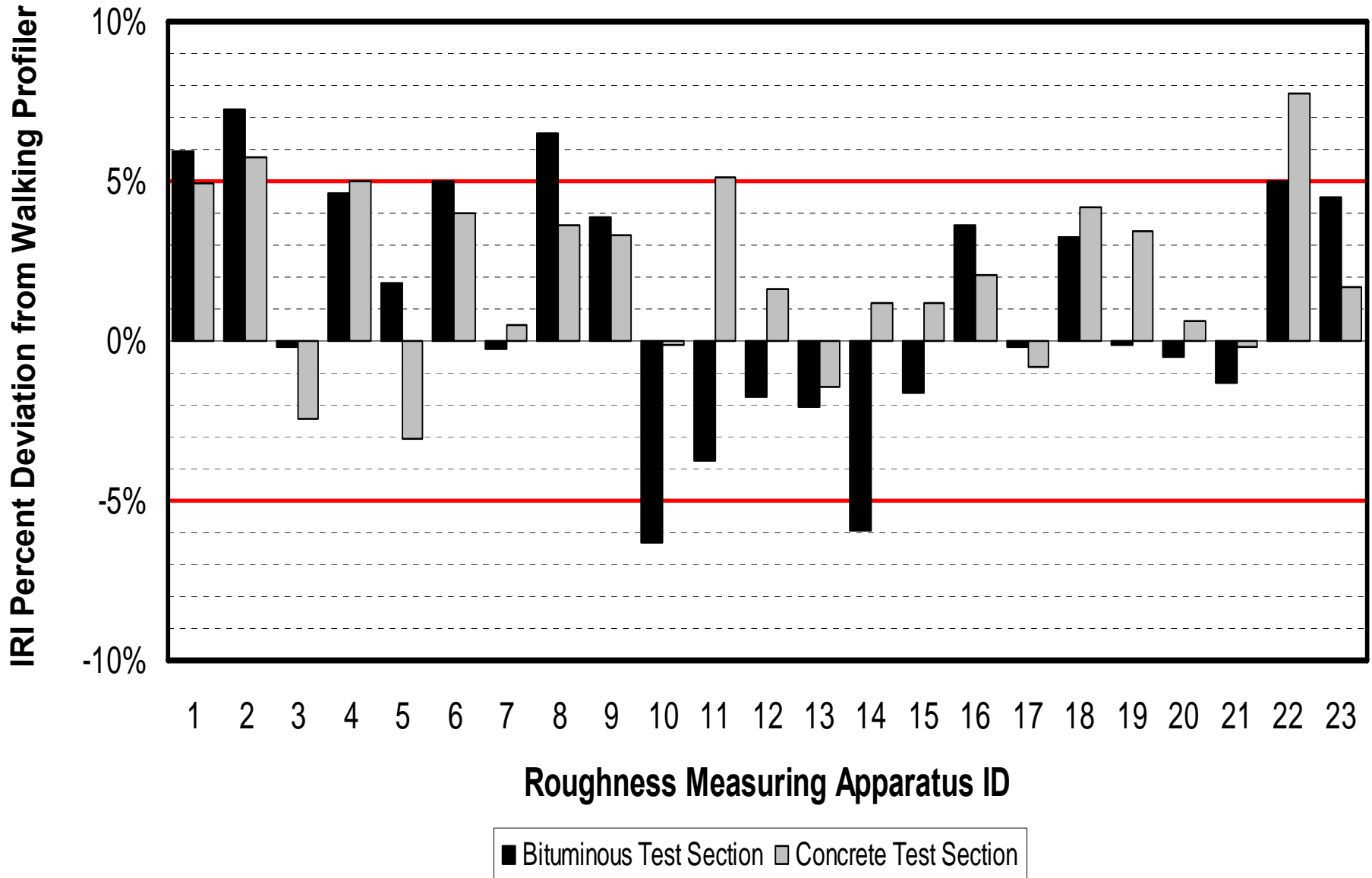


# 2006 Certification Results

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- 13 out of 23 (57%) smoothness measuring devices passed on first certification attempt.
- All failing devices passed initial retest attempt. (Three devices were not retested.)

# 2006 Initial Certification Results: IRI Percent Deviation from Walking Profiler



# Reasons for Failure

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1. Faulty equipment
  - Laser
  - Accelerometer
  - DMI
2. Software problems
3. Operator error

# Operator Error

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- Not calibrating equipment
- Inadequate lead-in
- Not maintaining a uniform speed during runs (accelerating, decelerating, braking)
- Not following test line closely

# Statistics for Passing Devices

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- IRI average deviation from WP was 0.0% on Bituminous Section and 0.6% on Concrete section.
- IRI average absolute deviation from WP was 2.0% on either test section.
- Average cross-correlation was 92.9% for either test section.

# Certification Stickers

## 2006 Smoothness Certificate

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

Ser. No.: \_\_\_\_\_

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

Mfr.: \_\_\_\_\_

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

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

Minnesota Dept. of Transportation



The 2006 certificates are red!!!



**Any Questions?**