



# **COMPARISON OF MPD VALUES FROM HIGH-SPEED LASER MEASUREMENTS WITH MPD FROM TWO STATIONARY DEVICES**

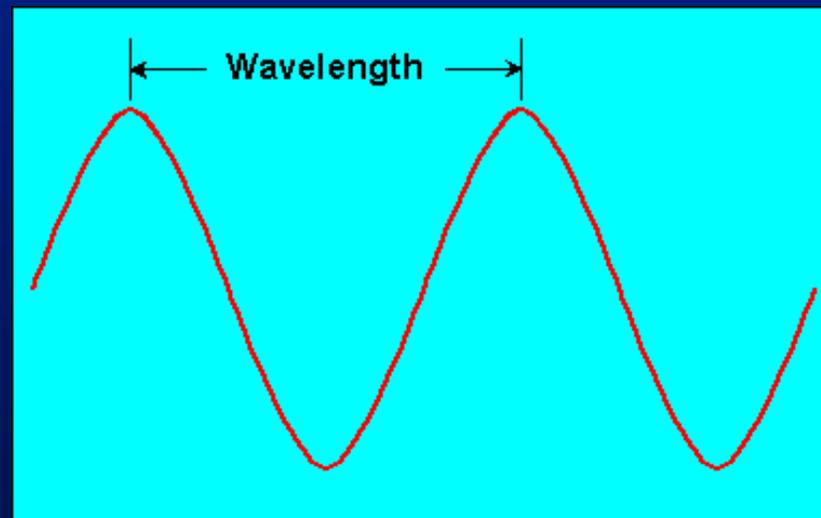
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**McLean, VA**

**RPUG 2013, San Antonio, TX**

# ***Pavement Texture (ISO)***

<b>Description</b>	<b>Wavelength Range (mm)</b>
Microtexture	< 0.5 mm
Macrottexture	0.5 to 50 mm
Megattexture	50 to 500 mm





## ***Macrotexture***

- Friction.
- Tire Pavement Noise.
- Rolling Resistance.

## ***Measurement of Macrotexture***

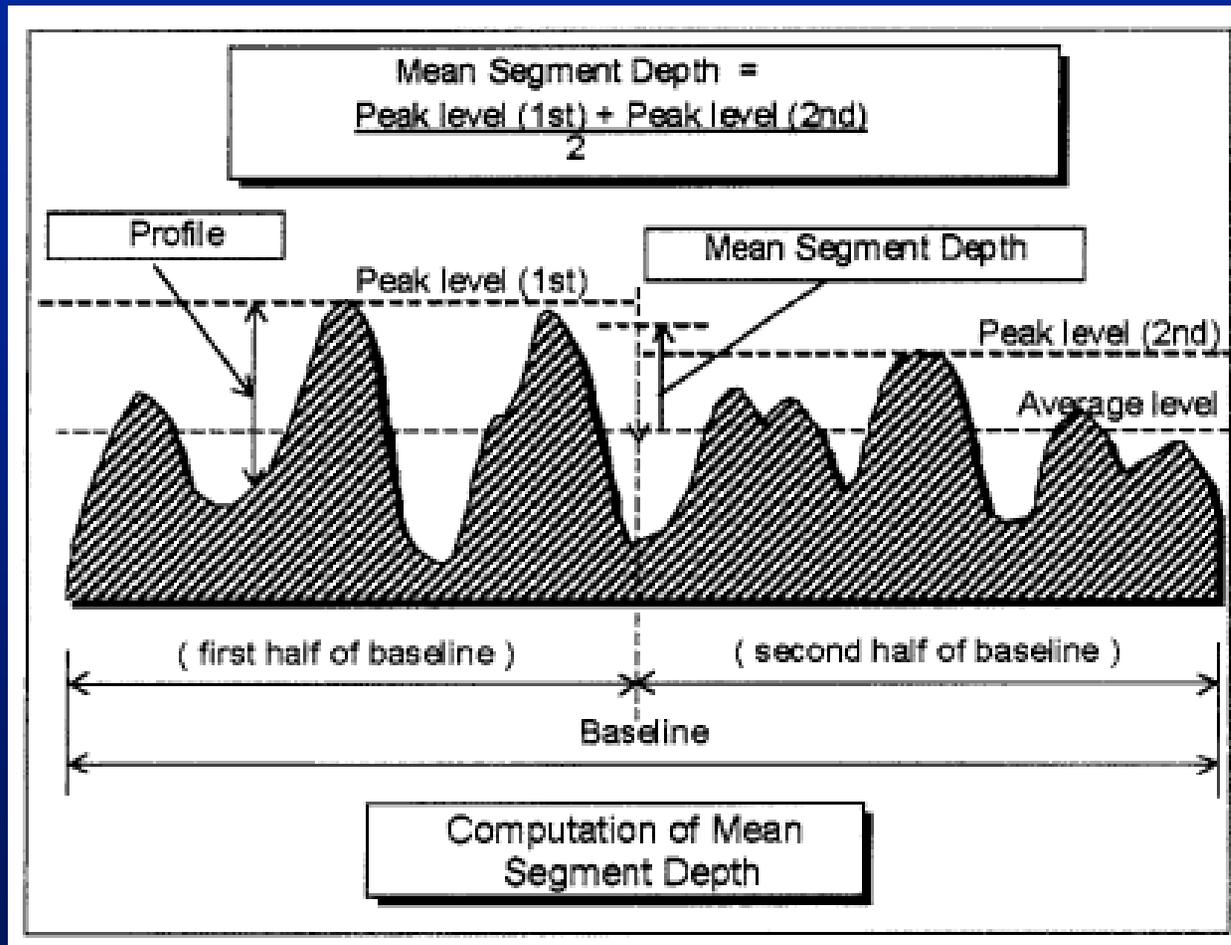
- **ASTM E 965, Sand Patch Test, Mean Texture Depth (MTD).**
- **ASTM E 1845, Laser Measurements, Mean Profile Depth (MPD).**
- **ASTM E 1845 has a regression equation to estimate MTD from MPD.**



## ***Measurement of Macrotexture at Network Level***

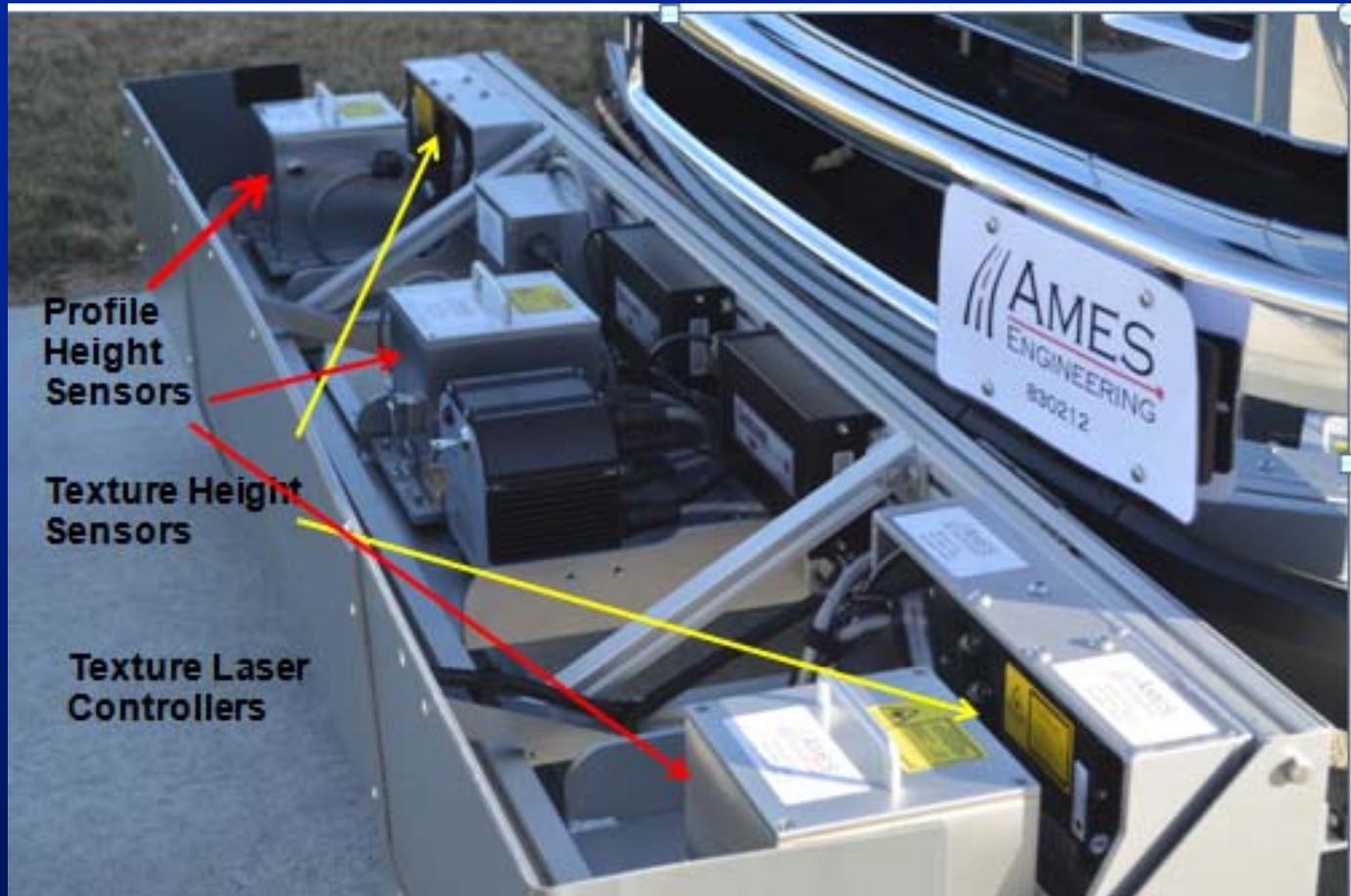
- **Single point laser sensor installed on a vehicle. Compute MPD from collected data.**
- **Simulate a digital sand patch on 3D data (e.g., Pavemetrics LCMS Data).**

# Computation of MPD, ASTM E 1845



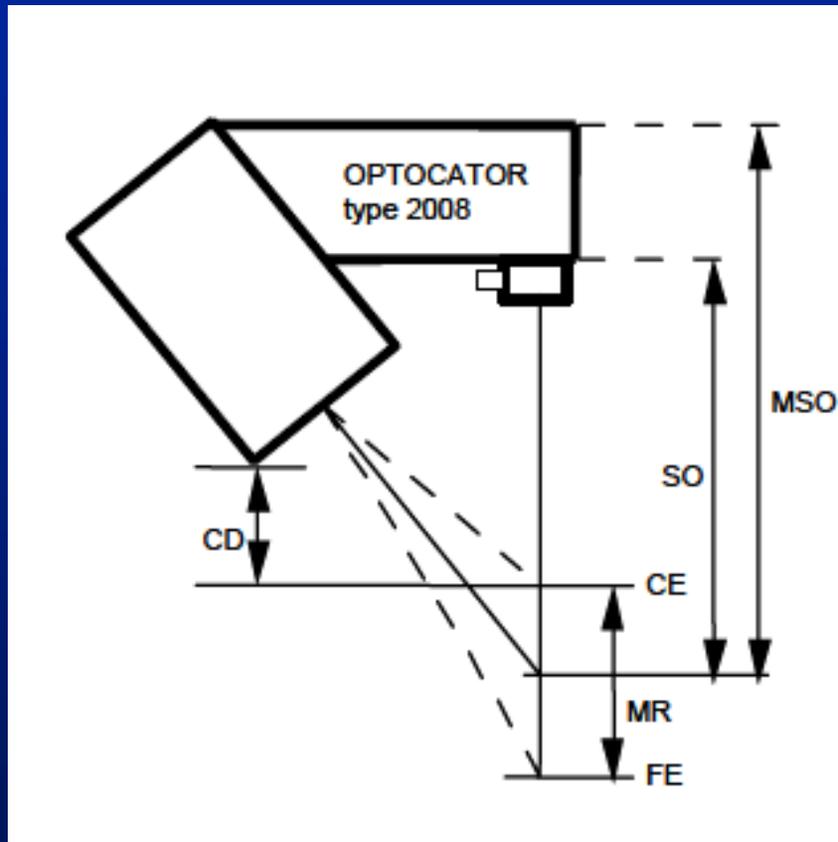
Baseline = 100 mm

## **LTPP Profilers - 2013**



**Texture Lasers: LMI Selcom Optocator 2008-180/390, 62.5 kHz**

# LMI Optocator 2008



From LMI-Selcom User Manual

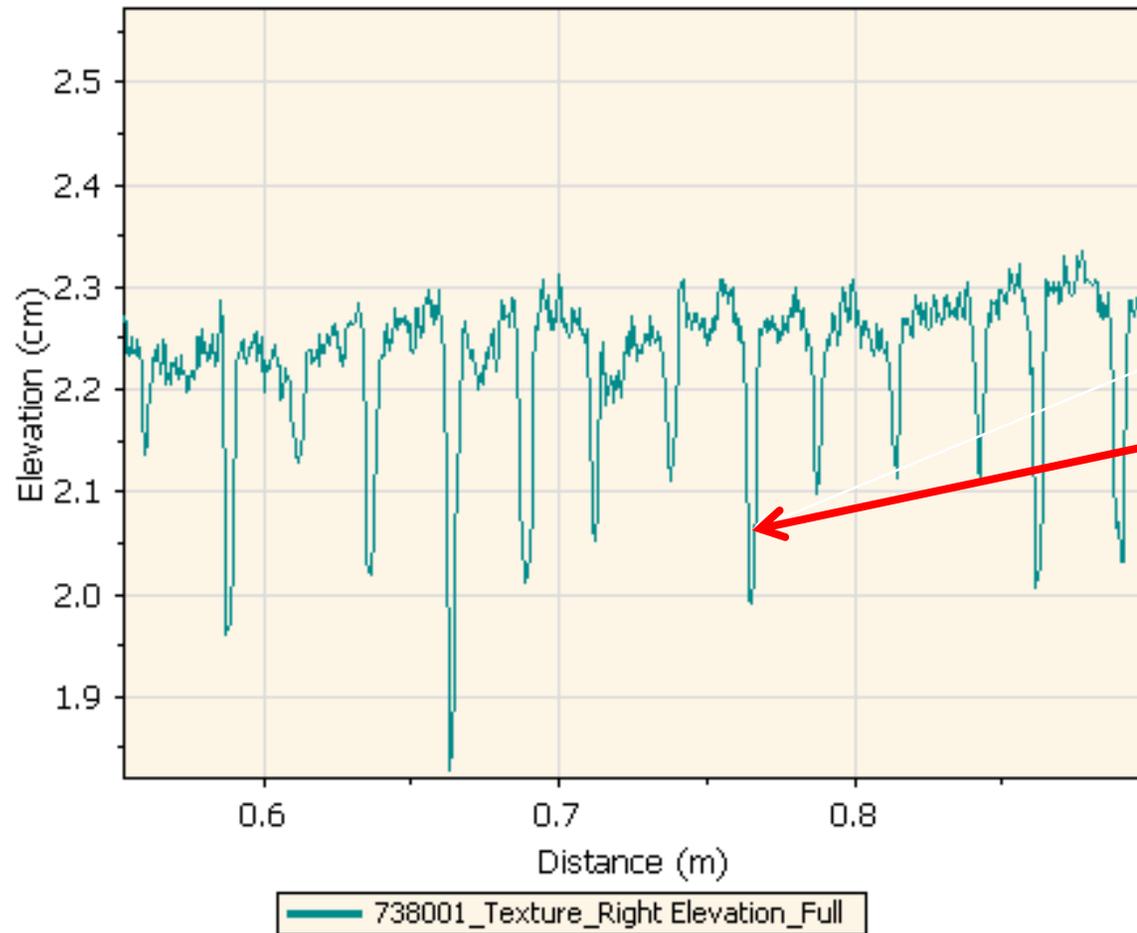


## ***Capabilities of Texture Laser***

- **Data are sampled at 62.5 kHz and all collected data are saved.**
- **For LTPP purposes data are decimated to obtain data at 0.5 mm intervals.**



# Data Collected at Concrete Section



Transverse  
Tines

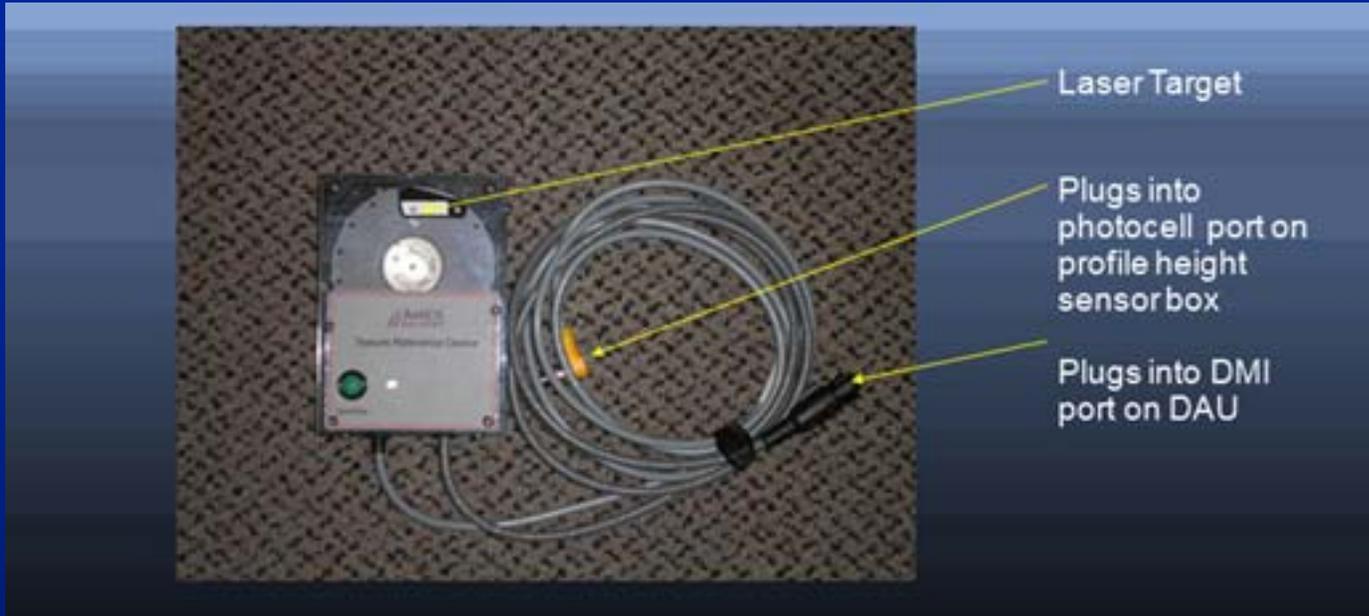
## ***Checking Accuracy of Texture Laser***

- **Block check.**
- **Texture Reference Disk provided by Ames Engineering.**

# Block Check



## **Texture Reference Disk**



- **Machined hard disk with four steps alternating from 0.5 to 1.0 mm.**

## **Texture Reference Disk**

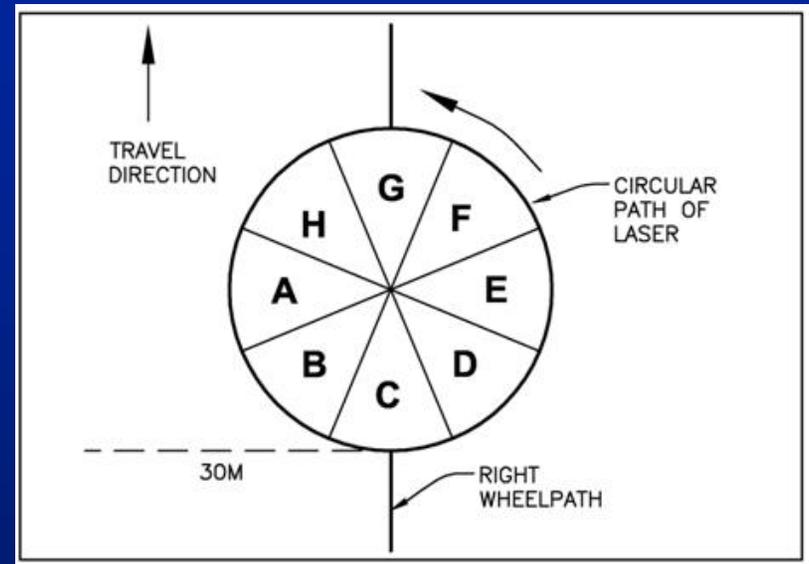


- Disk attains a speed of 7200 rpm and starts taking measurements. Simulates a speed of 54 mph.
- MPD computed from data displayed on the computer.
- Theoretical MPD of Disk = 0.75 mm.
- Collected data can also be viewed.



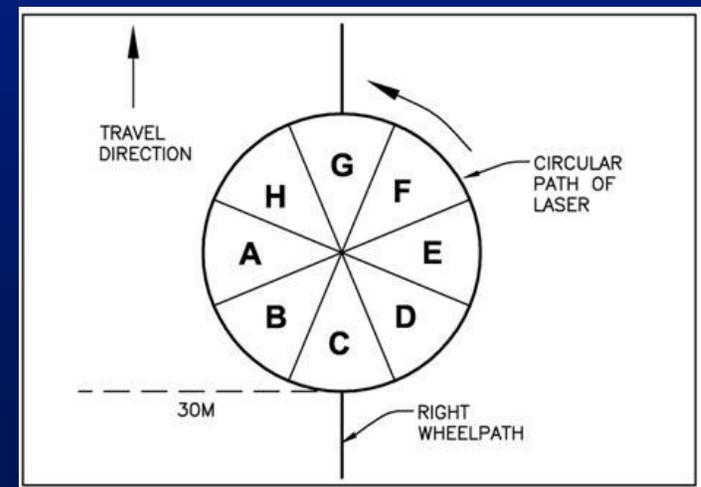
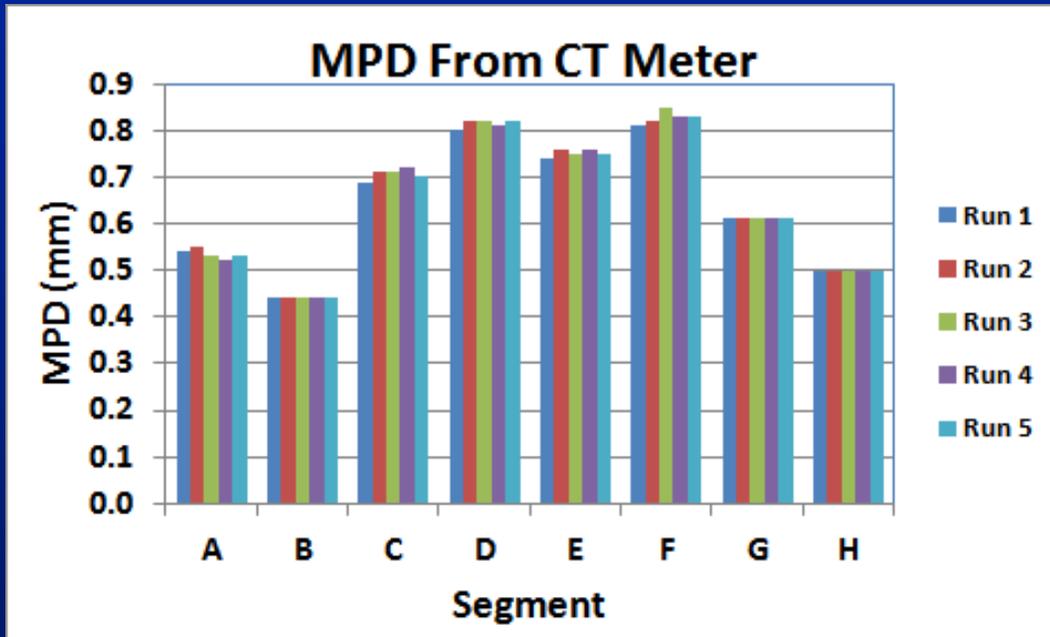
# Comparison of MPD From High-Speed Device with MPD From CT Meter and Ames Scanner

## CT Meter

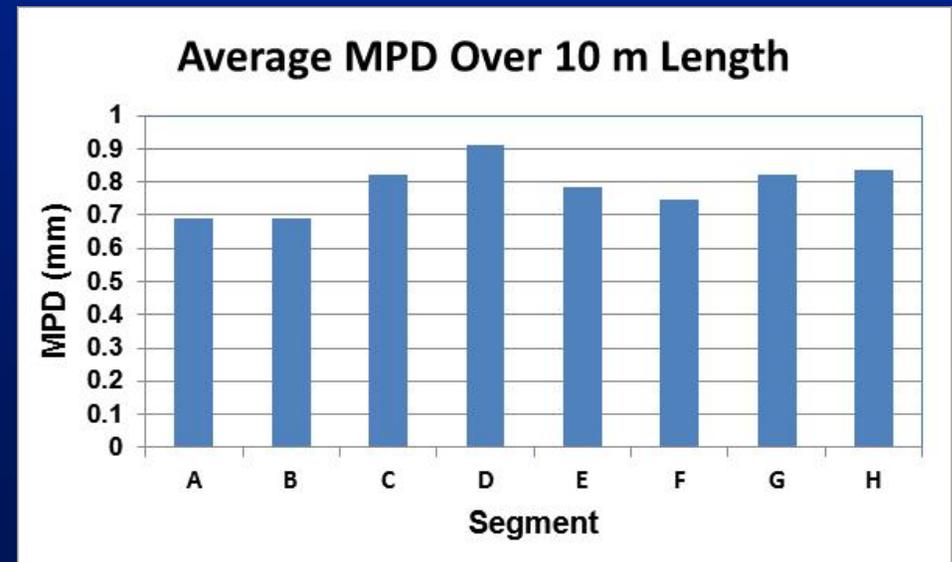
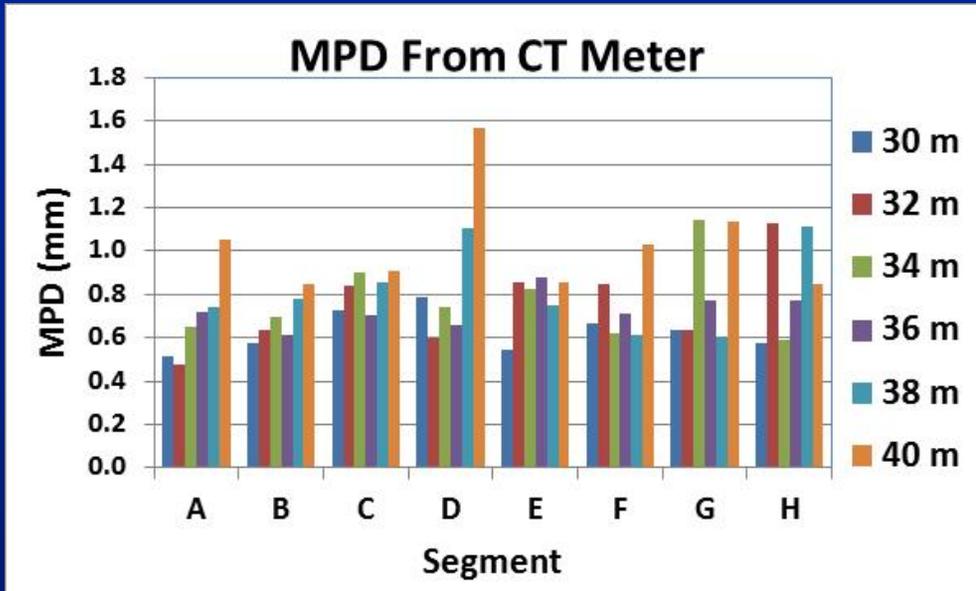


- Sensor mounted on a rotating arm.
- Follows a circular path having a radius of 142 mm.
- Sample spacing = 0.87 mm.

# MPD From CT Meter – Repeatability Asphalt Section



# CT Meter - MPD on Asphalt Section at 2 m Intervals Along Right Wheelpath



## **Ames Engineering Scanner**

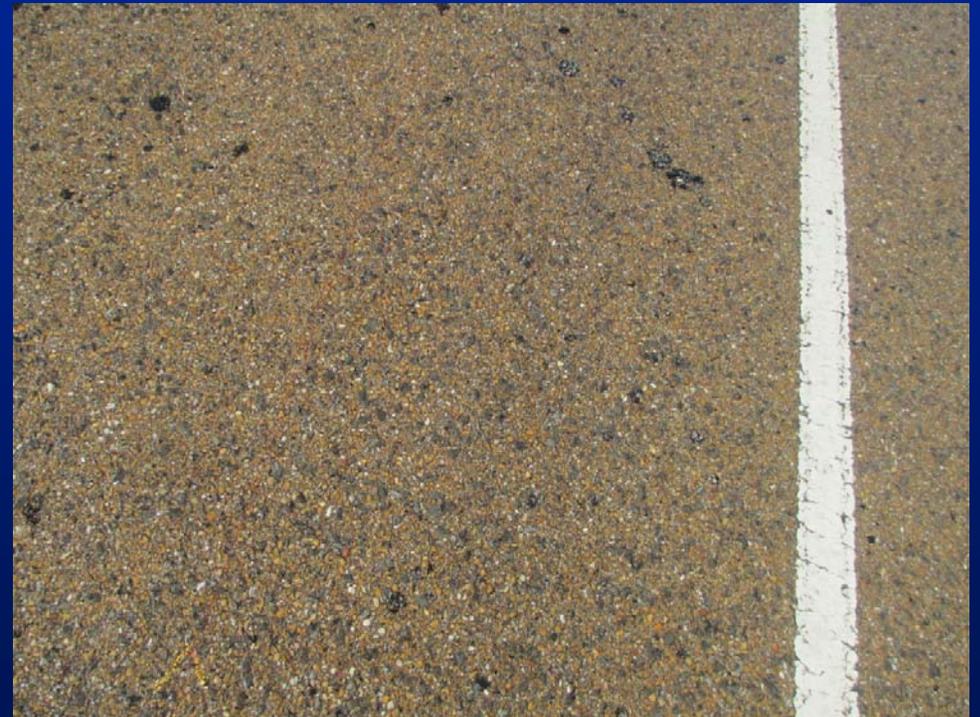
- **Dimensions: (Width, Height, Depth)  
6" x 9" x 6".**
- **Laser travels 100 mm along a longitudinal path.**
- **Was set to get 10 scans over a 75 mm width.**
- **Sample spacing approx. 0.014 mm.**



## ***Analysis Procedure***

- **Three Test Sections: Two asphalt (AC-1, AC-2), and one chip seal (CS).**
- **CT Meter and Ames Scanner tests performed over a 10 m distance at 2 m intervals. Results averaged.**
- **Average MPD from macrotexture data collected by high-speed device computed over same 10 m distance.**

# ***Test Section AC-1, Dense-Graded AC***



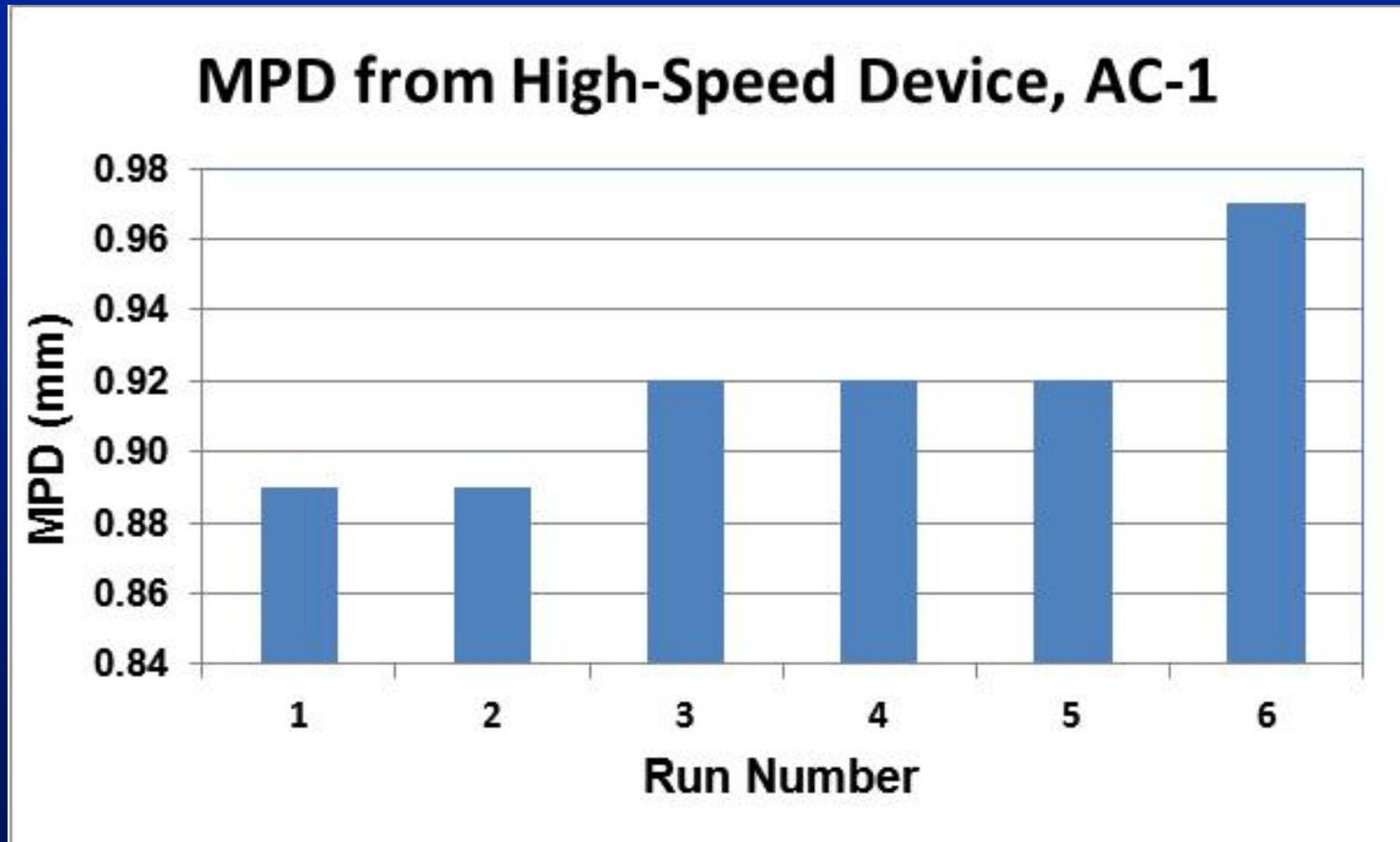
# ***Test Section AC-2, Dense-Graded AC***



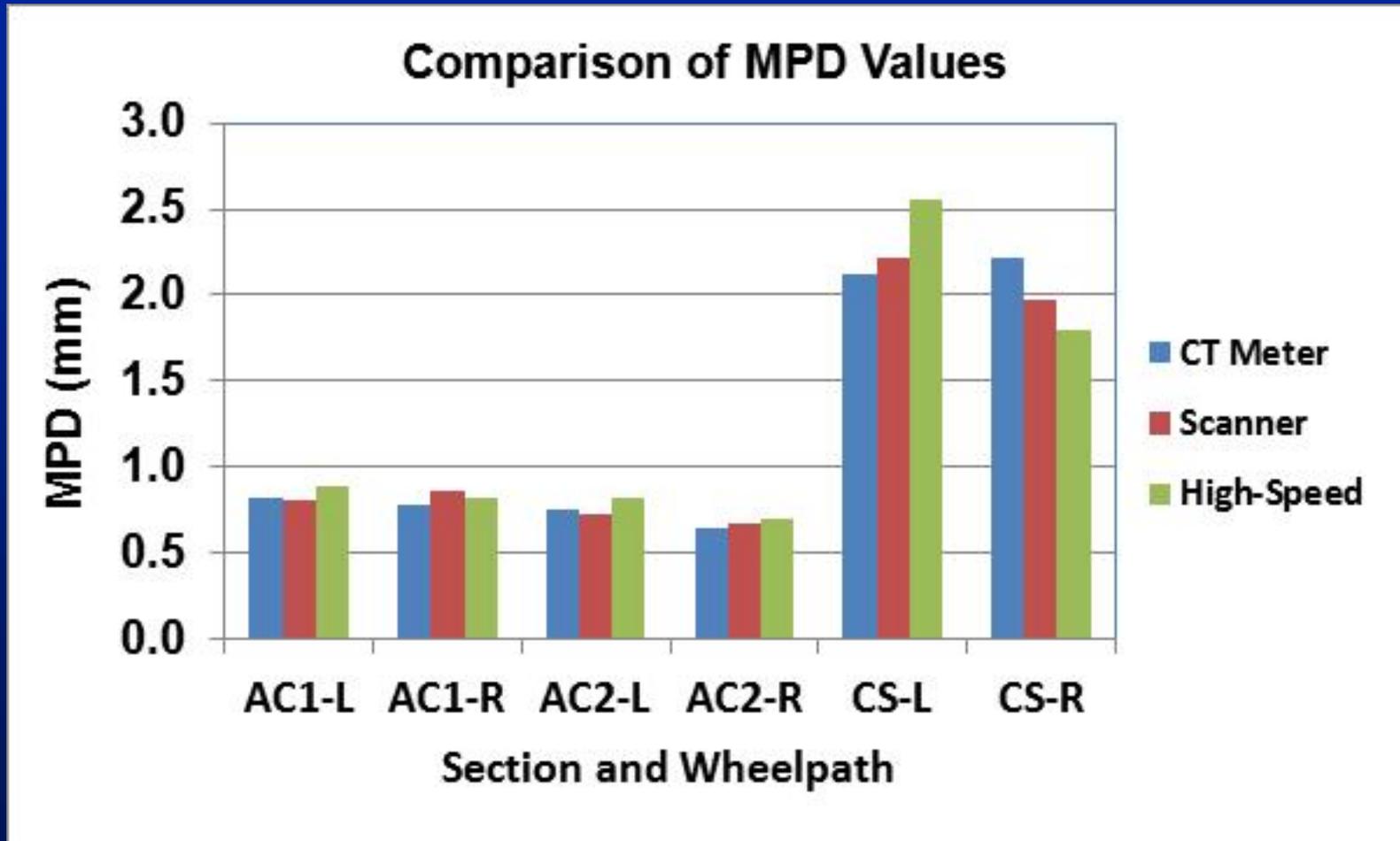
## *Test Section – Chip Seal*



# Repeatability of MPD from High-Speed Device Over 10 m



# Comparison of MPD Values



## **Comparison of MPD Values**

<b>Section/ Wheelpath</b>	<b>MPD (mm)</b>			<b>% Difference in MPD</b>	
	<b>CT Meter</b>	<b>Scanner</b>	<b>High- Speed</b>	<b>High-Speed vs. CT Meter</b>	<b>High-Speed vs. Scanner</b>
<b>AC1-L</b>	<b>0.82</b>	<b>0.81</b>	<b>0.89</b>	<b>8</b>	<b>10</b>
<b>AC1-R</b>	<b>0.78</b>	<b>0.87</b>	<b>0.82</b>	<b>5</b>	<b>-5</b>
<b>AC2-L</b>	<b>0.76</b>	<b>0.72</b>	<b>0.82</b>	<b>8</b>	<b>14</b>
<b>AC2-R</b>	<b>0.65</b>	<b>0.67</b>	<b>0.70</b>	<b>8</b>	<b>4</b>
<b>CS-L</b>	<b>2.12</b>	<b>2.22</b>	<b>2.56</b>	<b>21</b>	<b>15</b>
<b>CS-R</b>	<b>2.21</b>	<b>1.97</b>	<b>1.80</b>	<b>-19</b>	<b>-9</b>

## **Issues**

- **Improved procedures for verifying accuracy of macrotexture data collected by high-speed devices is necessary.**
- **High-frequency laser sensors may be noisy, thereby affecting MPD values.**
- **Single spikes were noted in the macrotexture data. Robust spike detection algorithms are needed.**

## **Issues**

- **ASTM E 1845 specifies a low-pass filter to be applied on the data before computing MPD. Differences on how the low-pass filter is programmed can affect MPD values.**
- **Need for a “standard” program to check MPD computations**
- **Data from high-speed laser is time-based. Lower speeds means more data are collected. Speed may affect MPD.**
- **Outlier detection scheme is needed to avoid cracks affecting MPD values.**