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A Framework for Developing Specifications and Performing Acceptance Testing of an Inertial Profiler

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AASHTO THE VOICE OF TRANSPORTATION

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WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE 1909-2009

VDOT Virginia Department of Transportation

Procedure for Purchasing an Inertial Profiler by an Agency

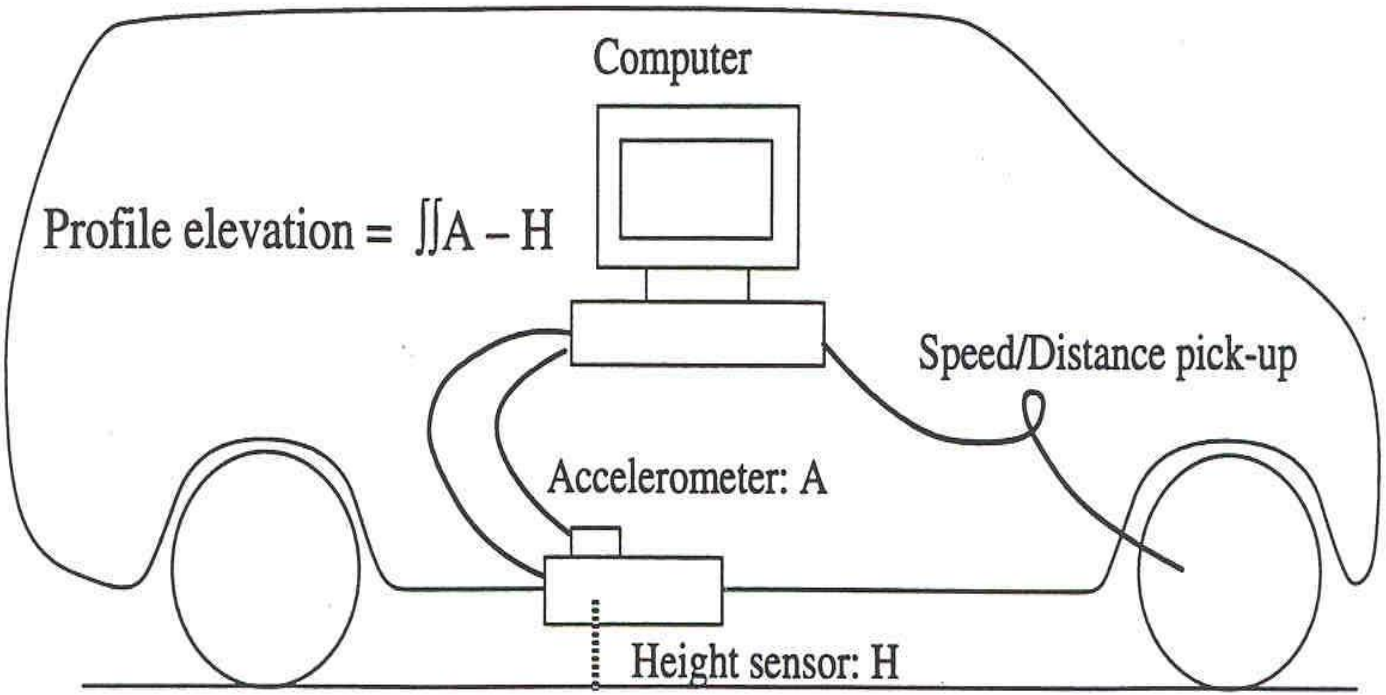
- **The specifications for the profiler are developed.**
- **Bid package developed and advertised.**
- **Typically the lowest bid is awarded the contract.**
- **It is important that specifications cover all details of the equipment to make sure you get what you want.**
- **The bid package must include an acceptance testing plan to check that the equipment can collect repeatable and accurate data before the equipment is accepted.**

SPECIFICATIONS FOR THE EQUIPMENT

HOST VEHICLE AND SAFETY LIGHTING

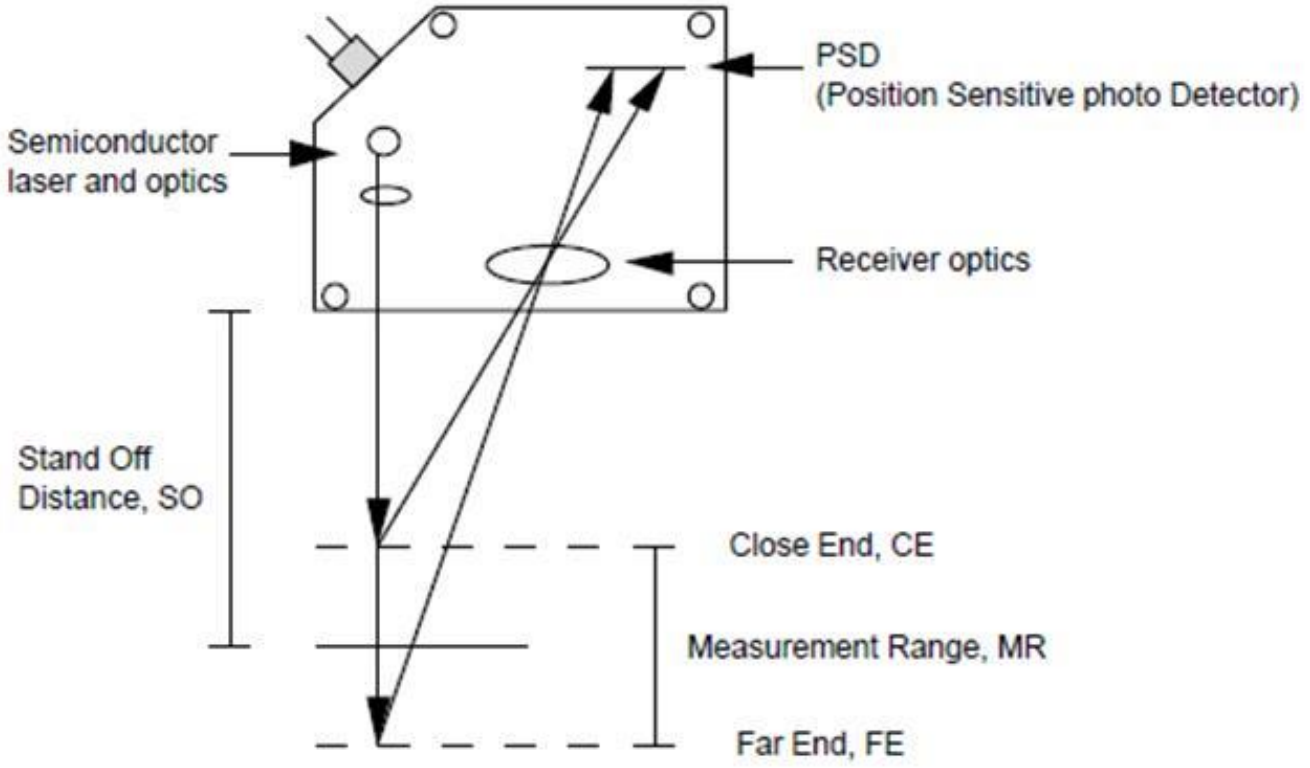
- **Strobe lights in front and rear vehicle lights.**
- **Security system for profiling bar.**

Inertial Profiler



Karamihas, Little Book of Profiling

Height Sensor - Laser



LMI Selcom

Types of Height Sensors

- **Single Point Laser or Line Laser (4 in wide line).**

- One value generated per profile (acts as a single-point)
- 100+ points utilized in bridging function
- Software embedded inside sensor

Height Sensor Type Effect on IRI

Surface Type	IRI (in/mi)	
	Single Point	Line Laser
Dense-Graded Asphalt Concrete	62	61
Stone Matrix Asphalt (SMA)	75	71
Open Graded Friction Course	70	63
Chip Seal	87	80
Concrete - Transverse Tining	72	72
Concrete - Longitudinal Tining	85	54
Concrete - Diamond Ground	108	72

1 m/km = 63 in/mi

Accelerometer

- Range ± 5g (NCHRP Report 434)

Distance Measurement System (DMI)

- DMI should measure distance with an error of less than 0.15 percent (AASHTO M-328).

Autotrigger (Photocell)

Vertical: Triggers off reflective tape placed on the pavement

Horizontal: Triggers off reflective mark on a cone placed on the shoulder

Sensor Spacing

Sensor Spacing = Distance between left and right wheel path sensors

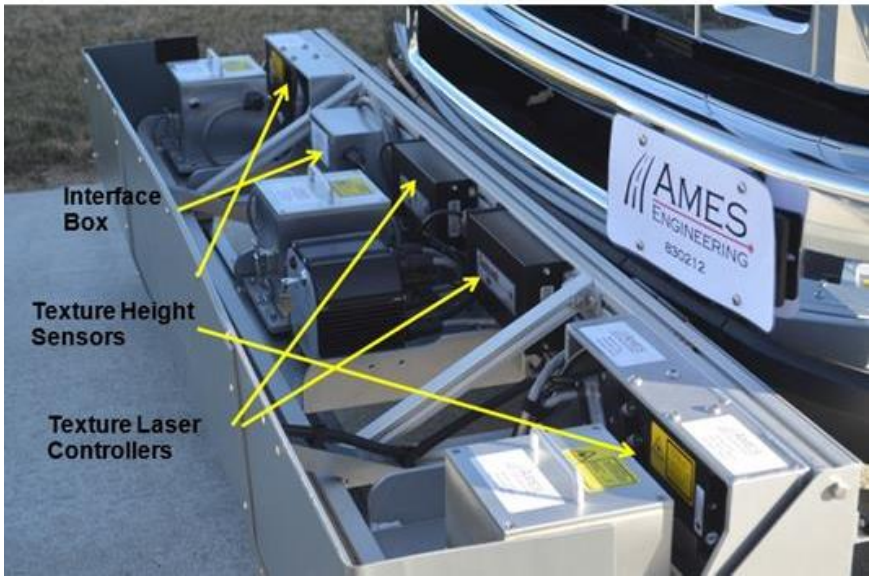
Computer and Peripherals

Calibration Blocks to Check Height Sensors

Block heights (typically 1” (25 mm), 2” (50 mm, 3” (75 mm)

Additional Equipment

GPS



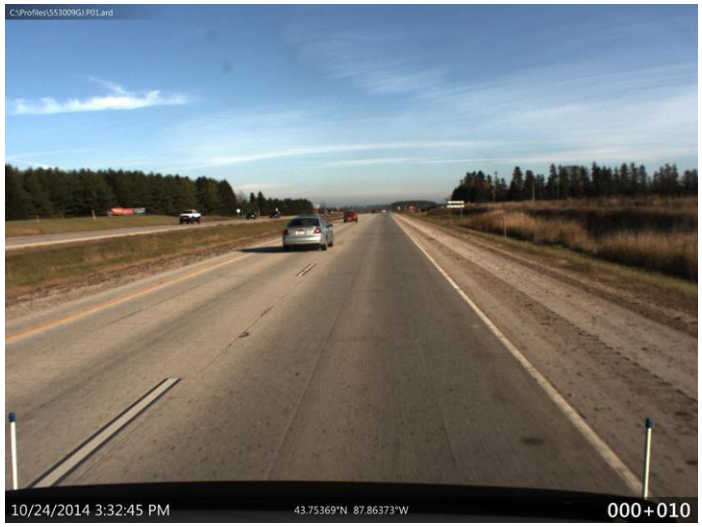
Macrotexture: Texture Sensors

Additional Equipment (Temperature Sensors)

Ambient Temperature

Pavement Surface Temperature

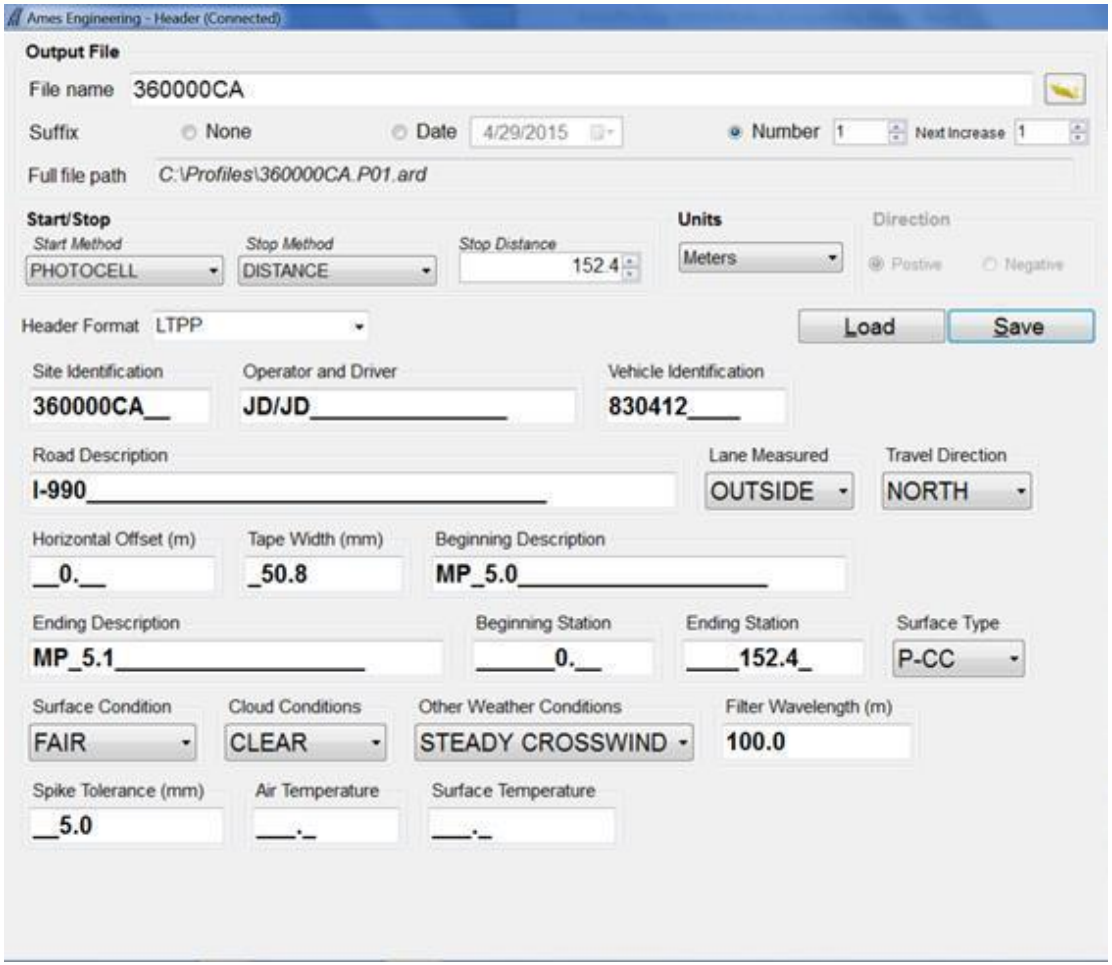
Additional Equipment (Camera)



Data Requirements

- **Profile data recording interval.**
- **Data filtering: Upper wavelength cut-off filter to be applied to the data.**
- **Ability to automatically mark invalid data (i.e., when profiler collects data outside its operating speed range)**
- **Ability to manually add event marks during profiling (i.e., mark features such as start and end of a bridge).**

Input Parameters (Header Information)



Software Requirements

- **Ability to perform calibration check of height sensors with calibration blocks.**
- **Ability to perform a bounce test (checks if accelerometer is cancelling out vehicle motion).**
- **Ability to perform real time quality control checks on the data (e.g., provide a warning if signals from height sensor are not being received).**
- **Ability to compute IRI at user specified intervals (e.g., 0.01 miles, 0.1 miles, 1 mile) and provide reports.**

Reports and Output Files

- **Specify format for reports that are printed.**
- **Specify format for output files to be loaded to a Pavement Management system.**

ACCEPTANCE TESTING OF PROFILERS

Acceptance Testing

- **Static Sensor Check of Laser Sensors: Use calibration blocks (Meet criterion in AASHTO R 57).**
- **Bounce Test (Meet criterion in AASHTO R 57).**
- **Test on Autotrigger: When does sensor record first reading after being triggered?**
- **Check Accuracy of the Distance Measuring System: Error less than 0.15 percent.**

Acceptance Testing

- **Establish test sections to evaluate repeatability and accuracy of data.**
- **Repeatability of IRI values: Look at standard deviation of IRI (must meet a specified criterion).**
- **Repeatability of IRI values: use cross-correlation analysis (meet AASHTO R 56).**

Acceptance Testing

- **Accuracy of IRI Values: Compare IRI values with IRI from a reference device (must meet a specified criterion).**
- **Accuracy of IRI Values: Cross correlate IRI from profiler with IRI from a reference device (meet AASHTO R 56 criterion).**
- **Ability of profiler to collect accurate data within its operating speed: Collect data at different speeds and compare data and IRI.**