PAVEMENT ROUGHNESS AND AUTOMATED DATA COLLECTION

Northeast Pavement Preservation Partnership
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Why Do We Care About Roughness?

- Safety
- Enjoyable ride
- Transport of goods
- Vehicle damage
- Fuel economy
International Roughness Index

- Developed under NCHRP Report 228 and accepted by the World Bank in 1982
- Based on vertical profile in the wheel paths
  - Is independent of vehicle and speed
  - Can be collected by a range of equipment
Profiling Equipment (IRI)

Other Sensor Types
Profile gets converted into a series of waves

- Converted to a Power Spectrum Density (PSD)
- Profile is converted to a large series of sinusoidal waves
  - Frequency
  - Amplitude
  - Offset
Important frequencies / wavelengths

• What frequencies are most important to drivers?
• IRI uses a standard set of values for priority
• Examples frequencies:
  – Rumble strips
  – Speed bump
  – Long hills
• ASTM E 1926
Analysis Tools

- Vehicle Specific Tools
- ProVAL – Free, publicly available software for analyzing roughness
Transverse Profiles & Rutting

- Systems can collect up to 4,000 points across at intervals as small as 0.2 inches (5 mm)
- Typically results are smoothed and reduced to approximately 200 points
- Lots of research with comparisons to field measurements
Rut Calculation

- Rutting is interpreted differently by different people
- Wire vs. Straight Edge Measurements
- Smoothing and removing crack depth
- Many other assumptions to match manual measurements
Automatic Road Analyzer

> TEXTURE (Option 2)
The LCMS sensors calculate full lane width texture measured in 5 AASHTO brands.

> PAVE3D DISTRESS
With the ARAN’s LCMS subsystem, 3D profile data is used for automated detection and full lane width image display.

> PAVE3D RUTTING
The 3D Laser Measurement System uses dual scanning lasers to accurately measure the transverse profile of the road with 4000 points over 4 meters.

> ROUGHNESS
The Laser SDP is a longitudinal profile measurement system that provides road profile data capture and real-time roughness index calculation using a combination of high-speed lasers and accelerometers.

> TEXTURE (Option 1)
Smart Texture utilizes high frequency lasers to measure the mean profile depth of road surface macrotexture.

> POSITIONING – POS LV 220
The POS LV tracks the position and orientation of the ARAN in real-time. This position and orientation solution and combines data from tactical-grade fiber optic gyros and accelerometers, a differential GPS, and a DMI.

> POSITIONING - GPS
Every ARAN is equipped with a GPS and is integrated with other subsystems so that if the receiver cannot lock on enough satellites to determine its position, the ARAN DMI and the ARAN Inertial Reference System will fill in the gaps.

> RIGHT-OF-WAY VIDEO
The ARAN can be outfitted with as many as six HDTV cameras which captures right-of-way images allowing you to virtually view the road from the comfort and safety of your office.

> GROUND PENETRATING RADAR
An electromagnetic device used to detect changes in road structure, including material thickness, changes in material and changes in material condition.

> POSITIONING - DMI
The Distance Measuring Instrument measures ARAN chainage and linear distance travelled. Every ARAN is equipped with a GPS and is integrated with other subsystems so that if the receiver cannot lock on enough satellites to determine its position, the ARAN DMI and the ARAN Inertial Reference System will fill in the gaps.
Analysis Tools
Right of Way Video

- High quality camera systems
  - Full HD image resolution
  - High frame rates and 3CCD sensors
3D Pavement Images
Crack Detection / Rating
iVision
THANK YOU / QUESTIONS?