U.S. Department of Transportation
Federal Highway Administration

RESOURCE CENTER

November 14, 2018

Pavement Distress Measurement Technology

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Outline: Pavement Distress Measurement Technology

- Why Important (Quality) – State and National Pavement Performance Measures
- Past Practices
- Current Practices
- National Activities to Assess Quality

State and National Pavement Performance Measures

- US Government Programs – Performance Based
- Effective May 2017
- Most SHA's have own Pavement Performance Measures

Data Needed for Calculating the National Pavement Measures

Condition Data:

- Roughness (IRI)
- Rutting (asphalt pavements only)
- Cracking
- Faulting (concrete pavements only)
- Can use Present Serviceability Rating (PSR) only where speed limit < 40 mph

Determining Condition for a Section (0.1 mile ~.16km)

Evaluate each of the metrics for the section to determine whether the section is good, fair or poor with respect to:

- Asphalt: IRI, rutting, cracking %
- Jointed Concrete Pavement (JCP): IRI, faulting, cracking %
- Continuously Reinforced Conc. Pvt. (CRCP): IRI, cracking %

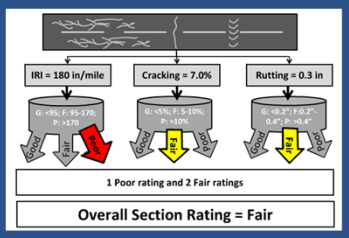
Pavement Condition Thresholds

	Good	Fair	Poor
IRI (inches/mile)	<95	95-170	>170
Rutting (inches)	<0.20	0.20-0.40	>0.40
Faulting (inches)	<0.10	0.10-0.15	>0.15
Cracking (%)	<5	5-20 (asphalt) 5-15 (JCP) 5-10 (CRCP)	>20 (asphalt) >15 (JCP) >10 (CRCP)

Calculation of Pavement Measures

	Pavement Type		
	Asphalt and Jointed Concrete	Continuous Concrete	
Overall Section Condition Rating	3 metric ratings (IRI, cracking and rutting/faulting)	2 metric ratings (IRI and cracking)	Measures
Good	All three metrics rated "Good"	Both metrics rated "Good"	→ percentage of lane-miles in "Good" condition
Poor	≥ 2 metrics rated "Poor"	Both metrics rated "Poor"	→ percentage of lane-miles in "Poor" condition
Fair	All other combinations	All other combinations	

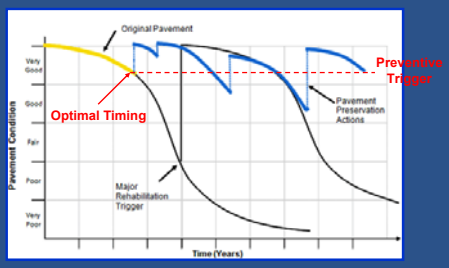
Pavement Metric Rating Example: Asphalt Surfaces, Interstate



WHY?

Pavement Management

Concept of Pavement Preservation (P²)



WHY?

Purposes of Distress Survey – Other Applications

Warranty
Design-Build Operate/Maintain
Preventive Maintenance – onset of cracking
Pavement M-E Design

HOW?

Evolution

Methodology	Fast	Safe	Repeatable
Walking			
Windshield	✓		
Semi-Automated	✓	✓	
Automated	✓	✓	✓

HOW?

Limitations of Historical Approach

- Slow
- Safety Concerns
- Repeatability of Individual Distresses?
- Data stored on paper and entered . . . manually!

HOW?

Current Technology

- High-speed (65 mph) Integrated Data Collection Vehicles
- Widespread adoption of 2D/3D digital pavement imaging
- Capable of capturing fine details; 1-3mm cracking
- Capable of capturing other data elements simultaneously; rutting, roughness, texture, etc.
- Objective, accurate and repeatable

Source: INO

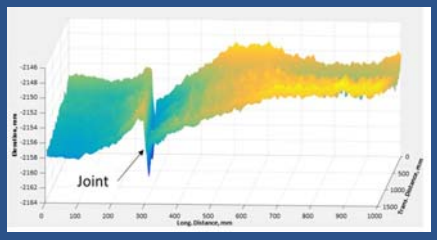
Has it been Proven?

Was Manual Proven?

How much faulting?

Source: APTech

Faulting



Source: GaTech

National Quality Standards - Ride

AASHTO R 43 (Quantifying Roughness of Pavements)
R 56 (Certification of Inertial Profiling Systems)
R 57 (Operating Inertial Profilers and Evaluating Pavement Profiles)
R 54 (Pavement Ride Quality When Measured Using Inertial Profiling Systems)
M 328 (Standard Equipment Specification for Inertial Profiler)

Over 12 years to develop – separate standards for data collection and data analysis

Activities – Transverse Profile (Rutting)

- TPF-5(299)/FHWA contract: "Calibration, Certification, and Verification of Transverse Pavement Profile Measurements", final report 2020
  - Standards exist for longitudinal profile (IRI)
- NCHRP 20-07/Task 411 Review and Update of AASHTO R87, Determining Pavement Deformation Parameters and Cross-Slope from Collected Transverse Profiles, contract expected to be awarded fall 2018 (1 year contract)
  - Improve existing definitions

AMES Engineering transverse profiler

Source: VaTech Vehicle Terrain Performance Laboratory

WHAT'S NEXT?

Comparing rut measurements using portable speed bumps

Source: Washington DOT

Temporary rumble strips used to create an artificially deep rut to be used as a reference point in the LRMS data - Ohio University

Creaform 3D Handheld scanner

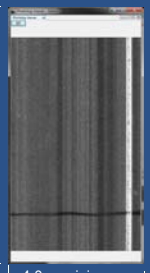
Source: VaTech Vehicle Terrain Performance Laboratory

Activities - Cracking Data Collection and Analysis

- NCHRP 01-60, Measuring the Characteristics of Pavement Surface Images and Developing Standard Practices for Calibration, Certification, and Verification of Imaging Systems, awarded September 2018, contract length 3 ½ years
  - Objective: Develop standards to assess the quality of pavement surface digital images
- NCHRP 01-57A, Standard Definitions for Comparable Pavement Cracking Data, contract completion 2019 - data analysis (AASHTO R 85)
  - Improve existing definitions

Kansas Pavement Condition Data Collection Vehicle (new 2013)

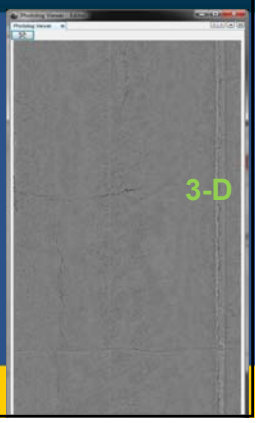
Pavement Images



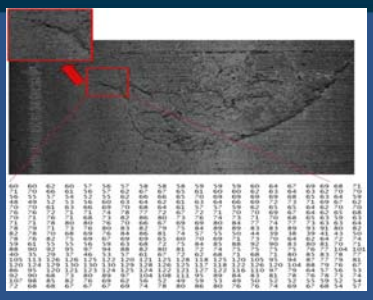
2-D

100 m Max.

4.0 m minimum
4.25 m preferred



3-D



2D image with pixel data matrix source Oklahoma State Univ.

Activities

- Jointed Concrete Pavement Faulting Collection and Analysis Standards, contract awarded September 2018, contract length 3 ½ years
  - Standards exist for longitudinal profile (IRI)
- Guidance for Quality Management of Pavement Surface Condition Data Collection and Analysis, contract award expected winter 2018/19, contract length 3 ½ years
  - Develop Quality Management Plan guidelines for pavement surface condition data collection and analysis

Activities

Development of Standard Data Format for 2-Dimensional and 3-Dimensional (2D/3D) Pavement Image Data that is used to determine Pavement Surface Condition and Profiles – contract complete

- Follow up contract: Evaluation of Proposed Standard Data Format and Compression Algorithms for 2D/3D Pavement Surface Image – final report 2019
  - Separate data collection from analysis
  - Reprocess data when new analysis algorithms are developed
  - Apply analysis algorithms to 2D/3D digital images from different sources
  - Share data efficiently between uses, software tools and electronic platforms

Activities – TPF-5(299)

Objectives: Improve the Quality of Pavement Surface Distress and Transverse Profile Data Collection and Analysis by assembling SHAs, FHWA, and industry representatives to:

- Identify data collection integrity and quality issues
- Identify data analysis needs
- Suggest approaches to addressing identified issues and needs

Based on this information, the SHAs and the FHWA will:

- Initiate and monitor projects intended to address identified issues and needs
- Disseminate results
- Assist in solution deployment

Administration

- FHWA is lead Agency
- Technical Advisory Committee – 21 funding agencies
  - Approval
- Friends – all others
  - Provide input, collaboration, assistance
- Funding commitment – over $2 million
  - Other funds

Questions?

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