Profile Viewer and Analyzer Software

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Presentation Overview

- Introduction
- Purpose
- Fundamentals of Profiles
- Capabilities
- Availability
- Future Enhancements



Introduction

- QA Tool for LTPP profile data
- Recommended for development by ETG
- Developed new rather than adapted





View and analyze pavement profile data
File formats

.erd
.txt
.ppf

Other formats



Fundamentals - Pavement Profilers

Profilers have evolved over the years



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-0.105877	-0.009103	
-0.105854	-0.008147	
-0.106831	-0.008191	
-0.107808	-0.008235	
-0.107785	-0.008279	
-0.107761	-0.008323	
-0.107737	-0.007368	
-0.107713	-0.006412	
-0.107689	-0.006457	

Profile Analysis

In order to use the information in a pavement profile, it must be analyzed first.

ProVAL IRI, RN, PI, etc.

-0.132403	-0.015827	24
-0.134366	-0.017866	ÌŻ
-0.134328	-0.017905	
-0.136290	-0.016945	
-0.136251	-0.016984	
-0.137212	-0.017024	5.4
-0.138173	-0.017063	60
-0.137133	-0.018102	44
-0.137093	-0.018141	
-0.137054	-0.019180	
-0.137014	-0.019218	1
-0.136974	-0.019257	
-0.137934	-0.018295	
-0.140893	-0.017334	17
-0.142851	-0.017373	31
-0.143808	-0.017412	
-0.144764	-0.017452	-4
-0144720	-0.015491	- Se
-0.14 5.11	-0.015531	1.0
-0.14000	0.010001	1.00
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Filtering

 A digital filter is a calculation procedure that transforms a series of numbers (a signal) into a new series of numbers



Filtering

 Electronic filters remove unwanted "noise" and produce a "clean" signal

MAA

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Passenger Discomfort

- Resonance of the abdominal cavity is at about 5 Hz (for vertical acceleration)
- Minimum tolerance for horizontal acceleration is at about 1 Hz



Road Roughness

Many types of road roughness measures are available: – International Roughness Index (IRI) – Ride Number (RN) – Profile Index (PI)



International Roughness Index

IRI is influenced by wavelengths ranging from 4 to 100 ft.





Ride Number

RN is influenced by wavelengths ranging from about 2 to 33 ft.





California Profilograph





Before and After





Add Blanking Band



Different Blanking Band Widths are Used - O. Mains Res



Frequency Response of Profilograph





Profile Analysis

- ASTM E-950
- Cross Correlation
- Power Spectral Density



ASTM E 950

ASTM E 950 defines precision and bias of longitudinal profiles



ASTM E 950

- Requires 10 runs of the same profile
- Profile must be 320 m (1056 ft) sampled at 0.30 m (1 ft) interval
- Total of 1057 elevations



- For road profile applications, correlation coefficient it is used to synchronize repeat measurements
- Most common difference is variations in start location on repeat profiles







- Cross correlation analysis determines the optimum horizontal offset to maximize agreement between the two profiles
- A plot of horizontal offset vs correlation coefficient is obtained by calculating the coefficient for each possible offset (each step in the data) within a reasonable range



The maximum correlation coefficient achieved is 0.9, by offsetting the blue profile +4.5 feet







- A PSD is a set of wavelengths, amplitudes, and phases that describe the individual sinusoids that make up the profile
- For pavements, the PSD highlights predominant wavelengths in the road profile























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Slope PSD - Log Y Scale



Slope PSD - Normal Y Scale



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Availability

Profile Viewer (ProVal)1.0 currently available

Contact:

– Resource Center Pavement Engineer
– LTPP Products Engineer



Future Development/Enhancements

- Profile Viewer (ProVal) 2.0 under development soon
- Enhancements:
 - continuously reported ride statistics
 - HHT
 - Band-pass filtered analysis
 - localized roughness ID techniques
 - grinding simulations



QUESTIONS?

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