

0-7107: Determine the Feasibility and Methodologies of Using Structural Data from the Traffic Speed Deflectometer in Network- and Project-Level Treatment Decision Making

Background

Incorporating pavement structural and functional conditions into a pavement management system leads to more successful and cost-effective pavement rehabilitation and preservation decisions. Current practices using falling weight deflectometers (FWDs) are not suitable for network-level data collection. Traffic speed deflectometers (TSDs) can report pavement response and condition data at highway speeds and are undergoing trial implementation in Texas and throughout the country.

The goals of this project were to analyze and validate TSD data for use at the project and network levels, and to provide recommendations on ways to incorporate TSD data into existing Texas Department of Transportation (TxDOT) pavement management systems. Researchers proposed procedures that use TSD structural data to enhance network- and project-level decisions.

What the Researchers Did

Researchers performed a literature review regarding TSD data methodology, validation, and processing. They polled TxDOT districts on how TSD data collected in each district were being used at the project and network levels. Researchers coordinated with TxDOT to organize TSD data collection within the Bryan District that included nine pavement test sections. The TSD calculated deflection indices

along the test sections were compared to FWD deflection data. Lastly, researchers compared the pavement structural condition and remaining life estimated from FWD and TSD data.

What They Found

The literature review indicated that the TSD maximum deflection recorded beneath the load center was a good indicator of pavement structural condition and could be compared to the corresponding maximum deflection measured by FWDs. The TxDOT survey results revealed that in most instances, TSD data were used to validate pavement management decisions rather than make them.

The TSD data collected in the Bryan District had poor returns on rigid pavement compared to flexible pavement. The TSD deflection data collected on the test sections showed the same trends as FWD data, and the correlation between corresponding TSD and FWD sensors was strong (**Figure 1**). The correlation was strongest between sensors directly beneath and near the load center, but the correlation weakened as the sensor distance from the load center increased.

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R^2 Values		TSD Sensor (Location, Inches)								
		W1 (0)	W2 (8)	W3 (12)	W4 (18)	W5 (24)	W6 (36)	W7 (48)	W8 (60)	W9 (72)
FWD Sensor (Location, Inches)	W1 (0)	0.80	0.72	0.62	0.43	0.28	0.11	0.02	0.00	0.00
	W2 (12)	0.75	0.74	0.67	0.52	0.36	0.17	0.05	0.01	0.00
	W3 (24)	0.56	0.66	0.71	0.69	0.61	0.43	0.26	0.16	0.09
	W4 (36)	0.32	0.47	0.56	0.65	0.66	0.56	0.43	0.33	0.23
	W5 (48)	0.21	0.34	0.45	0.57	0.62	0.60	0.51	0.43	0.33
	W6 (60)	0.16	0.28	0.38	0.51	0.57	0.57	0.52	0.45	0.37
	W7 (72)	0.17	0.29	0.38	0.50	0.57	0.58	0.53	0.46	0.39

Figure 1. TSD-FWD Sensor Correlation Matrix.

TSD and FWD data were used to generate pavement remaining life estimates until failure by cracking and rutting. The crack remaining life estimated by the TSD agreed with the FWD results. However, the TSD generally overestimated the pavement rut remaining life compared to the FWD.

The deflection comparison results demonstrated that the raw deflection indices calculated from TSD data can be used to accurately determine pavement structural condition. More testing is required to generate accurate remaining life estimates from TSDs.

What This Means

TSDs provide a comprehensive assessment of pavement structural condition that is more suited to network-level analysis than FWDs do. The results of this project show that the TSD

deflection indices match well with FWD data. Therefore, researchers suggest that future TSD data collection focus on flexible pavements to maximize data returns. Researchers recommend that all collected TSD data be categorized in accordance with **Table 1** to determine appropriate TxDOT pavement rehabilitation levels.

Table 1. Rehabilitation Levels from TSD Data.

Pavement Condition as Reported by TSD	Rehabilitation Level
Good surface and good structural condition	Preventative maintenance or light rehabilitation
Poor surface and good structural condition	Light rehabilitation
Good surface and poor structural condition	Medium to heavy rehabilitation
Poor surface and poor structural condition	Medium to heavy rehabilitation

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