Transportation Performance Management for Pavements

Federal Highway Administration (FHWA)

May 22, 2023

U.S. Department of Transportation
Federal Highway Administration

TPM
HOW WE GET THERE

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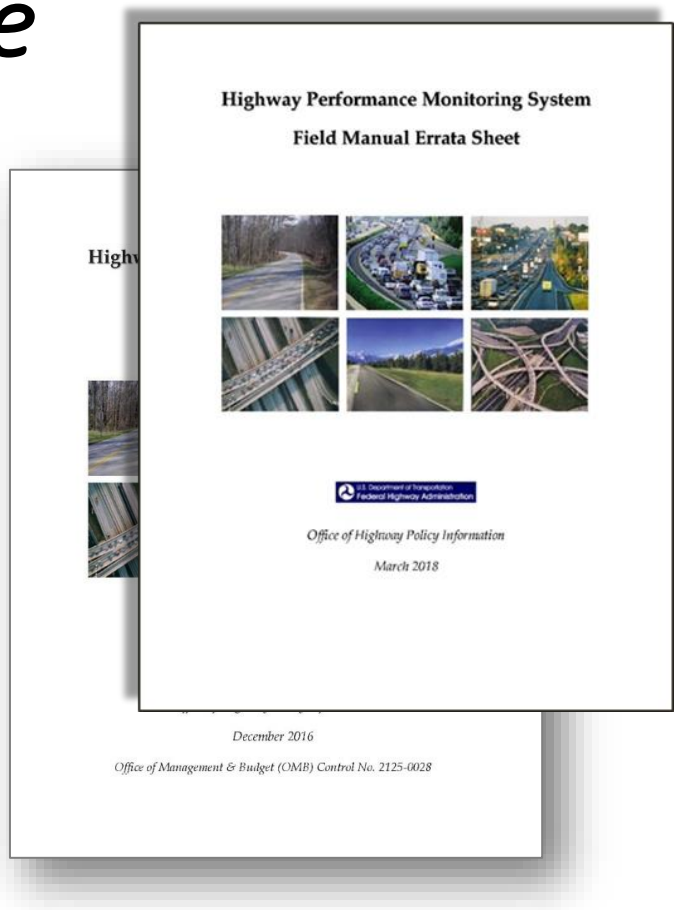
Key Acronyms

- **AC:** Asphalt-Concrete
- **JCP:** Jointed Concrete Pavement
- **CRCP:** Continuously Reinforced Concrete Pavement
- **HPMS:** Highway Performance Monitoring System
- **IRI:** International Roughness Index
- **LRS:** Linear Referencing System
- **NHS:** National Highway System
- **PRC:** HPMS Pavement Data Report Card (**P**avement **R**eport **C**ard)
- **PSR:** Present Serviceability Rating
- **TPM:** Transportation Performance Management

Pavement Performance

Depends on:

- Timely HPMS reporting
- Complete data
- Quality data



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Pavement Data Quality Considerations
TPF-5(299)

Table 6. Summary of data quality aspects adapted from Rodriguez (2017) relative to pavement condition data.

Data Quality Aspect	Relative Statement	Considerations
Accessibility	DOTs can easily locate and access the data.	Few DOTs give details on reporting, database, and record-keeping processes. DOTs should provide information on achieving data accessibility and provide successful case studies for good data storage and record keeping.
Consistency	The data are integrated and coordinated, if different vendors or equipment are used the information does not change.	Data consistency has proven challenging with the transition from manual data collection to high-speed data collection and the ability to collect more data than ever before. Lack of standard definitions for distresses creates challenges for data consistency. Changes in data collection vendors can cause consistency challenges. Limited existing standards may have been established for manual data collection and do not always translate to high-speed data collection equipment. The on-going TPF research should aid in data consistency as standard definitions for distresses and processes for certification, verification, and vendor selection are established.
Relevance	The data are relevant, clear, and concise, and it is processed.	DOTs have unique data requirements specific to their decision-making processes. Many vendors adjust their algorithms to provide unique definitions for each DOT. The on-going TPF research may result in standardized definitions for distress data, but it may take time for DOTs to implement them. In the meantime, DOTs should have processes to verify that the data they are receiving is relevant to their definitions and decision-making processes.
Completeness	The data that is used perform the job and make decisions is available.	Data completeness is often checked during database checks during acceptance. Some DOTs do not indicate processes for how data is checked for completeness. Successful practices for checking data completeness should be included.
Accuracy and Precision	The data received are accurate and precise.	DOTs have requested example procedures for establishing ground reference data so that data can be checked for accuracy. Many DOTs have processes for checking precision, and successful practices should be provided. Several of the on-going TPF research studies include options for accuracy and precision statements. These should be referenced as appropriate. Statistical processes for checking data accuracy and precision at appropriate sample sizes should be included.
Believability	DOTs can trust the data received.	Transparency of data collection processes and documentation, review, and record-keeping of QC activities increase data believability. Having established databases so that data can be checked year to year is also useful as there are some expectations for reasonable changes in pavement condition. Successful practices for QC and acceptance procedures and checking data year to year should be provided.
Timely for Use	The data are received on time.	Having the pavement condition data available for decision-making processes is important for DOTs. Only a few DOTs indicate schedule statements in the QMP. Successful practices of scheduling processes and having complete accepted data before decision-making processes should be included.

Note: This pavement data quality considerations matrix is referenced from the TPF-5(299) final report.

Pavement Measures Calculation (23 CFR 490.313)

	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 Condition Thresholds (23 CFR 490.313)

	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)

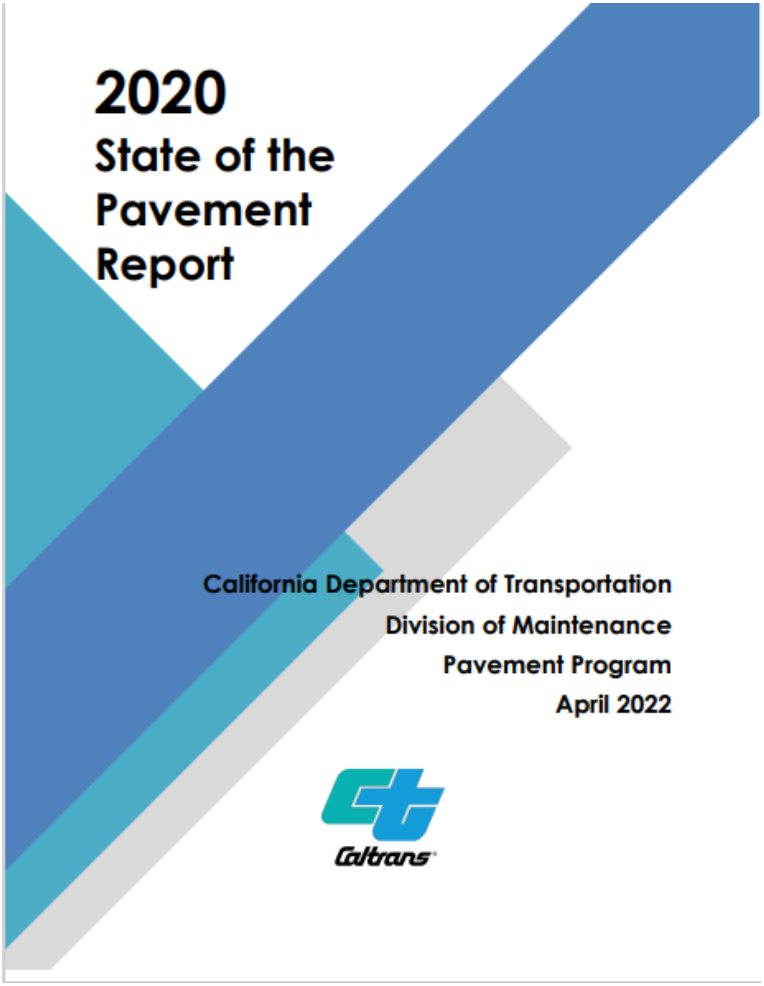

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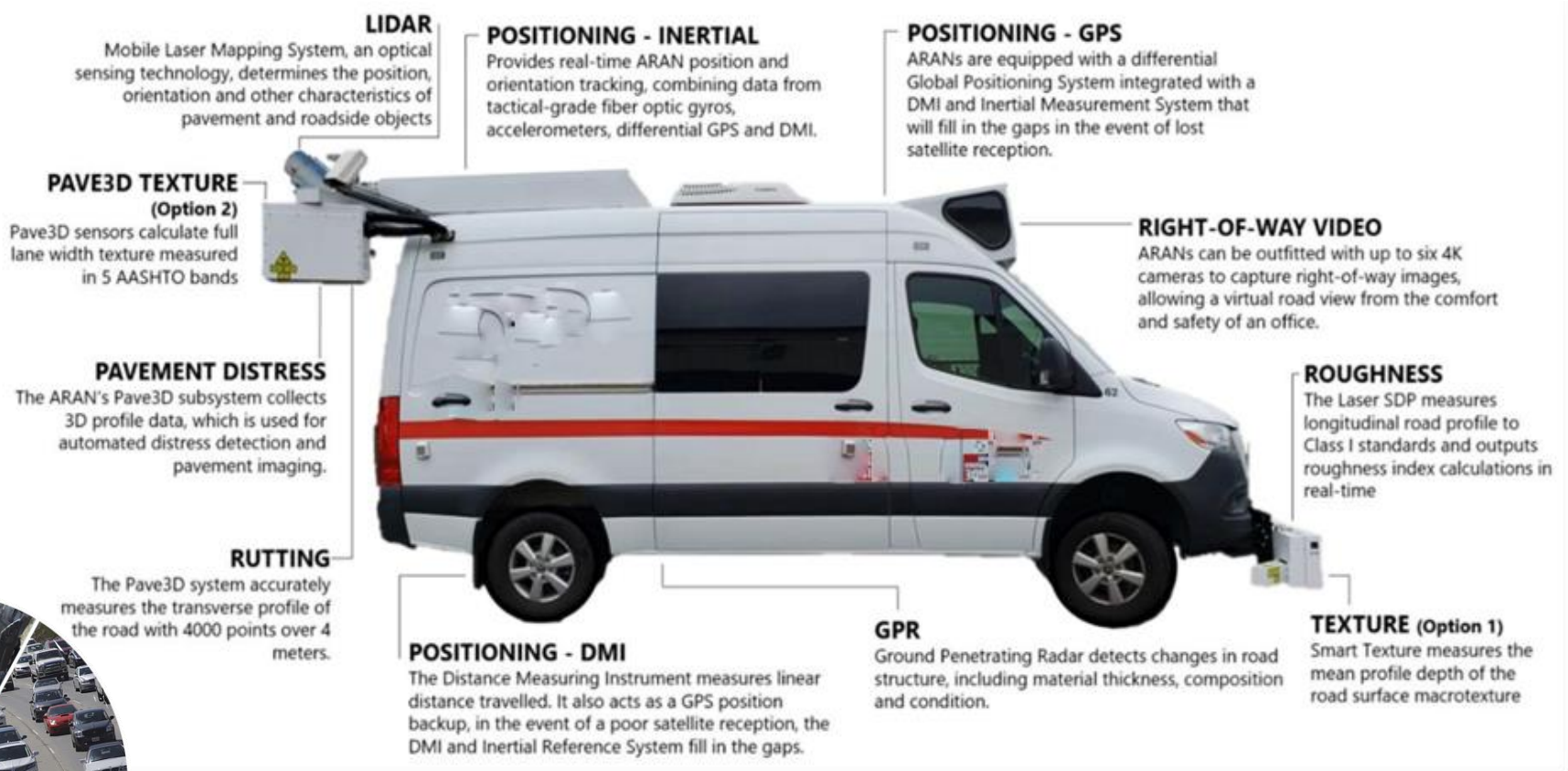
TABLE 8. FEDERAL PAVEMENT CONDITION & PERFORMANCE METRICS & MEASURE CRITERIA

Condition Metrics	Good	Fair	Poor
I.R.I. (inches per mile)	Less than 95	Between 95 to 170	Greater than 170
Cracking (percentage) for Asphalt Pavement	Less than 5	Between 5 to 20	Greater than 20
Cracking (percentage) for J.P.C.P.	Less than 5	Between 5 to 15	Greater than 15
Cracking (percentage) for C.R.C.P.	Less than 5	Between 5 to 10	Greater than 10
Rutting (inch) for Asphalt Pavement	Less than 0.2	Between 0.2 to 0.4	Greater than 0.4
Faulting (inch) for J.P.C.P.	Less than 0.10	Between 0.10 to 0.15	Greater than 0.15

Note: This graphic is edited Table 8 from the 2020 Caltrans State of the Pavement Report, dated April 2022

APCS – Automated Pavement Condition Survey



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Improve Pavement Quality Across California

https://catc.ca.gov/programs/sb1#General%20Overview

Present Serviceability Rating (PSR)

PSR	Description [Table 1. PSR description.[1,3]]
4.0 – 5.0	Only new (or nearly new) superior pavements are likely to be smooth and distress free enough (sufficiently free of cracks and patches) to qualify for this category. Most pavements constructed or resurfaced during the data year would normally be rated in this category.
3.0 – 4.0	Pavements in this category, although not quite as smooth as those described above, give a first-class ride and exhibit few, if any, visible signs of surface deterioration. Flexible pavements may be beginning to show evidence of rutting and fine random cracks. Rigid pavements may be beginning to show evidence of slight surface deterioration, such as minor cracks and spalling.
2.0 – 3.0	The riding qualities of pavements in this category are noticeably inferior to those of new pavements and may be barely tolerable for high-speed traffic. Surface defects of flexible pavements may include rutting, map cracking, and extensive patching. Rigid pavements in this group may have a few joint failures, faulting and/or cracking, and some pumping.
1.0 – 2.0	Pavements in this category have deteriorated to such an extent that they affect the speed of free-flow traffic. Flexible pavement may have large potholes and deep cracks. Distress includes raveling, cracking, and rutting and occurs over 50 percent of the surface. Rigid pavement distress includes joint spalling, patching, cracking, and scaling and may include pumping and faulting.
0.1 – 1.0	Pavements in this category are in an extremely deteriorated condition. The facility is passable only at reduced speeds and with considerable ride discomfort. Large potholes and deep cracks exist. Distress occurs over 75 percent or more of the surface.

Note: This rating system is described in 23 CFR 490.309(b)(1)(iv)(A), 490.309(b)(2)(iii)(A) and presented in HPMS (2016), "Chapter 4. Data Requirements and Specifications," table 4.4.

Present Serviceability Rating (PSR)

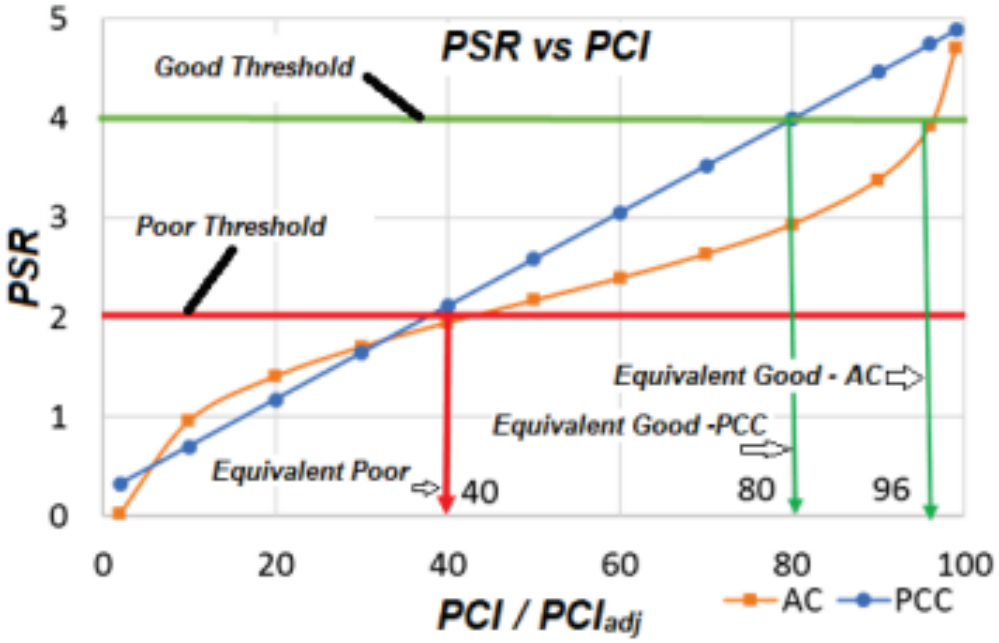
PSR	Overall Pavement Condition Rating [Table 2. Using PSR Metrics]
≥4.0	Good
>2.0 and <4.0	Fair
≤2.0	Poor

Note: This rating system is described in 23 CFR 490.309(b)(1)(iv)(A), 490.309(b)(2)(iii)(A) and presented in OMB (2016), "Chapter 4. Data Requirements and Specifications," table 4.4.

Surface Type	IRI (in/mi)	Rutting (Inches)	Cracking (Percent)	Faulting (Inches)	Rating
Asphalt Concrete Pavement	<95	<0.2	<5	N/A	Good
	95 – 170	0.2 – 0.4	5 – 20		Fair
	>170	>0.4	>20		Poor
Surface Type					
Jointed Concrete Pavement	<95	N/A	<5	0.1	Good
	95 – 170		5 – 15	0.1 – 0.15	Fair
	>170		>15	>0.15	Poor
Surface Type					
Continuously Reinforced Concrete Pavement (CRCP)	<95	N/A	<5	N/A	Good
	90 – 170		5 – 10		Fair
	>170		>10		Poor

Note: This information is from 23 CFR 490.313(b)(1) through 490.313(b)(3).

Present Serviceability Rating (PSR) vs. Pavement Condition Index (PCI)



Source: FHWA.

Figure 1. Illustration. Caltrans PCI2PSR relationship for AC and PCC pavements.

Note: This information is from the *Present Serviceability Rating Computation from Reported Distresses Report*: FHWA-HRT-21-041

Questions?

Image: Pixabay

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Thank you!

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