TRANSPORTATION POOLED FUND PROGRAM

U.S.Department of Transportation
Federal Highway Administration

FHWA/TPF-5(299)
Guidance for Quality Management of Pavement Surface Condition Data Collection and Analysis

By

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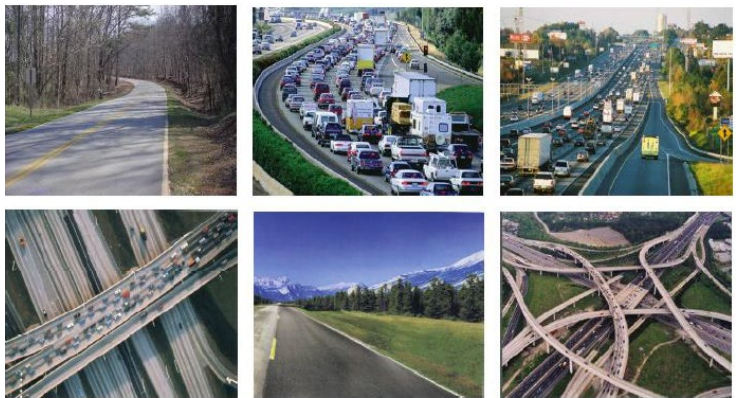
The Transtec Group



THE TRANSTEC GROUP

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Guidance for Quality Management of Pavement Surface Condition Data Collection and Analysis

- 42 Months: 3/2019 to 8/2022
- FHWA COR: Andy Mergenmeier
- Project Team: Transtec Group + Wood
- To produce Practical Guide for QMP

U.S.Department of Transportation
Federal Highway Administration

TPF TRANSPORTATION POOLED FUND PROGRAM

Anticipated Benefits

- Improve current QM plan and Quality Management Plan (QMP) guidelines by establishing standards that can be used by State and Local Transportation Agencies to develop their QMP;
- Improve the accuracy, precision, and reliability of pavement surface condition data; and
- Improve the cost-effectiveness of pavement surface condition data collection and analysis processes.

To Meet State DOTs' Needs on QMP!

How can We Get There?

1. Develop a clear understanding of the current state-of-the-practice for QMPs and SHA's challenges for developing and maintaining data QMPs.
2. Develop a living document of guidelines that combines the best information available and recommendations for needed future improvements.
3. Conduct pilot study to test the proposed QMP guidelines and to revise those guidelines as needed.

Work Plan

Literature Reviews

Draft QMP Guidelines
Pilot Project Work Plan

Conduct Pilot Project

Final QMP Guidelines

QMP 101

- Quality Management Plan
- FHWA Notice of Proposed Rulemaking (NPRM) 2017
- Ensure **acceptable quality data** and **enhanced consistency** through documenting and formalizing the QC and quality assurance (QA) processes and methods already implemented by the agencies
- Provide more **reliable estimates for the performance measures** used to support and monitor strategies towards achieving the performance targets established in asset management plans for the NHS.

QMP Structure

- Data collection equipment
  - including procedures for calibration, certification or validation, verification and daily quality checks;
- Personnel involved in data collection
  - including procedures for training, validation, and verification; and
- Collected data
  - including procedures for periodic review during data collection and final review after data collection.

5 QMP Components

1. Data collection equipment calibration and certification,
2. Certification process for persons performing manual data collection,
3. Data quality control measures to be conducted before data collection begins and periodically during the data collection program,
4. Data sampling, review and checking processes, and
5. Error resolution procedures and data acceptance criteria.

5 QMP Components

RPUG 2018
QMP Workshop Survey

1. Data collection equipment calibration and certification,
2. Certification process for persons performing manual data collection,
3. Data quality control measures to be conducted before data collection begins and periodically during the data collection program,
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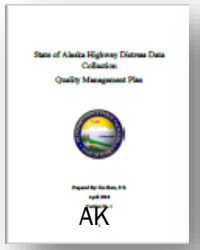
5. Error resolution procedures and data acceptance criteria.

State DOT QMP Reviews



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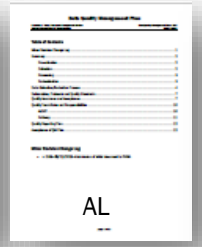
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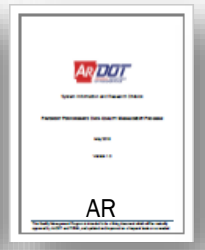

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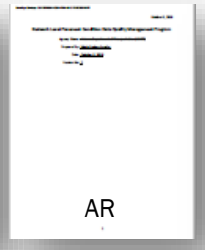
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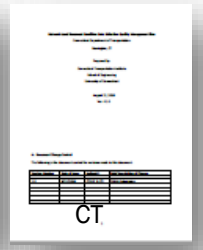
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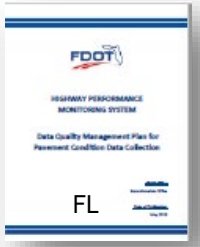

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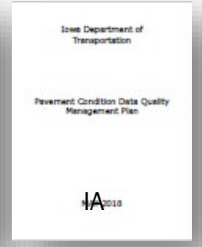

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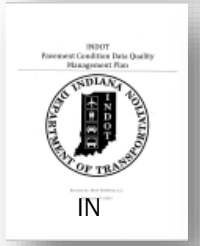

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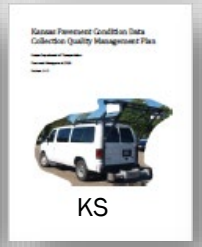

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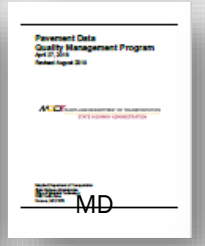

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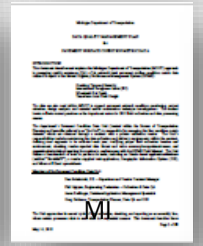
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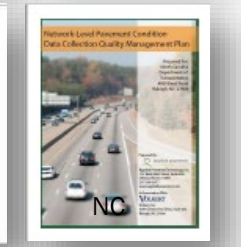

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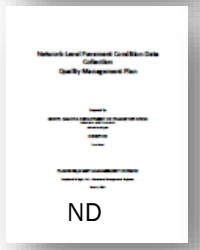
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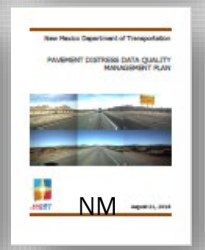

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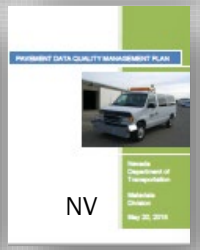

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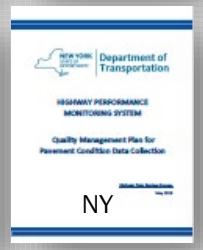

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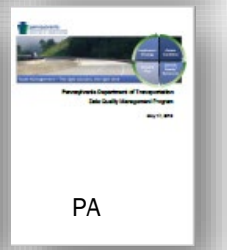
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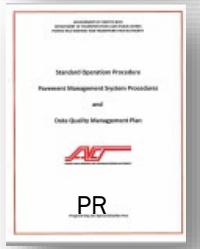

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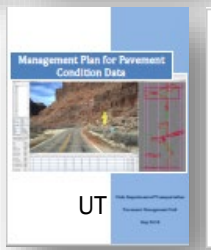

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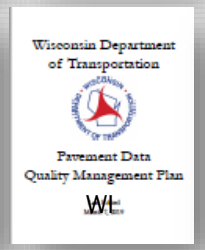

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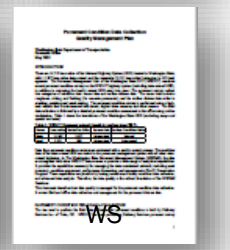
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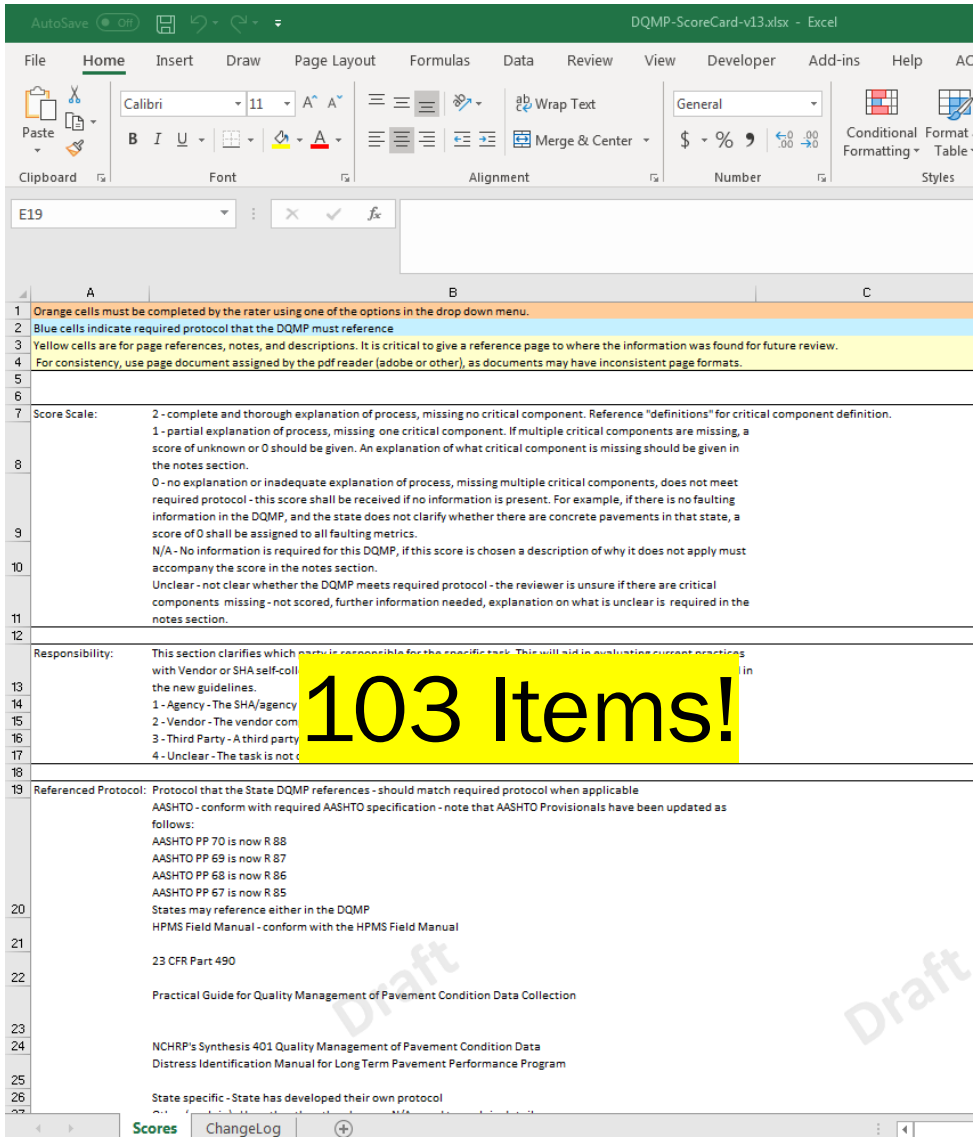
QMP Review Cards



103 Items!

Why QMP Review Cards

- Objective review – independent of reviewer
- Efficient review –efficiently in defining what is required
- Allow for direct comparison – in spite of different QMP formats, layout, etc.
- Transparent reviewing
  - Tool for “QC” of review or to quickly find more information for literature
  - Tool to give back to SHA for revisions and track improvements/outstanding issues

Categories of QMP Review Cards

1. Data Collection Equipment Calibration and Certification:
2. Certification Process for Persons Performing Manual Data Collection:
3. Data Quality Control Measures to be Conducted Before Data Collection Begins and Periodically During the Data Collection Program:
4. Data Sampling, Review, and Checking Processes:
5. Error Resolution Procedures and Data Acceptance Criteria:

Part of Category 1

1. Data Collection Equipment Calibration and Certification

PM2 Rule Pavement Condition Metrics Testing Protocols

DQMP should include a description of how the State DOT is collecting the pavement condition metrics to be reported in HPMS - if required protocol is not met the state should re

Metric	Does DQMP include the following regarding data collection and computation?	Required Protocol
IRI	IRI collection device in accordance with:	AASHTO M328-14
IRI	Collection of IRI data in accordance with:	AASHTO R57-14
IRI	Quantification of IRI data in accordance with:	AASHTO R43-13 MRI reported
Cracking	For asphalt: collection of pavement surface images in accordance with:	AASHTO PP68-14/R86 with modifications specified in the HPMS Field Manual
Cracking	For asphalt: quantification of cracking in accordance with:	AASHTO R55-10 with modifications specified in the HPMS Field Manual OR AASHTO PP67-14/R85 with modifications specified in the HPMS Field Manual
Cracking	For jointed concrete pavements: quantification of cracking in accordance with:	HMPS Field Manual
Cracking	For continuously reinforced concrete pavements: quantification of cracking in accordance with:	HMPS Field Manual
Cracking	For all pavements: Computation of cracking percent in accordance with:	HMPS Field Manual
Rutting	Collection and quantification of rut depth values conforming to:	AASHTO R48-10 with modifications specified in HPMS Field Manual
	OR (only one method is required to meet the PM2 rule - a score of N/A should be used for one of the methods)	
Rutting	Collection of transverse pavement profiles in accordance with:	AASHTO PP70-14/R88 with modifications specified in HPMS Field Manual
Rutting	Quantification of rut depth values in accordance with:	AASHTO PP69-14/R87 with modifications specified in HPMS Field Manual

Calibration — Does DQMP include the following regarding equipment calibration?

The DQMP should describe how each piece of equipment and its subsystems (DMI, GPS, Video, etc.) will be tested and calibrated. Control sites with known values are typically us
Calibrations involving equipment adjustments are typically performed by the equipment manufacturer. QC processes should include verification of original calibration throughc

Metric	Does DQMP include the following regarding equipment calibration?	Required Protocol
IRI	Calibration of inertial profiling system in accordance with:	AASHTO R57-14
IRI	Complete explanation of calibration of data collection equipment subsystems - fill out matrix for subsystems -->	
Cracking	Complete explanation of calibration of data collection equipment subsystems - fill out matrix for subsystems -->	
Rutting	Complete explanation of calibration of data collection equipment subsystems - fill out matrix for subsystems -->	
Faulting	Complete explanation of calibration of data collection equipment subsystems - fill out matrix for subsystems -->	
All	Responsible person assigned to calibration procedure and providing State DOT with certificate or proof of calibration	
All	Identifies frequency of routine calibration	
All	Identifies number, length, type of pavement(s), and range of condition values of control sites	
All	Identifies the equipment and ground reference used for calibration/certification.	
All	State DOT reviews, approves, and keeps record of calibration documentation	

Certification — Does DQMP include the following regarding equipment certification?

Other Key Feature - Responsibility

Clarify which party is responsible for the specific task. This will aid in evaluating current practices with Vendor or SHA self-collection and data quality control, acceptance, and assurance

1 - Agency - The SHA/agency completes the task

2 - Vendor - The vendor completes the task

3 - Third Party - A third party completes the task

4 - Unclear - The task is not clearly assigned

Other Key Feature – Matrix of Subsystems

- Consider different possible subsystems for data collection equipment and required calibrations.

Equipment Subsystem Calibration

The following matrix shows the different possible subsystems for data collection equipment and required calibrations. An overall score of 2 shall be applied if the DQMP references calibrations for all required subsystems for the metric. An overall score of 1 shall be applied if only one subsystem calibration receives a score of "No" for the metric. An overall score of 0 shall be applied if more than 1 subsystem calibration receives a score of "No" for the metric. An overall score of "unclear" may be applied if all subsystems receive "yes" or "unclear", with up to one "No" for the metric. An overall score of N/A may be applicable for faulting if the DQMP states there are no PCC pavements.

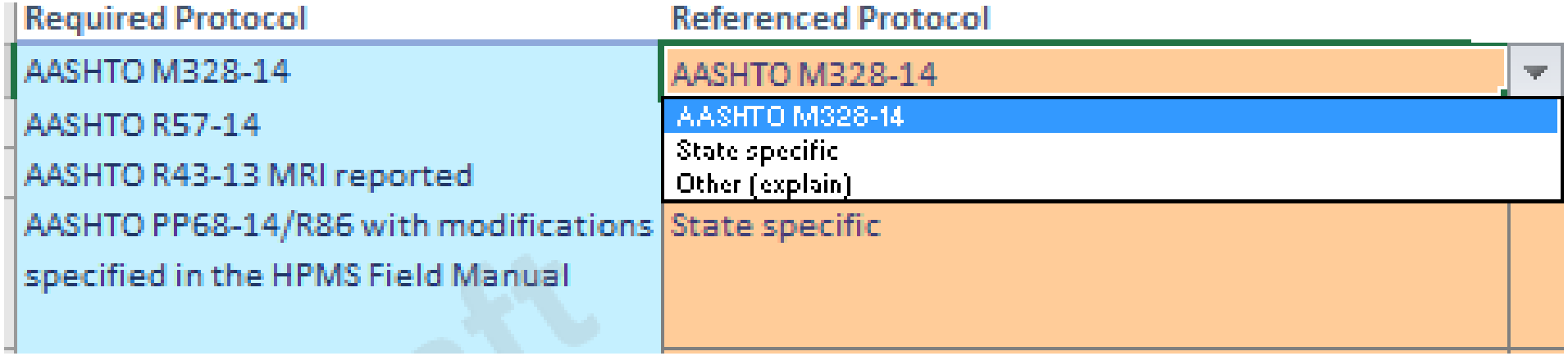
Subsystem:	IRI	Cracking	Rutting	Faulting
Inertial Profiler				
Height Sensor				
Accelerometer				
3D camera/sensor				
Calibration of distance measurements (range checks)				
Calibration image (optical checks)				
DMI				
GPS				
2D camera/sensor				
Calibration image (optical checks)				
Other (e.g., rut bar)				
Overall score (copied to main scorecard automatically)				

Referenced Protocol

- AASHTO Specs
- HPMS Field Manual
- 23 CFR Part 490
- Practical Guide for Quality Management of Pavement Condition Data Collection
- NCHRP's Synthesis 401 Quality Management of Pavement Condition Data
- Distress Identification Manual for Long Term Pavement Performance Program
- State-Specific
- Others (Explain)

Usage of QMP Review Cards

Orange cells must be completed by the rater using one of the options in the drop down menu.
Blue cells indicate required protocol that the DQMP must reference
Yellow cells are for page references, notes, and descriptions. It is critical to give a reference page to where the information was found for future review.
For consistency, use page document assigned by the pdf reader (adobe or other), as documents may have inconsistent page formats.



Potential Usage of QMP Reviews

- Show areas that FHWA can provide support/training to improve QMP.
- Shared during Peer Exchanges to obtain further feedback from SHAs and to identify common issues/opportunities and potential resolutions.

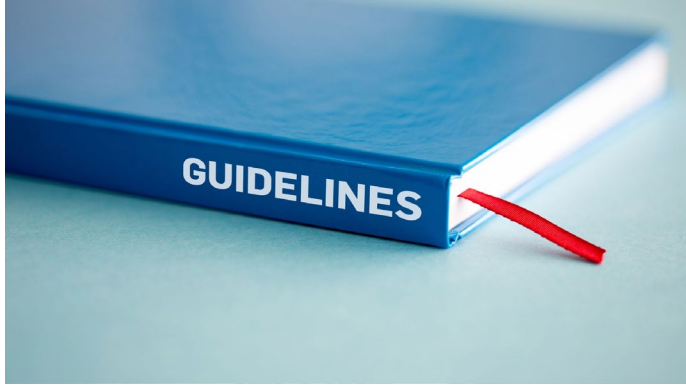
Review Relevant Projects

- TPF-5(299)/FHWA: Development of Standard Data Format for 2-Dimensional and 3-Dimensional (2D/3D) Pavement Image Data used to determine Pavement Surface Condition and Profiles,
- TPF-5(299)/FHWA: Following Contract for Independent Evaluation of Standard Data Format for 2-Dimensional and 3-Dimensional (2D/3D) Pavement Image Data used to determine Pavement Surface Condition and Profiles,
- TPF-5(299)/FHWA: Developing Guidelines for Cracking Assessment for Use in Vendor Selection Process for Pavement Crack Data Collection/Analysis Systems and/or Services,
- NCHRP 01-57A: Standard Definitions for Comparable Pavement Cracking Data (AASHTO R 85),
- NCHRP Project 20-05/Topic 49-15 Synthesis: Automated Pavement Condition

Review Relevant Projects (cont'd)

- NCHRP 20-07/Task 411: Determine Pavement Deformation Parameters and Cross Slope from Collected Transverse Profiles (Reviewing and Updating AASHTO R87)
- TPF-5(299)/FHWA Calibration, Certification, and Verification of Transverse Pavement Profile Measurements,
- NCHRP 01-60 Measuring the Characteristics of Pavement Surface Images and Developing Standard Practices for Calibration, Certification, and Verification of Imaging Systems,
- TPF-5(299)/FHWA Joint Concrete Pavement Faulting Collection and Analysis Standards (AASHTO R36)

Draft QMP Guidelines



- A living document that is easy to update as data collection practices evolves;
- Improve current QM practices by establishing standards for developing data QMPs;
- Improve the accuracy, precision, and reliability of data collection by agencies; and
- Improve agency's cost-effectiveness of data collection and analysis processes.

Develop QMP Guidelines

1. Establishing basic criteria used to identify pavement surface condition data to collect and analyze in support of the SHA's decision-making processes and recommended data elements as a function of intended uses.
2. Identifying and documenting standards used to establish QC, QA, acceptance criteria, and independent verification procedures for each of the pavement surface condition data items from step 1.
3. Documenting testing and analysis procedures used to select and set-up reference or certification test sites, verification sites, blind test sites, equipment and operators training and certification.

Develop QMP Guidelines (continue)

4. Detailing development of other methods and procedures, as appropriate, for pavement surface condition data collection and analysis, meeting the following characteristics: They are traceable, objective, practical, and transparent, and Developed in an open and transparent manner to ensure results are independent and do not include a commercial bias.
5. Supporting implementation of clear and proactive measures to mitigate or remove bias or favoritism that may exist, or be perceived to exist, in the outcomes.
6. Documenting and recommending effective statistical analysis procedures to analyze the data and verify that test results are within the allowed tolerances.

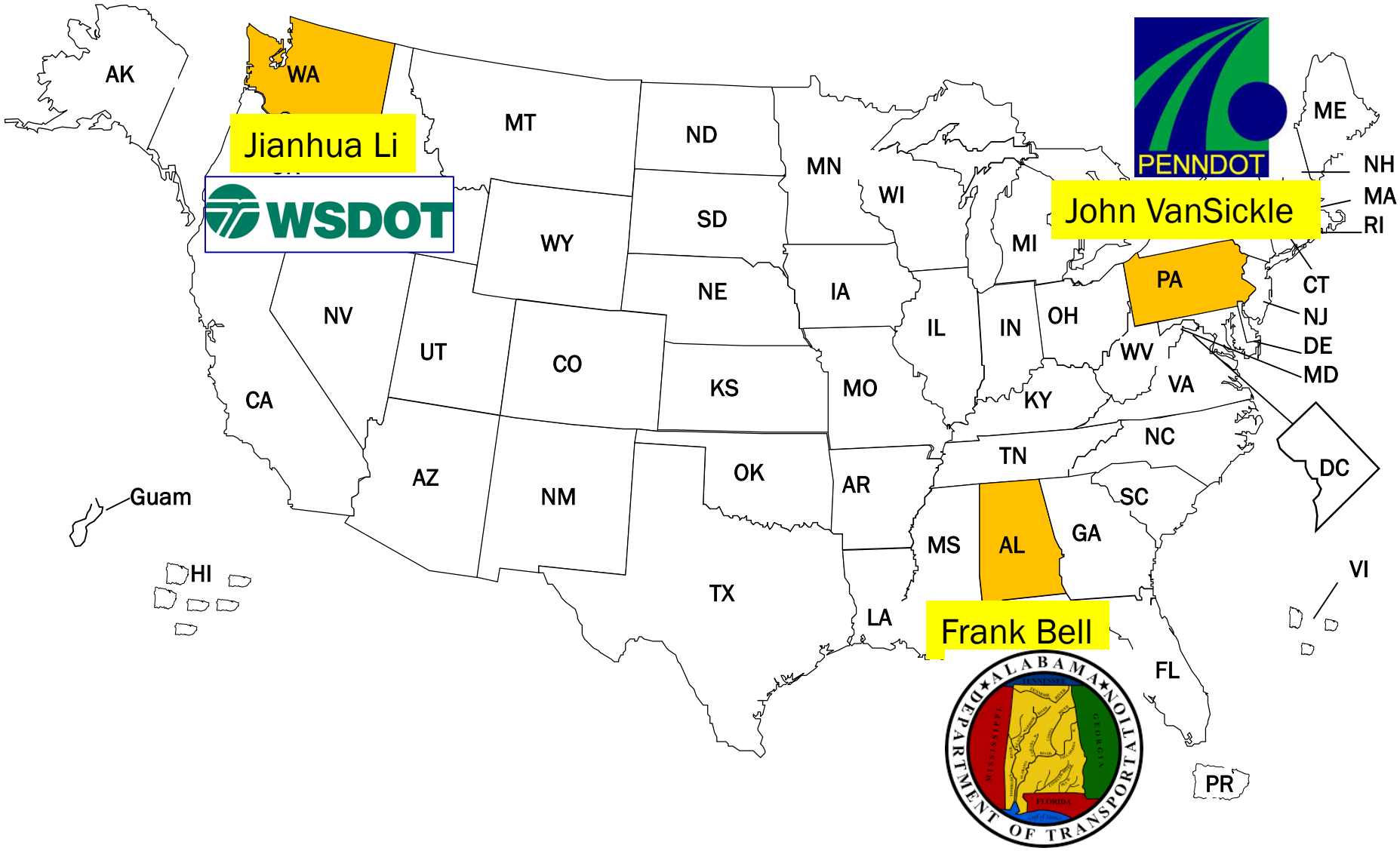
Develop QMP Guidelines (continue)

7. Providing case scenarios and other examples to further support understanding and implementation of the guidelines contained in steps 1 through 6.

Develop Work Plan for Pilot Projects

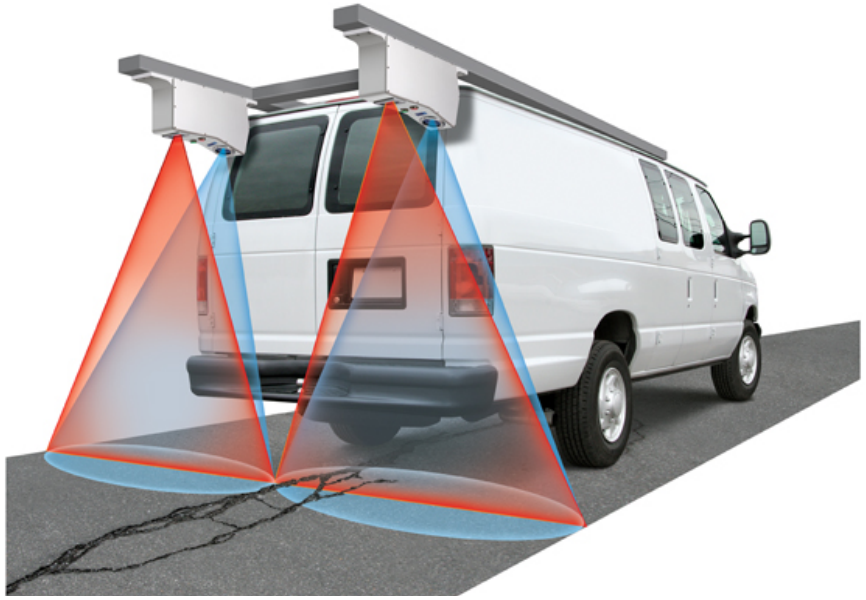
- Communications and coordination with all parties involved.
- Establishment of field experimental design.
- Selection of adequate equipment or personnel for collection of reference pavement surface condition data and actual collection of reference data.
- Collection of pavement surface condition data by the DCC.
- Analysis/comparison of reference and vendor pavement surface condition data and, as appropriate, issue resolution.

Pilot Projects



Conduct Pilot Projects

1. Selection of Test Sections
2. Field Data Collection and Certification
3. Quality Monitoring and Data Analysis
4. Recommend Modifications to QMP Guidelines



Next Steps?

Phases	Tasks	Phase I																						Phase II																							
		2019												2020												2021												2022											
		3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
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Phase I	Kickoff Meeting	D	F																																												
	1. Literature Review and Information Gathering																		D				F																								
	2. Draft and Final Phase I Report																						D													F										
Phase II	3. Conduct Pilot Project																								P				P				P														
	4. Draft and Final Phase II Report																																								D				F		
	Quarterly Reports			Q				Q				Q				Q				Q				Q			Q				Q				Q				Q				Q				Q

Legends:

	Research team effort
D	Draft project deliverables
F	Final project delievrables
P	Pilot projects (actual schedule depends on SHA's arrangement)
Q	Quaterly reports

To Meet State DOTs' Needs on QMP!

Thank You!

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