FHWA PAVEMENT ME USER GROUP MEETINGS

Fifth Annual National Meeting of the AASHTO Pavement ME User Group (PMEUG)
Technical Report

December 8-10, 2020 (Virtual Meeting)

https://www.pooledfund.org/Details/Study/549

Meeting Highlights and Key Takeaways

Attendance

- A total of 235 attendees participated in the meeting representing FHWA, AASHTO, 42 state highway agencies, six Canadian provincial highway agencies, one municipality, 25 consulting firms, 12 universities, and five industry groups.

Agency Report-Outs

- A number of agencies are using the Calibration Assistance Tool (CAT) to assist with model calibration.
- Several agencies who use consultants for pavement design, require the use of the Pavement ME Design (PMED) procedure.
- Several agencies have developed design catalogs based on PMED.
- Several agencies are in the process of preparing to calibrate to current PMED version.
- A total of 21 agencies have reportedly implemented PMED for asphalt and/or concrete pavement design. At least 24 additional agencies plan to implement it in the future.

AASHTO and PMED Software Updates

- Web Technology Application (WTA) development efforts will continue into FY22.
- AASHTOWare continues to support implementation efforts through PMED webinars.
- PMED v3.0.0 (web-based application) is anticipated for release in February 2022.
- The NCHRP 1-52 top-down cracking model was integrated into PMED v2.6.0 (released in July 2020).
- Enhancements have been made to the Backcalculation Tool (BcT) and updates have been made to the CAT tool.

Open Forum Discussion—Pavement ME Reality Check

- It is difficult to verify the use of new materials that were not part of the data set that was used to develop the PMED performance models. Engineering experience is important to ensure that the resultant designs make sense.
- Jointed plain concrete pavement (JPCP) design should only be based on slab cracking; other performance measures (such as IRI) could result in excessive thickness.
- Asphalt aging with respect to the PMED models needs further review.
- Asphalt layer thickness should not be increased to reduce nonwheel load-related distresses (not a cost-effective decision). The *Mechanistic Empirical Pavement Design Guide (MEPDG) Manual of Practice* provides suggestions for ways to reduce certain types of distresses.

Meeting Highlights and Key Takeaways (continued)

PMED Software Training

- Topic 1: Short-Jointed Plain Concrete Pavement (JPCP)/Bonded Concrete Overlays on Asphalt (BCOA) Design – Julie Vandenbossche (University of Pittsburgh).
- Topic 2: Improved Design Procedure for Unbonded Concrete Overlays (TPF-5(269)) – Julie Vandenbossche (University of Pittsburgh).
- Topic 3: Example Application of CAT Tool for Flexible Pavement Design – Wouter Brink (ARA).

PMEUG Future Events

- Future User Group meetings to be held in November timeframe in 2021 and in 2022 (expected to be held face-to-face).
- PMED software training webinars are being planned, first one anticipated for Spring 2021.
- Early stages for planning of the Implementation RoadMap workshop (stay tuned).

PMEUG Future Training Topics

- Potential future training topics (in order of preference):
  - Hot mix asphalt (HMA) Overlays of Existing Flexible Pavement.
  - Full-Depth Reclamation (FDR) / Cold In-place Recycling (CIR) Design.
  - Designing with Geotextiles.
  - HMA Overlays of Existing Rigid Pavement (including both intact and fractured portland cement concrete [PCC]).
  - Perpetual / Long-Life Design of Flexible Pavements.
  - Reflection Cracking.
  - PCC Overlays of Existing Flexible Pavement.
  - MERRA2 Climate Data.
  - PCC Overlays of Existing Rigid Pavement.
  - Continuously Reinforced Concrete Pavement (CRCP) Design.

TUESDAY, DECEMBER 8

1. Call to Order, Introductions, and Meeting Agenda and Goals – Dr. Linda Pierce NCE)

Linda Pierce called the meeting to order at 11:00 a.m. Central Standard Time (CST) and formally welcomed everyone to the 5th annual meeting of the American Association of State Highway and Transportation Officials (AASHTO) Pavement ME User Group (PMEUG) (see Attachment 1 for a complete list of attendees). She introduced other members of the project team, including Kelly Smith and Prashant Ram with Applied Pavement Technology, Inc. (APTech) and Julie Vandenbossche with the University of Pittsburgh, and she referenced the vital role of the Transportation Pooled Fund (TPF)-5(305) study (*Regional and National Implementation and Coordination of ME Design*) in the conduct of the annual meetings. Linda also reviewed the meeting agenda (see Attachment 2) and discussed some general housekeeping activities.

2. FHWA Welcome – Chris Wagner and Dr. Jennifer Albert (FHWA)

Chris Wagner welcomed everyone to the meeting and expressed his excitement for the continuation of the meetings the next 3 years. He informed the group of the transition of the FHWA Task Manager from himself to Dr. Jennifer Albert and reassured the attendees that a strong FHWA leadership role can continue to be expected. As in past meetings, he emphasized the importance of participation and interaction among attendees for a successful meeting outcome.

Jennifer provided an update on the new FHWA task order covering the PMEUG meetings. The 3-year task order was initiated in August 2020 and involves the planning and conduct of three annual meetings, the development and delivery of up to six software training webinars, and the development of a Pavement ME Design (PMED) Implementation RoadMap supported by a 1.5-day RoadMap workshop. Jennifer noted that upon completion of the task order, it is expected that AASHTO will assume responsibility for conducting future meetings.

Jennifer also briefed the participants on FHWA's effort to update its Pavement Design Policy. This effort consisted of stakeholder outreach in the form of listening sessions, regional peer exchanges, and a national workshop in 2018 and 2019, and those in turn have led to various follow-on activities, including a six-part Pavements Webinar Series scheduled from November 2020 through March 2021. Individuals interested in obtaining a link to attend the webinars can contact Jennifer at jennifer.albert@dot.gov.

Wouter Brink asked if FHWA's clearinghouse of current state of the practice (one of the follow-on activities discussed by Jennifer) is the same as the clearinghouse reported on in past User Group meetings. Linda and Kelly responded that they are different, in that the latter (which was completed in 2019) was focused solely on Pavement ME-related research.

3. AASHTO COMP and PMED Task Force Remarks – John Donahue (Missouri DOT) and Clark Morrison (North Carolina DOT)

John Donahue, Chair of Technical Subcommittee 5D (Pavement Design) of the AASHTO Committee on Materials and Pavements (COMP), provided a brief update on the subcommittee's activities. He indicated that the 3rd Edition of the AASHTO *Mechanistic Empirical Pavement Design Guide (MEPDG) Manual of Practice* was balloted and approved in 2019, and published in 2020. A ballot covering several recent addendums to the Manual

was recently approved, and these addendums will be incorporated in 2021. John also noted that the 2008 AASHTO *Guide for Pavement Friction* is in the process of being updated.

Clark Morrison, Chair of the AASHTOWare PMED Task Force, reported on the latest planning and development efforts of the task force. He indicated that the main areas of focus have been on the Web Technology Application (WTA) and the incorporation of several NCHRP research studies, most notably NCHRP 1-50 (*Quantifying the Influence of Geosynthetics on Pavement Performance*), NCHRP 1-51 (*Model for Incorporating Slab/Underlying Layer Interaction into the MEPDG*), and NCHRP 1-53 (*Improved Consideration of the Influence of Subgrade and Unbound Layers on Pavement Performance*). Clark also reported on key changes to the task force membership, including the addition of three new members—Hari Nair (Virginia DOT, new chair), Dulce Feldman (Caltrans) and Kumar Dave (Indiana DOT).

4. Canadian Update – Susanne Chan (Ontario MOT)

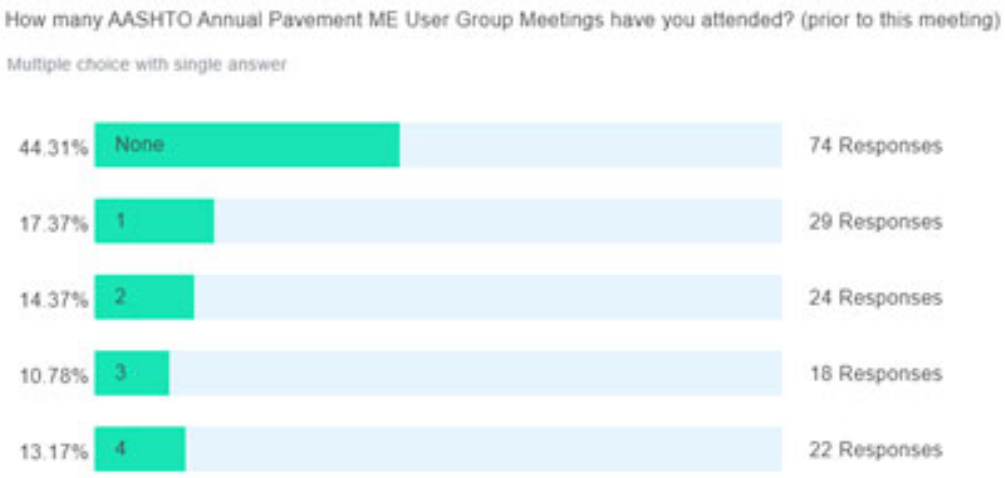
Susanne Chan updated the participants on the activities of the Transportation Association of Canada (TAC) MEPD Subcommittee. Susanne recently assumed the role of TAC Liaison from Ms. Tara Liske (Manitoba Infrastructure). She described the subcommittee's hosting of panel discussions on the practical application of ME designs as part of the 2020 TAC conference, as well as the group's involvement in conducting ME design trials and performing updates to the *Canadian Guide: Default Parameters for AASHTOWare Pavement ME Design*. Ongoing and future work activities include, among other things, development of a step-by-step Pavement ME User Guide, review of the American Concrete Pavement Association (ACPA) Concrete Pavement ME User Guide, and the conduct of trials on concrete pavement design features and on the asphalt top-down cracking model.

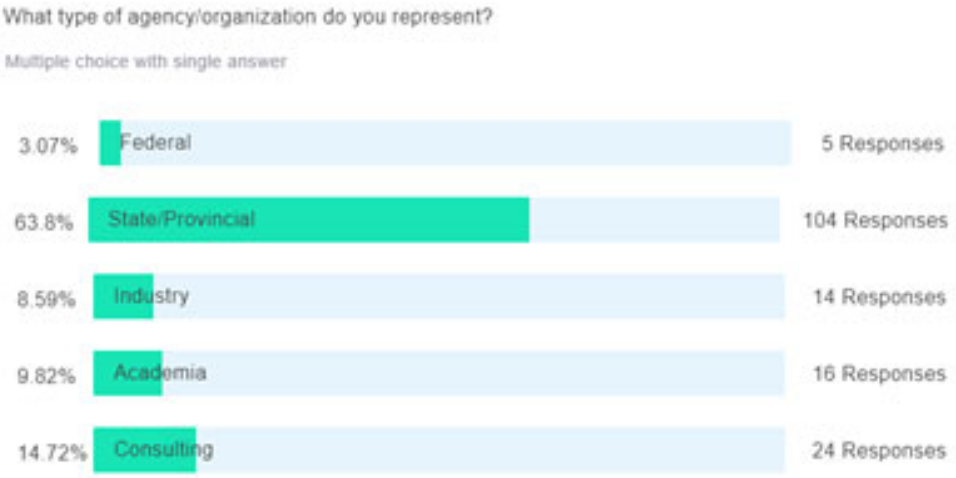
Jay Goldbaum asked if the subcommittee is investigating widened lanes for concrete design as part of the trials, to which Susanne responded no but that it could be considered in the future. In response to a question from Prajwal Tamrakar, Susanne indicated that the innovative materials and design strategies discussed at the 2020 TAC Conference included inverted pavement design (i.e., cushion layer of aggregates between two bound layers), jointed reinforced concrete pavement (JRCP) rubblization with ground tire rubber in warm-mix asphalt (WMA), and long-life design with stone matrix asphalt (SMA) surface with lab-derived materials input.

Following Susanne's presentation, the APTech project team introduced the first two poll questions to the group:

- *How many AASHTO Annual Pavement ME User Group Meetings have you attended (prior to this meeting)?*
- *What type of agency/organization do you represent?*

A total of 167 and 163 people, respectively, participated in these polls and the results are shown below. As expected, with the shift in meeting format from in-person to virtual, a sizeable percentage (44 percent) of the poll participants indicated attending none of the past meetings. On the flip side, 13 percent of the poll participants have attended all four meetings. Nearly two-thirds of the poll participants indicated they represent a state or provincial highway agency. This is a little less than past meetings, where agency representatives typically comprised about 70 percent of the attendees.





5. Agency Implementation Updates/Report-Outs – Designated Agency Speakers

This session of the meeting, which required additional time on Day 3 to complete, focused on agency reporting of PMED implementation status. As in past meetings, Linda Pierce and Kelly Smith showed the group the latest implementation maps for asphalt and concrete PMED and requested that each designated agency speaker provide an account of their agency's implementation status. Speakers were also asked to touch upon how PMED is being used (e.g., formal use on all projects or select projects, sole use or parallel use with other design procedures, examination/research only) or not used, what the agency's future plans are for PMED use, what implementation-related activities (including calibrations) have been going on, and what challenges and issues have been encountered.

A summary of the key aspects of PMED implementation provided by the various agency speakers is provided in the table below. In addition, the information presented by the speakers was used to update the PMED implementation maps. These maps are provided following the table.

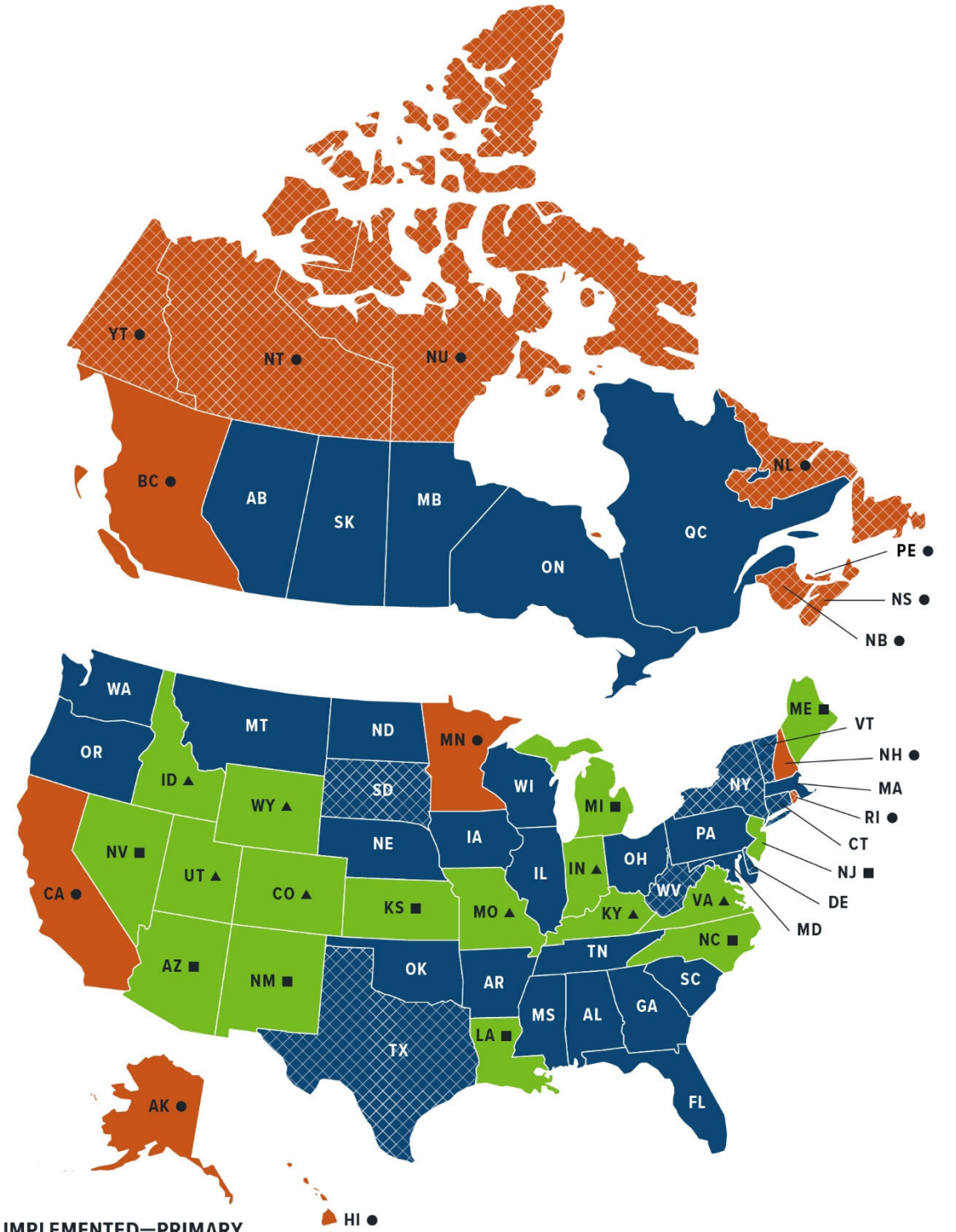
State/ Province	HMA Character-ization	PCC Character-ization	Unbound Layer & Subgrade Soil Characterization	Local Calibration	Parallel Design	Implementation	Current PMD Version	User Guide/ Design Manual
AL	Developed database; conducted local verification and asphalt mix characterization (2019)	Developing database	Subgrade soils completed	Adding calibration sites	Conducting design comparisons with AASHTO 1993	In progress	—	—
AK	Ongoing dynamic modulus University studies	N/A	Ongoing studies	N/A	N/A	No plans	N/A	Alaska Flexible Pavement Design Manual
AB	Level 1 and 2 inputs	N/A	Some testing	Anticipated 2021	Consultant designs (150 projects)	In progress	—	Pavement Design Manual
AZ	Completed	Completed	Completed	2010-2012; use global calibration defaults	2012-current	2019; with AZDOT SODA method	v2.1	Pavement Design Manual
AR	Completed	—	Completed	Asphalt Only	AASHTO 1993	Planning to implement	—	In progress
BC	N/A	N/A	N/A	No plans	N/A	No plans. Currently reviewing other agency efforts	—	N/A
CA	N/A	N/A	N/A	Global coefficients applicable to California conditions	N/A	2008 JPCP and CRCP only	—	Highway Design Manual, Chapter 620
CO	Yes, including CIPR dynamic modulus; polymerized asphalt (2019)	—	—	2010-2011; full calibration anticipated 2021	2012-2014 with AASHTO 1993	2014	v2.5.5	ME Pavement Design Manual
CT	—	—	—	—	—	Planning to implement	—	—
DE	—	—	—	—	—	Planning to implement	—	—
FL	Rutting and top down cracking	Developing concrete pavement test road (2019)	—	On 3rd Round	AASHTO 1993 for asphalt designs, evaluating v2.6	Concrete only	v2.2.6	Rigid Pavement Design Manual
GA	Added polymer mix types	Finishing concrete properties soon	—	Initial calibration in 2015 (v2.2.3). Plan to use CAT for calibration of v2.6	Planned	Planning to implement	—	Yes
HI	Moving toward polymer-modified and SMA mixes	N/A	N/A	N/A	N/A	No plans	—	N/A
ID	Completed	Completed	Completed	2018-19 completion	AASHTO 1993; PMED is official design method	2020	v2.5.3	—
IL	N/A	N/A	N/A	N/A	N/A	Potentially will use for CRCP	—	N/A
IN	Completed	Completed	Completed	2009; 2017 rutting models	—	2010; approximately 500 designs per year	v2.3	

State/ Province	HMA Character-ization	PCC Character-ization	Unbound Layer & Subgrade Soil Characterization	Local Calibration	Parallel Design	Implementation	Current PMD Version	User Guide/ Design Manual
IA	—	—	—	Completed (3rd calibration)	PCA for concrete and PerRoad for asphalt pavements	Planning to implement	—	—
KS	Completed	Completed	On-going, base stabilization	Completed (2nd calibration)	AASHTO 1993	Yes, but conducting parallel designs while reassessing procedure	v2.5	Planning to develop internal document
KY	Limited dynamic modulus testing	No	—	Verification using v2.3 and v2.5	—	HMA, concrete 2019 (online design catalog)	Validating v2.6	Pavement Design and website access
LA	Completed	Completed	Completed	v2.3 for both asphalt and concrete	AASHTO 1993	Yes, but conducting parallel designs	Waiting to calibrate v2.6	Pavement Design Guide
ME	In progress	No	Yes, working on subbase data	v2.6	AASHTO 1993 & PMED with global coefficients	HMA only; but have concerns with moving forward	v2.6	—
MB	Completed	—	Level 1 for base and subgrade, Level 3 for subbase	Yes	AASHTO 1993 (selected projects)	Planning to implement v2.6 once successfully calibrated	v2.6	Updating User Manual
MD	Completed	—	Completed	Confirmed need for calibration and will soon perform local calibration for HMA only	AASHTO 1993 & PMED with national models	Planning to implement. On hold for funding reasons	—	Pavement & Geotech Design Guide updated
MA	—	—	—	—	—	Planning to implement	—	—
MI	Completed (Level 1)	—	Completed	Yes	Use AASHTO 1993; ±1 inch deviation with PMED	Yes 2014 (on hiatus 2015-2018); all reconstruction projects	v2.3	ME Pavement Design User Guide
MN	N/A	N/A	N/A	N/A	N/A	No plans	—	N/A
MS	On-going expected completion 2021	—	Processing FWD data for stabilized base and subgrade	In progress	—	Planning to implement in 2022	—	—
MO	Conducting recycled HMA characterization	—	—	Initial calibration in 2009, 2nd calibration in 2019	—	2004 (national models)	—	—
MT	—	—	Using R-value for subgrade, but looking to go to resilient modulus	—	Using AASHTO 1993	Planning to implement	—	—
NE	—	—	—	In progress	—	Planning to implement 2021	—	In progress
NV	Completed	Completed	Database (regional calibration) of unbound SWCC inputs	Asphalt reflective cracking model; national calibration values for concrete	AASHTO 1993	2015	v2.3.1	Updating ME Design Manual
NB	—	—	—	—	—	No plans	—	—
NH	—	—	—	—	AASHTO 1972	No plans	—	—
NJ	Completed Level 1	—	—	Completion by 2021	AASHTO 1993; using PMED as a cross check	Yes	v2.5.3 (v2.6 in 2021)	Traffic User's Manual

State/ Province	HMA Character-ization	PCC Character-ization	Unbound Layer & Subgrade Soil Characterization	Local Calibration	Parallel Design	Implementation	Current PMD Version	User Guide/ Design Manual
NM	yes	CTE study	—	asphalt only	AASHTO 1993	2019	—	—
NY	—	—	—	—	—	Planning to implement	—	—
NL	—	—	—	—	—	No plans	—	—
NC	Completed	Completed	Yes	Yes for asphalt, calibrate concrete by 2021	Yes, use AASHTO 1993 with PMED shadow design	Yes, 2011-2015, currently using AASHTO 1993, but will re-implement PMED in future)	—	—
ND	Yes	Yes	Yes	2013-2014 concrete, asphalt recalibration with v2.5 release	AASHTO 1993 for asphalt rehabilitation designs	Yes, concrete (primarily default values, NDDOT CTE values); AASHTO 1993 for asphalt	v2.3.5	—
NS	—	—	—	—	—	No plans	—	—
OH	—	—	—	Verified/ calibrated in 2000s, gathering more data	—	No specific plans. PMED sometimes used for major rehabilitation designs.	—	—
OK	—	—	—	PCC only; asphalt underway	AASHTO 1993	Planning to implement (AASHTO 1993 primarily used)	—	—
ON	Level 3	Level 3	Level 3; some subgrade characterization	v2.5.5 asphalt models (2015); verifying concrete models	Yes	In progress. Consultants required to use PMED as check for high-profile projects.	—	Default Parameters Guide and User Guide (for consultants)
OR	Completed	Completed	—	Poor validation results for asphalt pavements	—	Yes for concrete designs	—	Yes
PA	Yes; includes SMA and RAP	Completed	Completed	2017 asphalt and concrete (v2.3.1), revisited in 2018 (v2.5) for asphalt; use local calibration coefficients for asphalt and concrete	Yes, AASHTO 1993 (for truck traffic > 500 vehicles)	In progress. Waiting on results of two research projects (CTE/faulting study and NCHRP 1-59)	v2.5.5	User Guide, Pavement Policy Manual
PE	—	—	—	—	—	No plans	—	—
QC	Completed	Completed	—	In progress	—	In progress	—	—
RI	—	—	—	—	—	No plans	—	—
SK	—	—	—	—	—	Developing an implementation plan	—	—
SC	Completed	Completed	Aggregate base, cement treated/stabilized bases and subgrades	On-going study	AASHTO 1972 for lower volume routes	Developing design catalog	—	—
SD	—	—	—	—	—	Planning to implement	—	—
TN	Completed 2013	Completed 2013	Completed 2013	2015	AASHTO 1993	Planning to implement by August 2021	—	User Manual and Input Design Guide

State/ Province	HMA Character-ization	PCC Character-ization	Unbound Layer & Subgrade Soil Characterization	Local Calibration	Parallel Design	Implementation	Current PMD Version	User Guide/ Design Manual
TX	Completed	—	—	—	—	considering asphalt models only	—	—
UT	Completed	Completed	Completed	Completed	No (PMED is only design method used)	2010	—	Pavement Design Manual of Instruction
VT	Underway	—	Underway	National calibration values (2015)	To be conducted	Planning to implement	—	Draft
VA	Level 1	—	—	2015	—	2018, new and reconstruction	—	Yes
WA	—	—	—	JPCP in 2005 and asphalt in 2008	—	In progress. Design catalog updated in 2009 is used as a baseline	—	Pavement Design Policy
WV	—	—	—	—	—	Planning to implement	—	—
WI	Updating	Completed	Completed	2014 using v2.1. Recalibration in progress with v2.5.5	—	Pilot implementation in 2014, problems and reverted back to AASHTO 1972 (WisPave 4) in 2018	v2.1; but inconsistent design results	Yes (updating when recalibration is complete)
WY	—	—	On-going study	Use local calibration coefficients	—	Implemented in 2012	—	—

ASPHALT PAVEMENTS AND/OR OVERLAYS



IMPLEMENTED—PRIMARY DESIGN METHOD: 8

IMPLEMENTED—USED IN CONJUNCTION WITH OTHER METHODS: 9

PLANNING TO IMPLEMENT: 32

▲ Implemented—Used as Primary Design Method

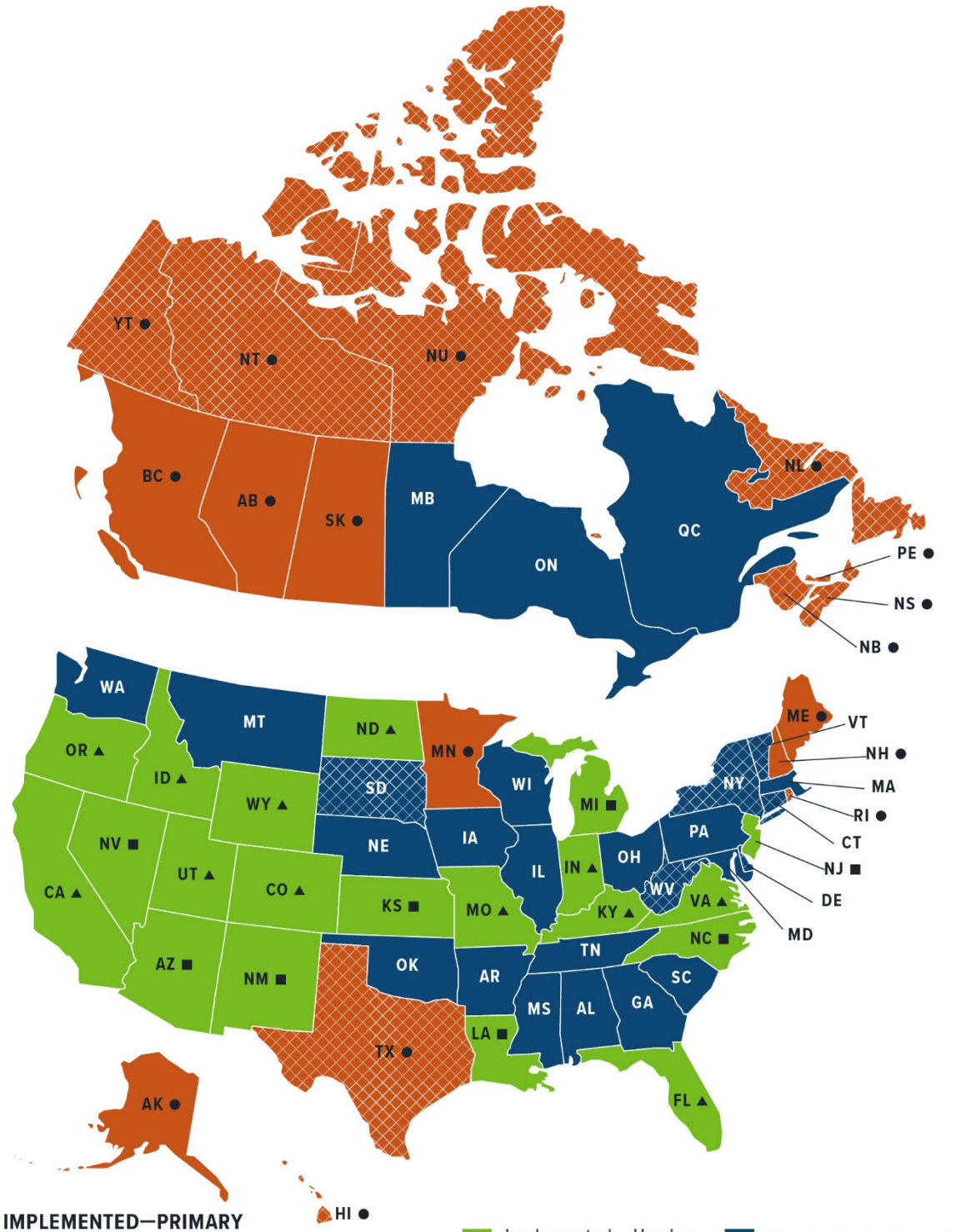
■ Implemented—Used in Conjunction with Other Design Methods

Planning to Implement

● No Plans to Implement

Previous Surveys

CONCRETE PAVEMENTS AND/OR OVERLAYS



6. AASHTO Briefing – Ryan Fragapane (AASHTO)

Ryan Fragapane introduced himself and informed the group that he took over Vicki Schofield's role with AASHTOWare following her retirement at the end of 2019. Ryan provided links to the AASHTO (https://www.aashtoware.org/products/pavement) and ARA (www.me-design.com) websites and described the types of pertinent information on PMED available at the sites. He discussed two webinars on local calibration—"Getting Started with Local Calibration" conducted on December 2, 2020 and "Using the Calibration Assistance Tool (CAT) of Local Calibration" scheduled for December 16, 2020—and provided a summary of AASHTOWare PMED licenses.

Ryan discussed AASHTOWare's Web Technology Application (WTA) development efforts, which were initiated in FY19 and will continue into FY22. He also touched upon other AASHTOWare activities, such as its customer service pilot program and data integration project.

7. Software Enhancements/Updates – Chad Becker (ARA)

Chad Becker provided an overview of the enhancements and updates being made to the PMED software and related tools. He first discussed the feature highlights of PMED v3.0.0, which is anticipated to be released in February 2022. That version of the program will be a web-based application with three deployment options and will include a direct climate integration feature for easy selection of MERRA and NARR climate data. Several other features will be incorporated into the software, and various webinars and user guides will be developed and made available to aid users in their transition to v3.0.0.

Chad next discussed the integration of the NCHRP 1-52 top-down cracking model into PMED v2.6.0, which was released in July 2020. That model integration involved the addition of two new design inputs (asphalt content and mix gradation) and two new performance prediction outputs (crack depth over time and area of cracking over time).

Rounding out his presentation, Chad described the enhancements made to the Backcalculation Tool (BcT) and the updates made to the CAT. He noted that BcT v1.0.6, which will soon be posted on the Pavement ME website (www.me-design.com), now provides support for the new Dynatest FWD file format (Microsoft Access) and includes many "quality of life improvements" related to thickness-based segmentation and joint load transfer efficiency (LTE) analysis. Chad reported extensive use of the CAT, with 41 unique registered users. He indicated that the newest version of the tool (v2.6) has been made compatible with both PMED v2.5 and v2.6, but cautioned users to make sure the .dgpx files match the version of the CAT wanting to be used.

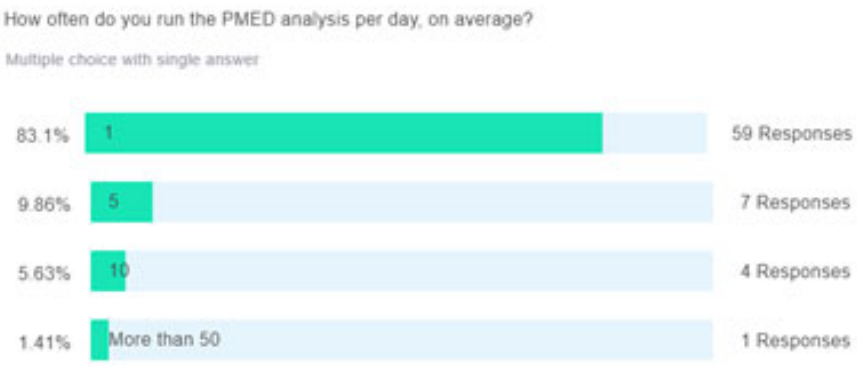
Justin Schenkel inquired whether the run time for PMED v2.6 was sped up or slowed down. Chad indicated that the run time was significantly improved from v2.5.5, but that there is still a legacy slow-down of about 2 to 2.5 times compared to v2.3. Justin also inquired about a significant unspecified error with v2.3, as asserted by the industry groups in Michigan. Chad stated that he is not aware of any such error in that software version.

Jay Goldbaum asked how the local calibration will be integrated into the web application. Chad indicated that locally calibrated factors will be able to be imported into the agency's workspace within the program. Sunil Saha asked if Chad could go over the selection of MERRA2 grid stations in the PMED climate module. Chad briefly described the process and encouraged users having issues with selecting climate data to contact the ME Design Support Team at pavementmedesign@ara.com. The process entails entering the project location (nearest city) in the climate module (next to the Google map), selecting one of the nine MERRA2 grid points that display as red markers on the map, downloading the climate data for that grid point from the LTPP InfoPave site, unzipping the climate data file and dragging it into the .hcd folder, and refreshing the map. After refreshing, the grid point marker turns to blue and can then be selected for the design.

This discussion led to the next poll question pertaining to PMED usage. The question was originally posed as "On average over the past year, approximately how many projects have you run on a daily basis?" but was later rephrased as follows to generate more meaningful feedback for the ME Design Support Team:

- *How often do you run the PMED analysis per day, on average?*

A total of 71 participants responded to the poll question and the results are summarized below. As can be seen, the vast majority of the respondents indicated they conduct one analysis per day on average.



8. Michigan DOT's Implementation and Calibration Efforts – Dr. M. Emin Kutay (Michigan State University)

Dr. Emin Kutay presented his work for the Michigan DOT involving the improvement of PMED thermal cracking prediction via mix-specific calibration coefficients (the full report for the study can be found at https://www.michigan.gov/documents/mdot/SPR-1668_Final_Report_610314_7.pdf). The objectives of the study were to investigate the reasons for the extreme sensitivity of the thermal cracking model observed in the 2014 calibration (conducted using PMED v2.3 and 20 calibration projects) and to re-do the calibration if improved predictions are possible. The investigation found that thermal cracking prediction is extremely sensitive to variations in the fracture parameter n, and much better matches between predicted and actual cracking can be obtained using mix-specific Level 1 K factors. A multi-gene genetic programming (MGGP) equation was developed to predict the best K factor for a given mix, based on various job mix formula factors (e.g., design traffic, HMA thickness, design air voids and asphalt binder content of the HMA top

layer, low-temperature PG grade). The mix-specific K factors for the 20 calibration projects resulted in significant reductions in bias and precision, compared to the 2014 calibration that resulted in a single K factor of 0.75.

Harold Von Quintus asked if actual creep compliance and indirect tensile strength (ITD) data for the mixes were used, or if the default Level 3 mixture properties were used. Emin indicated that test data on 65 mixes were used in the 2014 calibration and these data provided for actual ITD and quasi-measured creep compliance inputs for the analysis. Harold also inquired about the air voids used in the study, pointing out that PMED uses in-place air voids not the design air voids (as was included in the MGGP equation). Emin acknowledged this was the case but explained how the analysis had to be approached from a job mix formula standpoint in the absence of in-place air voids data. He indicated that some historical in-place air void data may become available in the future which could then be considered. He also noted that the E values used in the analysis were based on in-place air voids. Alauddin Ahammed added that average compaction/density data can be used to calculate the field air voids. Emin said an effort is underway to identify and gather design and construction data on many pavement sections, and that in-place air voids could be targeted.*

WEDNESDAY, DECEMBER 9

9. Missouri DOT's 2nd Calibration Study – Jason Blomberg (Missouri DOT)

Jason Blomberg discussed the Missouri DOT's second local calibration study, completed in 2020 using PMED v2.5.5. Jason indicated while the study looked at both new designs (full-depth HMA pavement and full-depth JPCP) and rehabilitation designs (asphalt and concrete overlays), their primary focus was on calibrations for new design. Also, while calibrations were performed for the various performance models, the Missouri DOT only uses bottom-up fatigue cracking and permanent deformation (AC-only and total rutting) as design criteria for full-depth HMA pavement and transverse cracking and joint faulting as design criteria for full-depth JPCP.

Jason reported that the study deliverables include a final project report (available online at https://spexternal.modot.mo.gov/sites/cm/CORDT/cmr20-007.pdf), an updated ME Design User Manual, an updated materials database, and guidance on how to use the new calibration coefficients and how to use ME Design for asphalt and concrete overlays. He also explained how the second local calibration study results affected the agency's alternate bidding process. Because of the significant increases in HMA distress prediction and the agency's desire to maintain the same life-cycle model for alternate bidding, the HMA fatigue cracking and rutting thresholds and the JPCP transverse cracking threshold were adjusted. This has led to 0.5- to 1.0-inch thickness increases for both pavement types.

In response to two questions from Jay Goldbaum, Jason stated that no trench studies were performed in the calibration effort and that the Missouri DOT uses the same distress threshold values for all classes of roads. In response to a question from Mohammadreza Mirzahosseini, Jason indicated the consultant who performed the study did not use the CAT and that the details of the process should be available in the project report.

Tom Yu asked if a 10 percent fatigue cracking threshold (at Year 30) for asphalt is equivalent to a 2 percent slab cracking threshold (at year 25) for concrete. Jason answered that the values are appropriate within the context of the agency's alternate bidding process but that a more realistic scenario is 10 percent fatigue cracking after 10 to 12 years. Steven Henrichs asked if the Missouri DOT has IRI and faulting criteria for concrete design, to which Jason responded that these performance parameters are looked at but are not considered in design. Scott George asked if cores were taken to verify if cracking was top-down or bottom-up. Jason reported that cores were taken but couldn't recall the procedure used to distinguish the type of cracking.

10. Alabama's Flexible Pavement Design Implementation Effort – Dr. Nam Tran (National Center for Asphalt Technology [NCAT])

Dr. Nam Tran presented on NCAT's effort to implement the Pavement ME flexible design procedure for the Alabama DOT. He gave an overview of the steps for implementation and discussed the project objectives and tasks, which centered around the gathering of data on asphalt pavement test sections and conducting local verification of the Pavement ME performance models.

A total of 121 LTPP test sections in Alabama and neighboring states and 34 structural sections at the NCAT Test Track were identified and used in the study. Materials, traffic, climatic, and field performance data on all of the sections were compiled into databases and used to perform PMED design runs. Nam showed the predicted versus measured performance plots for the LTPP test sections and the NCAT sections. He pointed out differences in the results for the two data sets and provided some possible explanations for the observations. Nam concluded his presentation by stating they will assist Alabama DOT in determining the next step in implementation, with consideration of financial and other factors.

11. Incorporating Rehabilitation Design using Pavement ME in Virginia – Affan Habib (Virginia DOT)

Affan Habib provided an overview of the Virginia DOT's status regarding PMED implementation and discussed the agency's continued implementation efforts. The DOT implemented PMED for new design in 2018 and used v2.2.6 for that work. For rehabilitation design, the agency uses the AASHTO 1993 procedure, but is currently working to implement the PMED for rehabilitation projects.

Affan described two paths the DOT considered for its future implementation efforts:

1. Transition from PMED v2.2.6 to the current version (either v2.5 or v2.6), re-calibrate the models for new design, and implement PMED rehabilitation design (with possible need for calibration).
2. Implement PMED rehabilitation design using v2.2.6 (with possible need for calibration), transition to the current version (v2.5 or v2.6), and re-calibrate the models for new design and rehabilitation design.

According to Affan, option 2 was selected based on the agency's urgent need to conduct HMA overlay designs. The DOT developed a strategy for implementation and has carried out the strategy part way. Projects have been selected for verification/calibration and data

(traffic, subgrade, distress, etc.) for those projects have been compiled. Some initial analyses have been performed, but there are many issues to be addressed regarding calibration and several additional steps are required for implementation to occur. Affan reported that the DOT will use Level 2 inputs to characterize the existing pavement, since FWD data are not usually available.

Brandon Hee asked if they observed delamination in the GPR data used to get asphalt thickness and Hari Nair reported delamination was observed at some of the 15-16 sites tested with the GPR. MaryJane Hayden asked if Virginia experiences much top-down cracking and Affan responded they do but they don't differentiate it from bottom-up cracking.

During his presentation, Affan asked the group if it is possible to implement PMED for both new design and rehabilitation design at the same time. Harold Von Quintus shared that it is possible to implement them simultaneously but noted it is best to determine the cracking and rutting calibration coefficients for new design first and apply them to the rehab sections. Harold also pointed out that layer debonding is an issue for rehabilitation design calibration and he recommended input Level 3 not be used.

12. Indiana DOT's Implementation Initiative of PMED v2.6 – Kumar Dave and Nick Cosenza (Indiana DOT)

Kumar Dave provided a brief overview of the Indiana DOT's experience and perspective with PMED. He reported that the agency was one of the first to implement the procedure (circa 2009) and that they have used it to design hundreds of projects (both new and rehabilitation) each year. They performed their first major calibration in 2017 for asphalt pavement rutting and are now calibrating the cracking model using PMED v2.6. Kumar indicated that with the number of projects they have designed with PMED and the increasing amount of pavement management data for those projects, they can expect better verification of the models.

Nick Cosenza reported on the Indiana DOT's effort to transition from PMED v2.3 to v2.6. He first discussed the results of a research project on traffic, which, based on updated and expanded traffic station data, showed significant increases in truck traffic and notable changes in the hourly distributions. He discussed the analysis of the permanent deformation model, which showed comparable levels of predicted total rutting between the 2017 locally calibrated model (using PMED v2.3) and the PMED v2.6 default model but conflicting trends regarding the primary source—subgrade versus HMA—for rutting. Nick pointed out that the default model over-predicts subgrade rutting, as it does not account for the fact that the Indiana DOT does a lot of cement stabilization of soils, which helps to prevent subgrade rutting.

Nick also touched upon the analysis of the bottom-up and top-down fatigue cracking models. He described how the PMED v2.6 default model predicted substantially more bottom-up cracking than the v2.3 default model, and how the DOT was able to support the use of a lower in-place air void content (7 percent instead of 8 percent) in order to give more reasonable predictions of bottom-up cracking. He indicated they like the new top-down cracking model in v2.6 but are still evaluating its application.

In closing, Nick summarized the new HMA .xml input files that have been prepared and presented the link (https://www.in.gov/indot/3418.htm) that design consultants can use to access the HMA, traffic, and climate input files. He noted that the currently posted files are for PMED v2.3, but that the v2.6 files will be posted when the DOT officially adopts the newest software version (possibly in January 2021).

Jay Goldbaum asked how close the predicted total rutting was to the actual rutting on the project and Nick indicated they were pretty close. Nat Velasquez asked if a recalibration is necessary every time a new software version is released. Nick recommended that, at a minimum, verification should be performed with each new software release.

Justin Schenkel inquired about which traffic files were used in the analyses of v2.6 and Nick stated that they used the older traffic data because of some issues with using new traffic data in v2.6. Shihai Zhang asked if the DOT simply increased the compaction requirement in 2019 to increase the in-place density. Nick answered that they actually reduced the compaction requirement to get lower air voids; they changed their mix design specification, which forced contractors to change gradations to make mixes more compactable.

13. Development of Concrete Material Database for Pavement ME Design in Georgia – Dr. S. Sonny Kim, Dr. Stephan Durham, and Chandler Banks (University of Georgia)

Dr. Sonny Kim introduced the research study involving the development of a concrete material database for PMED in Georgia. He briefly described the Georgia DOT's transition to the PMED from their current design procedures (AASHTO 1972 for flexible design and AASHTO 1981 for rigid design) and summarized four key research studies that are leading the way toward implementation of the PMED rigid design procedure.

Dr. Stephan Durham presented the background for Georgia DOT research project (RP) 18-03, *Development of Concrete Material Property Database for Pavement ME Input*. He discussed the material sources (aggregates, cement, etc.) used to create 12 concrete mixtures reflective of typical Georgia DOT mixtures, and described the experimental test matrix for the 12 mixtures, which focused on several variables (e.g., cement and fly ash content, water-to-cement ratio, coarse aggregate type, air content).

Stephan and Chandler Banks presented the laboratory test results for the 12 mixtures, including compressive strength (f'_c), modulus of elasticity (MOE), Poisson's ratio, modulus of rupture (MOR), coefficient of thermal expansion (CTE), and thermal conductivity. They discussed the results of an analysis on the impact of mechanical and thermal properties on rigid pavement performance using the PMED software and typical JPCP and CRCP cross-sections. The analysis indicated, among other things, that JPCP slab cracking and CRC punchout distress are significantly affected by f'_c and MOR (higher values result in decreased distress) and CTE is a crucial property affecting JPCP joint faulting and IRI (higher CTE values result in increased faulting and IRI).

Chetana Rao asked if lower CTE values were observed with increasing coarse aggregate content, for a given aggregate type. Sonny answered that there was not much variation in the volume content of the coarse aggregates, but that one of the previous research studies showed that more coarse aggregate lowers the CTE values. Adrian Archilla asked at what age the CTE was measured and if the change in CTE with age was analyzed. Chandler

indicated the CTE was measured at 28 days and that, while a previous study examined CTE as a function of age, the current study did not. In response to some final questions from the audience, Sonny and Stephan reported that the design analysis included doweled transverse joints at 15-ft spacing and that rapid-set concrete was not tested.

14. Maintenance Cycles for Long-Life Concrete Pavement – John Becker (American Concrete Pavement Association-Pennsylvania Chapter)

John Becker spoke on long-life concrete pavement (LLCP) in Pennsylvania and the development of corresponding maintenance schedules based on PMED analyses. He began his presentation by giving FHWA's definition for LLCP and describing several key components of LLCP. He then summarized LLCP projects in Pennsylvania (14 recently completed or under construction by PennDOT and the Pennsylvania Turnpike) and provided a comparison of PennDOT's standard concrete pavement specification and the LLCP specification.

John explained that, with the movement toward both long-life concrete and asphalt pavement, both paving industries were asked by PennDOT to propose maintenance cycles for their respective long-life pavements for possible use in the agency's life-cycle cost analysis (LCCA) process. The Pennsylvania Chapter of ACPA undertook developing the LLCP maintenance cycles by using design input and criteria from PennDOT's PMED User Guide and LLCP-related inputs and conducting PMED software runs for 15 design scenarios representative of five geographical locations and three traffic levels. The resulting distress (cracking, faulting, and spalling) and IRI predictions for each design scenario were used to formulate maintenance and repair needs over a 50-year analysis period. The proposed maintenance cycle, currently under review by PennDOT, consists of joint sealing activities at Years 10, 20, and 30, and concrete pavement restoration (CPR) activities (patching, diamond grinding, and joint sealing) at Year 40. John discussed how this cycle compares with the standard concrete pavement cycle and closed with some suggestions for enhancing the use of PMED to predict pavement performance.

15. Michigan DOT PMED State of the Practice, Agency Issues, and Industry Concerns – Justin Schenkel (Michigan DOT)

Justin Schenkel set the stage for the open forum discussion by presenting Michigan DOT's Pavement ME reality check. He made his PowerPoint presentation available to participants in advance of the meeting (see the PMEUG meeting webpage at https://sites.google.com/view/pmeug2020/home) to help generate a conversation on Pavement ME, based on Michigan DOT's issues and challenges.

Justin briefly discussed the DOT's Pavement ME research history and showed the agency's implementation transition (PMED is implemented but only for reconstruction projects, v2.3 is used with global calibration factors for JPCP and local factors for HMA). He referenced the Michigan DOT ME website (https://www.michigan.gov/mdot/0,4616,7-151-9623_26663_27303_27336_63969---,00.html) where the current (2020) ME User Guide and various input files can be found.

Justin explained that PMED designs are constrained by AASHTO 1993 designs in that the final PMED design for each pavement type cannot be more than ±1 inch from the AASHTO 1993 design. He reviewed the PMED performance thresholds used for new design and the

typical HMA and JPCP cross-sections, and then described some of the design issues they have encountered.

- Occasional high IRI prediction for JPCP based on weather station selection. Significant differences in the freezing index values from multiple close-proximity weather stations affect the site factor in the IRI model, which in turn affects the design slab thickness.
- Substantial JPCP thickness reduction associated with widened slab compared to standard 12-ft slab. The DOT does not use the widened slab design, as it produces unreasonably low thickness designs.
- Occasionally high thermal cracking predictions for HMA. Despite using their most robust asphalt binders, they are getting unusually thick asphalt designs that are driven by thermal cracking. In some cases, a 0.5-inch reduction in HMA thickness can yield a ten-fold increase in the predicted thermal cracking.
- Impacts of base, subbase, and subgrade on pavement design thickness. Variations in the material types and associated resilient moduli used for these layers are showing minimal impacts on HMA and PCC design thickness. The importance of these layers in the AASHTO 1993 design procedure are much more apparent.

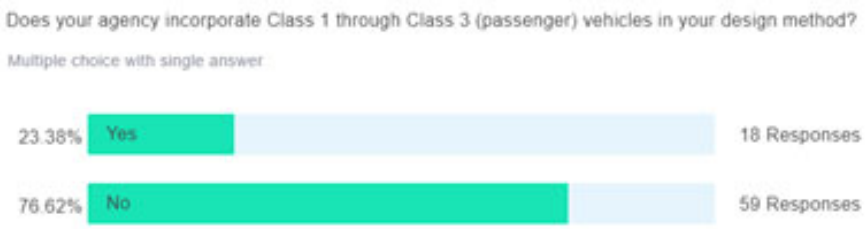
In its efforts to implement PMED for rehabilitation design, the Michigan DOT is seeking input on how to characterize existing pavement. Specific questions posed by Justin included:

- How do we define the existing layer properties?
- How do we define the existing condition?
- Is the existing HMA pavement entered as one layer or separate layers?
- How do we design HMA over JRCP?
- How do we model HMA on rubblized concrete?
- How do we design thin HMA overlays (<4 inch)?
- How do we explain unexpected PMED outcomes?
- How do we define equivalency? In Michigan, bottom-up fatigue cracking controls HMA design whereas terminal IRI dictates JPCP design.

Finally, at Justin's request, the following poll question was posed to the group:

- *Does your agency incorporate Class 1 through Class 3 vehicles in your design method?*

A total of 77 participants responded to the poll question and the results are summarized below. Approximately one-fourth of the respondents indicated that Class 1-3 vehicles are considered in their design methodology.



Scott George asked if the Michigan DOT is using a stabilized open-graded drainage layer (OGDL), to which Justin responded that they use a non-stabilized OGDL. Sunghwan Kim inquired about the design life used to determine pavement thickness. Justin reported they use a 20-year design life for HMA and JPCP. Regarding the issue of high IRI predictions for JPCP, Eric Ferrebee commented that IRI and faulting are best mitigated through changes in the slab geometry and concrete properties, not through increased thickness.

Regarding the issue of HMA transverse cracking and thickness, Harold Von Quintus suggested looking at what actual performance data tells you in terms of the importance of asphalt thickness versus predicted transverse cracking length or the observed cracking length. Harold also stated agencies should not use input Level 3 (Levels 1 and/or 2 should always be used). For rehabilitation design, Harold recommended always basing decisions on cores. He also pointed out that the minimum asphalt thickness given in the NCHRP 1-37A report is only for new designs, and PMED is applicable for HMA overlays greater than 1.5 inch thick.

16. Pavement ME Reality Check: Open Forum Discussion – Meeting Participants

Linda invited participants to build off Justin Schenkel's presentation by more broadly discussing PMED issues and challenges. Below are some of the key discussion items from the open forum.

- Jamshid Armaghani advised to be very careful not to over-emphasize the applicability of ME design in all cases. PMED cannot be used to verify new materials that were not part of the LTPP and other pavements sections used to develop the performance models. New research, such as the NCHRP 1-52 top-down cracking model, needs to be conducted and incorporated into the software, so that users can be more comfortable with the applicability of the tool. Ultimately, engineering experience is important in deciphering if a design makes sense.
- Tom Yu commented that structural design for JPCP should only be based on slab cracking, because if it is based on other performance measures such as IRI, one could end up with excessive thickness. Regarding very thin designs with the widened slab approach, Tom agreed with the concern but said this design feature is a very cheap insurance policy for taking care of other issues, such as joint faulting. Regarding the impact of subgrade on design thickness, Tom noted that response under loading is the only subgrade property PMED considers, and that this is one weakness that needs to be addressed.
- Harold Von Quintus made the point that asphalt aging is a key item for consideration in the PMED models. He also emphasized that pavement thickness should not be increased to try to reduce nonwheel load-related distresses, because it is not a cost-effective decision. The *MEPDG Manual of Practice* provides some suggestions for ways to reduce certain types of distresses.
- Chris Brakke commented on the issue of equivalency. He indicated the Iowa DOT is in a similar position as the Michigan DOT in terms of having two strong paving industries and a pavement type selection process driven by differences in pavement thickness. Chris discussed his agency's current design procedures (AASHTO 1993 for flexible pavement and Portland Cement Association [PCA] 1984 for rigid pavement) and the current effort to transition to PMED. He and Kelly Smith described the key issues encountered in evaluating PMED HMA and JPCP designs—

thermal cracking and faulting, respectively—and the proposed strategies for dealing with these issues.

- John Donahue emphasized Tom Yu's point about not solving JPCP joint faulting through increased slab thickness. He also described an anomaly in the faulting model related to the differential energy input that adversely affects predicted faulting.

THURSDAY, DECEMBER 10

17. FHWA Research Update – Tom Yu (FHWA)

Tom Yu provided an update of FHWA's Pavement Design program area, which is one of six pavement-related program areas centering around the theme of pavement sustainability. He explained how the U.S. DOT and FHWA mission statements translate, in effect, to providing long-life pavement on the nation's roads.

Tom stated there are three elements for well-performing pavement—effective structural design, durable materials, and quality construction. He asserted that, when it comes to structural design, there is too much emphasis placed on the structural section and not enough on the foundation. He pointed out that PMED is based on pavement response and since the stiffnesses of the foundation layers are much less than the structural layers, the pavement response is not impacted as much by the foundation layers. However, because foundation layers deteriorate over time thereby affecting pavement performance, there is a need for ensuring the foundation layers retain their integrity over the life of the pavement.

Tom described four FHWA Pavement Design program activities focused on pavement foundation. These include:

- Foundation Design for Concrete Pavements.
- Failure Mechanism of Pavement Foundation.
- Feasibility of Utilizing Intelligent-Compaction Equipment to Ensure Uniformity and Quality of Pavement Foundation.
- Inverted Pavements.

He also described FHWA's planned activities, which focus on pavement evaluation and the design and construction of (a) pavement foundations and (b) inverted pavements.

18. NCHRP Research Update – Dr. Linda Pierce (NCE)

Dr. Linda Pierce updated the participants on NCHRP research projects related to PMED. She illustrated and briefly discussed the complete timeline of projects, from the completion of NCHRP 1-37A in 2004 to several on-going studies, such as NCHRP 1-59 (*Including the Effects of Shrink/Swell and Frost Heave in ME Pavement Design*) and 1-61 (*Evaluation of Bonded Concrete Overlays on Asphalt Pavements*). Linda noted the years in which the results of some of the projects (e.g., the NCHRP 1-52 top-down cracking model in 2018/19) were incorporated into Pavement ME and cited three studies currently under consideration by the PMED Task Force—NCHRP 1-50 (*Quantifying the Influence of Geosynthetics on Pavement Performance*), 1-51 (*A Model for Incorporating Slab/Underlying Layer Interaction into the PMED Concrete Pavement Analysis Procedures*), and 1-53 (*Improved Consideration of the Influence of Subgrade and Unbound Layers on Pavement Performance*).

Linda concluded her presentation by reporting on the total ME-related research sponsored to date (32 projects over 23 years at a cost of $19.5 million) and summarizing the areas where NCHRP research has been focused. With respect to the latter, asphalt has been the primary areas of focus (10 projects) whereas traffic/climate has received the least amount of focus (2 projects).

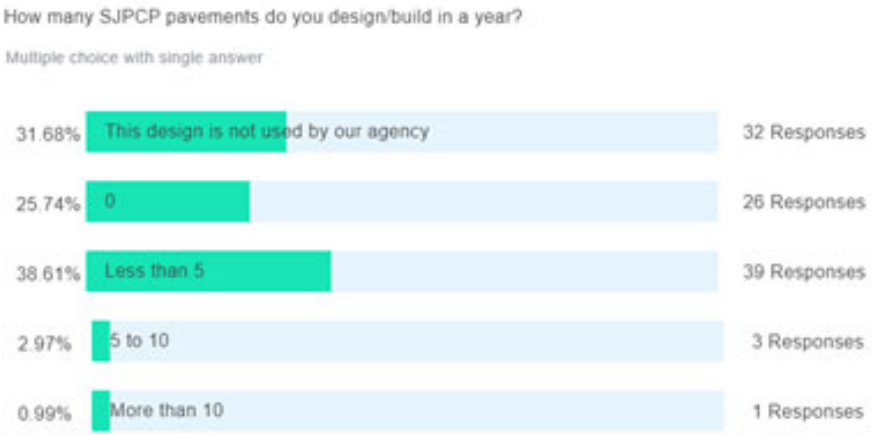
19. Software Training Topic 1: SJPCP/BCOA Design – Dr. Julie Vandenbossche (University of Pittsburgh)

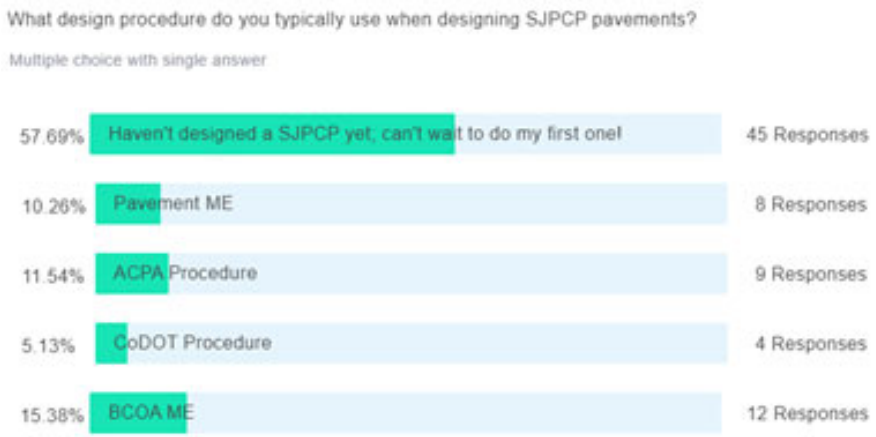
As part of her first block of training, Dr. Julie Vandenbossche presented on the SJPCP design procedure within the PMED software program. Also referred to as bonded concrete overlays of asphalt pavement (BCOAs), this design can be applied to both existing HMA pavement and composite pavement. The concrete overlay thickness generally ranges between 4 and 8 inches and uses slab sizes between 4.5 and 8 ft.

To gauge the use of SJPCP pavements and the procedures used to design these pavements, Julie posed the following two poll questions to the group:

- *How many SJPCP pavements do you design/build in a year?*
- *What design procedure do you typically use when designing SJPCP pavements?*

A total of 101 and 78 participants, respectively, responded to these questions. As shown below, approximately one-third of the respondents indicated SJPCP is not used, whereas a slightly higher percentage indicated they design and build less than five pavements per year. Among the respondents who design SJPCP pavements, the results were somewhat evenly split with the BCOA-ME procedure capturing the most responses, followed closely by the ACPA and PMED procedures.





Julie continued her presentation by navigating through the SJPCP design module and discussing the key inputs, including selection of the sole performance criterion (longitudinal fatigue cracking), characterization of the existing asphalt layer properties, and selection of the PCC surface layer properties. For the latter, she referenced the use of the fiber-reinforced concrete (FRC) calculator (https://cptechcenter.org/news/new-frc-tool-and-publications-issued-by-cp-tech-center/) for increasing the MOR of a PCC overlay containing fibers.

To demonstrate the application of SJPCP design (6-ft joint spacing) for an existing asphalt pavement, Julie presented an example project whereby the surface elevation of the existing pavement is maintained after placement of the overlay. She showed how alternative designs involving different combinations of PCC overlay and milled asphalt thickness can be developed, along with alternatives involving new JPCP with longer joint spacings (10 and 12 ft) placed on two quality levels of asphalt base (new HMA and reclaimed asphalt pavement [RAP]). Julie encouraged performing multiple designs and comparing the key inputs (slab size, asphalt base characterization) and outputs (slab thickness, predicted types and amounts of slab cracking).

Julie also discussed the application of SJPCP design for an existing composite pavement. She pointed out this type of overlay can be designed as either a bonded overlay (BCOA), whereby the PCC surface engages the strength of the asphalt base layer, or an unbonded concrete overlay (UBOL), whereby the asphalt base only provides support to the PCC surface. Julie provided the following rule-of-thumb for differentiating the two design types, and illustrated how PMED can be used to design each type (SJPCP or new JPCP for BCOA, JPCP overlay on PCC [unbonded] for UBOL):

- BCOA: Asphalt base layer thickness (at time of overlay) $\geq$ 4 inches
- UBOL: Asphalt base layer thickness (at time of overlay) $\leq$ 3 inches

Tyler Speakmon asked if there is any way to account for fibers other than simply adding to the modulus of rupture and, if not, whether any research been done to account for the effects that increasing strength has on other aspects of the design. Julie explained that, in addition to strength increase, fibers in SJPCP can serve as tie bars to keep slabs from floating and as joint load transfer mechanisms. She indicated while there is no direct adjustment for load transfer capacity in SJPCP design, the adjustment to MOR accounts for the overall improvement to the structure in terms of cracking performance. The performance benefits of

FRC via increased load transfer can be accounted for when a faulting model becomes available.

Xingwei Chen asked if the slab width for SJPCP is the same as the joint spacing. Julie indicated that all of the design procedures assume a square slab, but there may be instances where the dimensions have to be slightly different. Lastly, Kumar Dave asked if the tool is applicable if the existing concrete is JRCP or CRCP. Julie's response was yes, but she noted that it would extend the tool beyond what it was intended for and that there would be an increase in the stiffness of the cement-stabilized base layer modeled in the procedure.

20. Software Training Topic 2: Improved Design Procedure for Unbonded Concrete Overlays (TPF-5(269)) – Dr. Julie Vandenbossche (University of Pittsburgh)

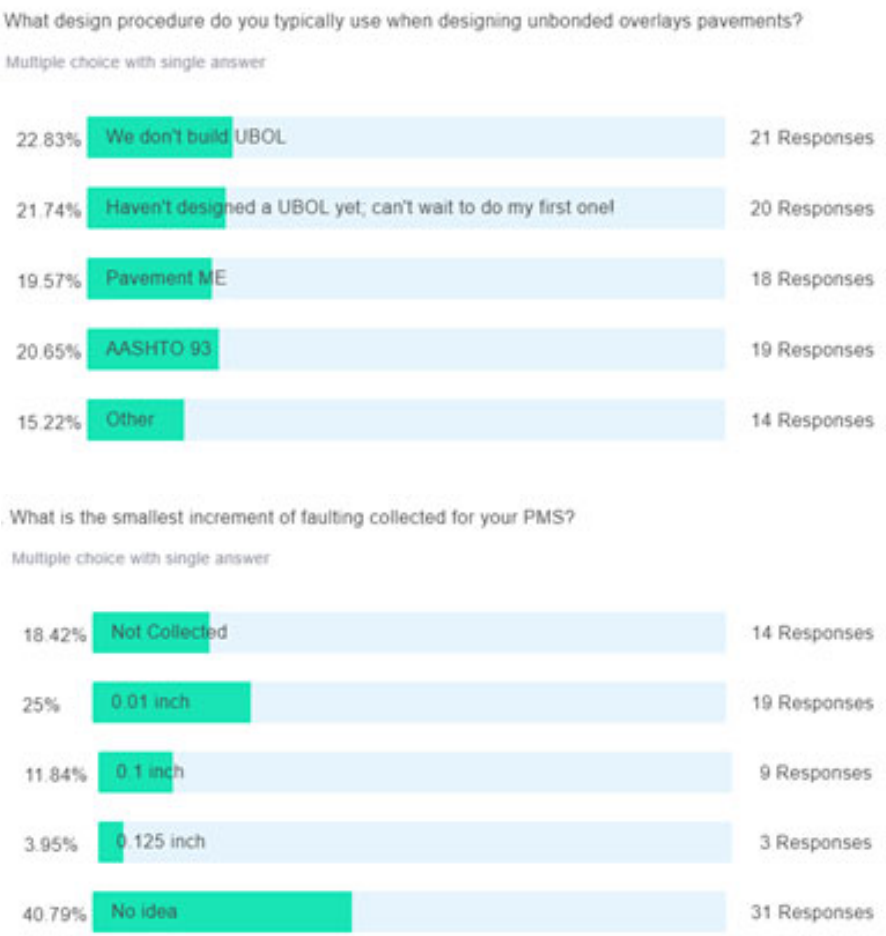
In her second block of training, Dr. Julie Vandenbossche presented on the Pooled Fund TPF-5(269) study, which developed the Pitt UBOL-ME design procedure for unbonded concrete overlays. Julie discussed how a critical factor in performance is the interlayer, which can consist of a nonwoven geotextile fabric or an asphalt layer of varying condition and properties. She provided the key factors to interlayer success and described how the Pitt UBOL-ME structural model directly accounts for the interlayer behavior.

Julie discussed the Pitt UBOL-ME joint faulting model and illustrated the predicted faulting trends for overlays containing different interlayer types, different dowel bar sizes, and different slab dimensions. She also touched upon the slab cracking model and showed the impacts of interlayer type, dowel size, and shoulder type on required overlay thickness.

Following this training session, Julie posed two more poll questions to the participants:

- *What design procedure do you typically use when designing unbonded overlay pavements?*
- *What is the smallest increment of faulting collected for your PMS?*

A total of 92 and 76 participants, respectively, responded to these questions and the results are shown below. About 44 percent of the respondents haven't designed or built UBOL pavements. About 20 percent each use PMED and AASHTO 1993 to design this type of pavement. Regarding the increment of faulting data collected, most respondents had no idea what increment is used, 25 percent reported an increment of 0.01 inch, and 12 percent reported an increment of 0.1 inch.



Tim Anderson asked if there is a widened slab option for Pitt UBOL-ME, to which Julie responded yes. Eric Ferrebee inquired if the design program is free and available online. Julie stated it is free and can be obtained at http://uboldesign3.azurewebsites.net/.

21. Software Training Topic 3: Example Application of CAT Tool for Flexible Pavement Design – Wouter Brink (ARA)

Wouter Brink began his training session by briefly reviewing past and current CAT training webinars (October 10 and 22, 2019 and December 2 and 16, 2020) and providing an overview of the local calibration process. He provided a detailed demonstration of the CAT using actual data from a pool of flexible pavement projects. The demonstration focused on the calibration of the bottom-up fatigue cracking model.

Wouter illustrated the process for uploading PMED project files and measured data to the web-based CAT. He showed how to develop the experimental design matrix within the CAT by identifying primary variables that impact performance, how to select the projects to be used for calibration, and how to statistically determine the minimum number of sections required for the calibration. He explained how to use the tool to review the adequacy of the selection section data and the populated experimental design matrix.

In the next part of the demonstration, Wouter described setting up the initial verification, which requires selecting either the global model calibration coefficients (PMED default values) or importing coefficients from a previous local calibration. Wouter noted that the

latter coefficients need to be compatible with PMED v2.5.5 and v2.6. Once the initial verification runs for the selected projects are completed, the measured versus predicted plot is displayed in the CAT, along with various computed statistics. Wouter showed how the results can be analyzed in detail to identify ways to improve performance prediction capabilities through proper refinements to the data set.

After a second set of runs (i.e., optimization runs) are completed, the resulting measured versus predicted plot, residual error plot, and regression analysis table are displayed. Wouter explained that the user must identify what the needs of the model are and identify the cracking model coefficients that can be adjusted to reduce the bias and/or standard error in the cracking predictions. He showed the iterative process of selecting revised coefficients and observing the effects within the CAT, as well as the optimization review module that allows the user to compare the results of the initial verification, accepted optimization (i.e., local calibration), and validation runs.

At the end of Wouter's demonstration, Harold Von Quintus emphasized the importance of reviewing the data before starting the calibration process. He strongly encouraged knowing what data you have and what the data mean relative to the PMED methodology.

Jay Goldbaum asked if the December 2, 2020 webinar is posted online yet and Wouter indicated he will get it uploaded following the User Group meeting. Linda Pierce provided the group with the webpage link for the webinar (https://me-design.com/MEDesign/Webinars.html?AspxAutoDetectCookieSupport=1). Prajwol Tamrakar asked what the minimum number of pavement sections is and Wouter explained it is used to check if there are enough sections from a statistical standpoint from which to make reliable conclusions about the results.

Jay Goldbaum asked if the length of a project is critical or if a project can be broken down into segments (e.g., five 1-mi long segments for a 5-mi project)? Harold advised against using long segments as there is likely to be significant variability in things like thickness and condition that will complicate the local calibration process. He recommended segment lengths be no longer that what is typically used in pavement management (500 or possibly 1,000 ft). Daniel Gorin asked for an explanation of bias and how it differs from trends. Wouter answered that bias is the consistent under- or over-prediction between measured and predicted performance, and that it is determined as the average residual error. Harold added that the trend is related to individual residual errors whereas bias is the combination of all the residual errors.

22. Overview of Future User Group Events – Dr. Jennifer Albert (FHWA)

Dr. Jennifer Albert briefed the participants on the plans for future PMEUG meetings under the new task order. She indicated the month of November is being targeted for the 2021 and 2022 meetings, and the expectation is for those meetings to be held face-to-face.

Jennifer also spoke on the software training webinars that are being planned. She noted that while the schedule for the webinars has not been set, it is anticipated the first one will occur in the spring of 2021 and an official announcement about it will be made soon. Jennifer requested participants contact the APTech project team or FHWA regarding any topics of interest for the webinars or a desire to present information in the webinars.

Lastly, Jennifer discussed the Implementation RoadMap workshop. She indicated that working meeting was originally expected to take place in the spring of 2021, but it may need to be delayed a few months so that a face-to-face format can be used.

23. Future Software Training – Dr. Linda Pierce (NCE) and Kelly Smith (APTech)

Dr. Linda Pierce re-engaged the group on the issue of software training. She summarized the training topics covered in past user group meetings and explained the need to develop the future webinars around topics that are of most interest to the group. To solicit feedback, the following poll question was presented and participants were asked to rank the ten training topics in order from highest to lowest interest.

- *What software training topics would be of greatest interest and/or value to you in future webinars and user group meetings?*
  - *CRC Design.*
  - *Designing with Geotextiles.*
  - *Full-Depth Reclamation (FDR) / Cold In-Place Recycling (CIR).*
  - *PCC Overlays of Existing Rigid Pavement.*
  - *Reflection Cracking.*
  - *Perpetual / Long-Life Design of Flexible Pavements.*
  - *HMA Overlays of Existing Flexible Pavement.*
  - *PCC Overlays of Existing Flexible Pavement.*
  - *HMA Overlays of Existing Rigid Pavement (including both intact and fractured PCC).*
  - *MERRA2 Climate Data.*

A total of 70 responses were received and the following priorities were identified:

1. HMA Overlays of Existing Flexible Pavement.
2. FDR / CIR Design.
3. Designing with Geotextiles
4. HMA Overlays of Existing Rigid Pavement (including both intact and fractured PCC).
5. Perpetual / Long-Life Design of Flexible Pavements.
6. Reflection Cracking.
7. PCC Overlays of Existing Flexible Pavement.
8. MERRA2 Climate Data.
9. PCC Overlays of Existing Rigid Pavement.
10. CRC Design.

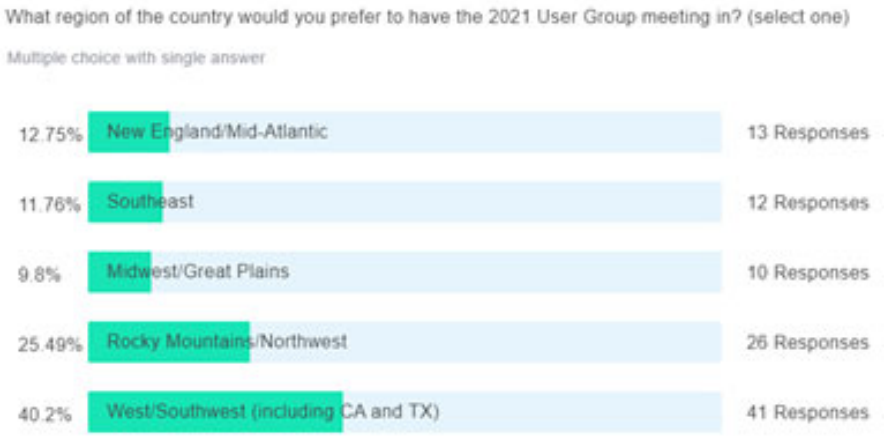
24. 2021 User Group Meeting – Dr. Linda Pierce (NCE) and Kelly Smith (APTech)

Dr. Linda Pierce and Kelly Smith queried the group about the desired location for the 2021 face-to-face User Group meeting. The following question and location options were posed:

- *What region of the country would you prefer to have the 2021 User Group meeting in?*
  - *New England / Mid-Atlantic.*
  - *Southeast.*
  - *Midwest / Great Plains.*

- *Rocky Mountains / Northwest.*
- *West / Southwest (including California and Texas).*

A total of 102 participants responded and the results are shown below. As can be seen, the greatest number of votes were for the West / Southwest region followed by the Rocky Mountains / Northwest region.



Brian Chang asked if the next annual User Group meeting can be arranged as both a virtual and in-person meeting. Kelly indicated that, since the new task order includes provisions for live-streaming the face-to-face meetings, participants who are unable to attend the meeting in person will be given the opportunity to attend virtually.

25. Meeting Wrap-Up

Dr. Linda Pierce, Kelly Smith, and Dr. Jennifer Albert thanked everyone for their participation in the meeting and expressed appreciation to all the speakers and presenters. Also, Linda reminded the group that a meeting report will be prepared and made available in the coming weeks and that 2021 events will include a couple of training webinars, the RoadMap workshop, and the annual User Group meeting. Linda adjourned the meeting at 2:40 p.m CST.

Attachment 1. Meeting Participants

TPF-5(305) Technical Advisory Committee (TAC) and Pooled Fund Member Participants

Name	Agency	TPF-5(305) TAC Member	PMED Task Force Member	Email Address
Tom Yu	FHWA	Yes	FHWA Liaison	tom.yu@dot.gov
Jennifer Albert		Yes	No	jennifer.albert@dot.gov
Chris Wagner		Yes	No	christopher.wagner@dot.gov
Nadarajah Sivaneswaran		Yes	No	Nadarajah.Sivaneswaran@dot.gov
Stephen Cooper		No	No	Stephen.J.Cooper@dot.gov
Matthew Corrigan		No	No	matthew.corrigan@dot.gov
Richard B. Duval		No	No	Richard.Duval@dot.gov
LaToya Johnson		No	No	Latoya.Johnson@dot.gov
Chu Wei		No	No	chu.wei@dot.gov
Larry Wiser		No	No	Larry.Wiser@dot.gov
Ryan Fragapane	AASHTO	Yes	Yes	rfragapane@aashto.org
Tinika Fowlkes		No	No	tfowlkes@aashto.org
Scott George	Alabama DOT	Yes	No	georges@dot.state.al.us
John Jennings		Yes	No	jenningsj@dot.state.al.us
Scott Weinland	Arizona DOT	No	No	SWeinland@azdot.gov
Mehdi Parvini	California DOT	Yes	No	Mehdi_Parvini@dot.ca.gov
Dulce Rufino Feldman		Yes	Yes	dulce.rufino@dot.ca.gov
Melody Perkins	Colorado DOT	Yes	No	melody.perkins@state.co.us
Mary Jane Hayden	Florida DOT	Yes	No	MaryJane.Hayden@dot.state.fl.us
Greg Davis		Yes	No	Greg.Davis@dot.state.fl.us
Ian Rish	Georgia DOT	Yes	No	irish@dot.ga.gov
Ciprian Donisa		No	No	CDonisa@dot.ga.gov
Robie Cunningham		No	No	RCunningham@dot.ga.gov
Jeremiah Daniel		No	No	jedaniel@dot.ga.gov
Eugene Utsalo		No	No	eutsalo@dot.ga.gov
Charles Wienrank	Illinois DOT	Yes	No	charles.wienrank@illinois.gov
Ben Behnami	Iowa DOT	Yes	No	Ben.Behnami@dot.iowa.gov
Chris B. Brakke		Yes	No	Chris.Brakke@iowadot.us
Nat Valesquez Jr.	Kansas DOT	Yes	No	nat.velasquez@ks.gov
Ryan Barrett		Yes	No	Ryan.Barrett@ks.gov
Sunil Saha	Kentucky TC	Yes	No	sunil.saha@ky.gov
Brad Frazier		No	No	Brad.Frazier@ky.gov
Jonathan Reynolds		No	No	Jonathan.Reynolds@ky.gov
Adam Ross		Yes	No	Adam.Ross@ky.gov
M. Alauddin Ahammed	Manitoba Infrastructure	Yes	No	alauddin.ahammed@gov.mb.ca
Yasir Shah		Yes	No	Yasir.Shah@gov.mb.ca
William Tang		No	No	William.Tang@gov.mb.ca
Marcus Wong		No	No	marcus.wong@gov.mb.ca
Praveen Desaraju	Maryland SHA	No	No	PDesaraju@mdot.state.md.us
Justin Schenkel	Michigan DOT	Yes	No	schenkelj@michigan.gov
Jami Trudelle		No	No	TrudelleJ1@michigan.gov
W. Griffin Sullivan	Mississippi DOT	Yes	No	wsullivan@mdot.ms.gov
W. Alex Middleton		No	No	amiddleton@MDOT.MS.GOV
Bill Barstis		No	No	wbarstis@mdot.ms.gov
John Donahue	Missouri DOT	Yes	No	john.donahue@modot.mo.gov
Jason Blomberg		No	No	Jason.Blomberg@modot.mo.gov
Jeff Kroner		No	No	jeffery.kroner@modot.mo.gov
Christine Kelgard	Nevada DOT	Yes	No	CChia@dot.nv.gov
Nathan Morian		No	No	nmorian@dot.nv.gov
Clark Morrison	North Carolina DOT	Yes	Yes	cmorrison@ncdot.gov
Shihai Zhang		No	No	szhang2@ncdot.gov
TJ Murphy	North Dakota DOT	No	No	tjmurphy@nd.gov
Andy Ayash		No	No	aayash@nd.gov
Amy Beise		No	No	abeise@nd.gov
Jon Stork		No	No	jstork@nd.gov

Name	Agency	TPF-5(305) TAC Member	PMED Task Force Member	Email Address
Susanne Chan	Ontario MOT	Yes	Yes	susanne.chan@ontario.ca
Warren Lee		No	No	Warren.Lee@ontario.ca
Fiona Leung		No	No	Fiona.Leung@ontario.ca
Josh Freeman	Pennsylvania DOT	Yes	No	josfreeman@pa.gov
Lydia Peddicord		Yes	No	lpeddicord@pa.gov
Dahae Kim	South Carolina DOT	Yes	No	kimd@scdot.org
Eric Carroll		No	No	CarrollE@scdot.org
Hari Nair	Virginia DOT	Yes	Yes	harikrishnan.nair@vdot.virginia.gov
Girum Merine		Yes	No	girum.merine@vdot.virginia.gov
Affan Habib		No	No	Affan.Habib@vdot.virginia.gov
Bipad Saha		No	No	bipad.saha@vdot.virginia.gov
Tirupan Mandal	Wisconsin DOT	Yes	No	Tirupan.Mandal@dot.wi.gov

Non-TAC / Non-Pooled Fund Member Participation

Name	Agency	PMED Task Force Member	Email Address
Kelly Smith Prashant Ram Max Grogg	APTech	No No No	klsmith@appliedpavement.com pram@appliedpavement.com mgrogg@appliedpavement.com
Linda Pierce Timin Punnackal Sarah Stolte	NCE	No No No	LPierce@ncenet.com tpunnackal@ncenet.com sstolte@ncenet.com
Chadwick Becker Harold Von Quintus Wouter Brink Praveen Gopisetti Shreenath (Shree) Rao	ARA	No No No No No	cbecker@ara.com hvonquintus@ara.com wbrink@ara.com lgopisetti@ara.com srao@ara.com
Steve Saboundjian	Alaska DOT&PF	No	steve.saboundjian@alaska.gov
Wei He Jhuma Saha	Alberta Transportation	No No	wei.he@gov.ab.ca Jhuma.Saha@gov.ab.ca
Manoj Jogi	British Columbia MOTI	No	Manoj.Jogi@gov.bc.ca
Jennifer Pinkerton	Delaware DOT	No	jennifer.pinkerton@delaware.gov
Kyle Buyuan Brian Chang Kristi Grilho Brandon Hee Ken Hong	Hawaii DOT	No No No No No	kyle.l.buyuan@hawaii.gov brian.k.chang@hawaii.gov kristi.m.grilho@hawaii.gov brandon.h.hee@hawaii.gov ken.k.hong@hawaii.gov
John Arambarri Tyler Coy	Idaho Transportation Department	No No	john.arambarri@itd.idaho.gov tyler.coy@itd.idaho.gov
Kumar Dave Seonghwan Cho Nick Cosenza Allen Davidson Tony Jones Jusang Lee Pankaj Patel Matthew Thomas	Indiana DOT	Yes No No No No No No No	KDAVE@indot.IN.gov scho@indot.in.gov ncosenza@indot.in.gov adavidson@indot.in.gov twjones@indot.in.gov JLee@indot.IN.gov papatel@indot.in.gov mthomas@indot.in.gov
Xingwei Chen James Ball Jeffrey Lambert Mark Ordogne	Louisiana DOTD	No No No No	xingwei.chen@la.gov James.ball@la.gov jeff.lambert@la.gov mark.ordogne@la.gov
Uma Maheswar Arepalli Lyric Deagle Karen Gross	Maine DOT	No No No	uma.arepalli@maine.gov lyric.deagle@maine.gov karen.gross@maine.gov
Tim Anderson Steven Henrichs Bruce Tanquist	Minnesota DOT	No No No	Timothy.Lee.Andersen@state.mn.us steven.henrichs@state.mn.us bruce.tanquist@state.mn.us
D.J. Berg Jeff Jackson Greg Zeihen	Montana DOT	No No No	djberg@mt.gov jejackson@mt.gov gzeihen@mt.gov
Katharine Fischer Kellie Troxel	Nebraska DOT	No No	katharine.fischer@nebraska.gov kellie.troxel@nebraska.gov
Patrick Colburn Kevin Prince Eric Thibodeau Ryan Worsman	New Hampshire DOT	No No No No	patrick.colburn@dot.nh.gov kevin.prince@dot.nh.gov ethibodeau@dot.state.nh.us Ryan.K.Worsman@dot.nh.gov
Nusrat Morshed Sudeh Sadeqlu Vatsalkumar Patel Ogechi Schwiers	New Jersey DOT	No No No No	Nusrat.Morshed@dot.nj.gov sudeh.sadeqlu@dot.nj.gov Vatsalkumar.Patel@dot.nj.gov Ogechi.Schwiers@dot.nj.gov
Nicholas Davis Tom Kane	New York State DOT	No No	nicholas.davis@dot.ny.gov thomas.kane@dot.ny.gov
William Feehan Patrick Bierl	Ohio DOT	No Yes	william.feehan@dot.ohio.gov Patrick.Bierl@dot.ohio.gov
Amanda Warren	Oklahoma DOT	No	awarren@odot.org

Name	Agency	PMED Task Force Member	Email Address
Paul Burch	Oregon DOT	No	paul.t.burch@odot.state.or.us
Dustin Haas		No	dustin.j.haas@odot.state.or.us
Doug Keys		No	Douglas.keys@odot.state.or.us
Dan Schiller		No	daniel.schiller@odot.state.or.us
Brian Sullivan		No	Brian.J.Sullivan@odot.state.or.us
Rick Villarreal		No	Richard.Villarreal@odot.state.or.us
Felix Doucet	Quebec MOT	Yes	Felix.Doucet@transports.gouv.qc.ca
Julie Roby		No	julie.roby@transports.gouv.qc.ca
Denis St-Laurent		No	denis.st-laurent@transports.gouv.qc.ca
Olivier Sylvestre		No	olivier.sylvestre@transports.gouv.qc.ca
Ania Anthony	Saskatchewan MOHI	No	Ania.Anthony@gov.sk.ca
Daniel Gorin		No	daniel.gorin@gov.sk.ca
Diana Podborochynski		No	diana.podborochynski@gov.sk.ca
Bayan Faraj	Tennessee DOT	No	bayan.faraj@tn.gov
Austin Holliman		No	Austin.Holliman@tn.gov
Xiaoyang Jia		No	Xiaoyang.Jia@tn.gov
Hong Park		No	hong.park@tn.gov
Sampson Udeh		No	sampson.udeh@tn.gov
Mark E. Woods		No	Mark.Woods@tn.gov
David Holmgren	Utah DOT	Yes	dholmgren@utah.gov
Lauriane Collins		No	lwales@utah.gov
Jason Simmons		No	jasonsimmons@utah.gov
Jianhua Li	Washington State DOT	No	liJia@wsdot.wa.gov
Mark Russell		No	russelm@wsdot.wa.gov
Kim Schofield		No	schofik@wsdot.wa.gov
Jeff Uhlmeyer		No	Uhlmeyj@wsdot.wa.gov
Vince Allison	West Virginia DOT	No	Vincent.L.Allison@wv.gov
Sherri Rowan		No	sherri.k.rowan@wv.gov
Michael Troyan		No	michael.o.troyan@wv.gov
Ryan Steinbrenner	Wyoming DOT	No	ryan.steinbrenner@wyo.gov
Emiliano Martinez		No	emiliano.martinez@wyo.gov
Whitney Wise		No	whitney.wise@wyo.gov
Ahmed Ghazy	City of Winnipeg Manitoba	No	aghazy@winnipeg.ca

Academia/Consultant/Industry Representative Participation

Name	Agency	PMED Task Force Member	Email Address
Eric Ferrebee	ACPA	No	eferrebee@acpa.org
Brent Burwell	ACPA	No	bburwell@pavement.com
Richard Jucha	ACPA	No	rjucha@pavement.com
John Leckie	ACPA	No	jleckie@pavement.com
Patrick Long	ACPA	No	plong@pavement.com
Sarah Sanders	ACPA	No	ssanders@pavement.com
Larry D. Scofield	ACPA	No	lscofield@pavement.com
Angela Folkestad	ACPA (CO/WY Chapter)	No	afolkestad@pavement.com
Mark Shelton	ACPA (MO/KS Chapter)	No	mark@moksacpa.com
John Becker	ACPA (PA Chapter)	No	jbecker@pavement.com
Jason Reaves	ACPA (SD Chapter)	No	jreaves.sdacpa@midconetwork.com
Ramon Bonaquist	Advanced Asphalt Tech	No	aatt@erols.com
Claudia Zapata	Arizona State U.	No	czapata@asu.edu
Amy Miller	Asphalt Pavement Alliance	No	amiller@asphaltroads.org
Yusheng Jiang	Case Western Reserve Univ.	No	yjx470@case.edu
Tyler Speakmon	CEMEX	No	michaelt.speakmon@cemex.com
Mike Skinner	Colorado Asphalt Assoc.	No	mikeskinner@co-asphalt.com
Greg Mulder	ConcreteState	No	gmulder@concretestate.org
Brian Wyatt	ECS Limited	No	bwyatt@ecslimited.com
Brian Jasion		No	bjasion@ecslimited.com
Georgene Geary	GGfGA Engineering, LLC	No	ggeary@ggfga.com
Jamshid Armaghani	Global Sustainable Solutions	No	jamshid@bellsouth.net
Andrew Balasundaram	Golder	No	abalasundaram@golder.com
Mark Ondecko	Gulisek	No	mark.ondecko@gulisek.com
Halil Ceylan	Iowa State University	No	hceylan@iastate.edu
Sunghwan Kim		No	sunghwan@iastate.edu
Nazik Citir		No	ncitir@iastate.edu
Xuan Chen	Kiewit Engineering Group	No	xuan.chen@kiewit.com
Nicole Souder		No	Nicole.Souder@Kiewit.com
Jean-Pascal Bilodeau	Laval University	No	jean-pascal.bilodeau@gci.ulaval.ca
Erdrick Pérez-González		No	erdrick.perez-gonzalez.1@ulaval.ca
Mahdi Ghazavi	Michigan State University	No	ghazavim@msu.edu
Syed Haider		No	syedwaqa@egr.msu.edu
Mumtahin Hasnat		No	hasnatmu@msu.edu
Muhammed Emin Kutay		No	kutay@egr.msu.edu; kutay@msu.edu
Hamad Muslim		No	muslimha@msu.edu
Nam Tran	NCAT, Auburn University	No	nht0002@auburn.edu
Fabricio Leiva		No	leivafa@auburn.edu
Mark Pardi	Ohio Concrete	No	mark@ohioconcrete.org
Gary W. Sharpe	Palmer Engineering	No	gsharpe@palmernet.com
Bruce Dietrich	Pavement Analytics, LLC	No	bdietrich@pavementanalytics.com
Wiley Cunagin		No	wcunagin@gmail.com
M. Mirzahosseini	Purdue University	No	mhoseini@purdue.edu
Behnam Jahangiri		No	bjahangiri@purdue.edu
Reza Pouranian		No	mpourani@purdue.edu
Chetana Rao	Rao Research and Consulting	No	crao@raorc.com
Jay Goldbaum	RockSol Consulting Group	No	goldbaum@rocksol.com
Hao Wang	Rutgers University	No	hwang.cee@rutgers.edu
Xiaodan Chen		No	xiaodanchen74@hotmail.com
Pengyu Xie		No	px19@scarletmail.rutgers.edu
Vladimir Mitchev	S&ME	No	vmitchev@smeinc.com
Jay Thompson	SEPI	No	JThompson@sepiinc.com
André Contant	SNC Lavalin	No	andre.contant@snclavalin.com
Frank Liu		No	frank.liu@snclavalin.com
Andy Johnson	SCPA	No	ajohnson@secement.org
Donovan Bradshaw	Standard Testing and Eng.	No	dbradshaw@stantest.com
Amr Ayed	Stantec	No	amr.ayed@stantec.com

Name	Agency	PMED Task Force Member	Email Address
Charles Stuart	SWCPA	No	cstuart@swcpa.org
Prajwol Tamrakar Garrett Fountain	Tensar Corp	No No	PTamrakar@tensarcorp.com GFountain@tensarcorp.com
Jesse Kwilosz	The Transtec Group, Inc.	No	jesse@thetranstecgroup.com
Sam Esfandiarpour Chaminda Wekumbura Maria Elena Oberez	Thurber Engineering	No No No	sesfandiarpour@thurber.ca chaminda@thurber.ca eoberez@thurber.ca
Ignacio Rodriguez	THX Ingeniería	No	itrodriguez@thxingenieria.cl
Sonny Kim Stephen A. Durham Chandler Banks	University of Georgia	No No No	kims@uga.edu sdurham@uga.edu chandler.banks@uga.edu
Adrian Ricardo Archilla	University of Hawaii	No	archilla@hawaii.edu
Clark Graves Kean Ashurst Brad Rister	University of Kentucky	No No No	clark.graves@uky.edu kean.ashurst@uky.edu brad.rister@uky.edu
Charles W. Schwartz	University of Maryland	No	schwartz@umd.edu
Sarah Gassman Nicolet DeVine	University of South Carolina	No No	gassman@cec.sc.edu nicoletc@email.sc.edu
Amy Simpson	Wood	No	amy.simpson@woodplc.com
Paul Mykytka	WSP	No	paul.mykytka@wsp.com
Mohammad Mosawi	n/a	No	m.mosawi86@gmail.com

Attachment 2. Meeting Agenda

Session 1—Tuesday December 8, 2020

Time (ET)	Session and Topics
Noon–12:45 PM	1A. WELCOME AND INTRODUCTIONS Welcome | Linda Pierce (NCE) and Kelly Smith (APTech) FHWA Welcome and Remarks | Jennifer Albert (FHWA Task Manager & Pooled Fund Manager) AASHTO COMP and ME Task Force Remarks | John Donahue (Missouri DOT, AASHTO COMP Technical Subcommittee 5D Chair) and Clark Morrison (North Carolina DOT, AASHTOWare Pavement ME Design Taskforce) Canadian Update | Susanne Chan (Ontario Ministry of Transportation, Transportation Association of Canada MEPD Subcommittee Liaison) Review of meeting agenda and goals | Linda Pierce (NCE) and Kelly Smith (APTech)
12:45–2:20 PM	1B. AGENCY IMPLEMENTATION UPDATES/REPORT-OUTS Agency briefings on implementation plans, timelines, and progress | Designated Agency Speakers
2:20-2:30 PM	BREAK
2:30-3:30 PM	1C. AASHTOWARE PAVEMENT ME DESIGN SOFTWARE UPDATE AASHTO Briefing (announcements/news, customer relations) | Ryan Fragapane (AASHTO) Software enhancements/updates (incl. new features/capabilities) | Chad Becker and Harold Von Quintus (ARA)
3:30-4:00 PM	1D. IMPLEMENTATION/CALIBRATION EFFORTS—ISSUES, CHALLENGES, SOLUTIONS Michigan DOT's Implementation and Calibration Efforts | M. Emin Kutay (Michigan State University)

Session 2—Wednesday December 9, 2020

Time (ET)	Session and Topics
Noon–12:05 PM	OPENING Session Overview | Linda Pierce (NCE)
12:05-2:00 PM	2A. IMPLEMENTATION/CALIBRATION EFFORTS—ISSUES, CHALLENGES, SOLUTIONS (continued) Incorporating Rehabilitation Design using Pavement ME in Virginia | Affan Habib (Virginia DOT) Missouri DOT's 2nd Calibration Study | Jason Blomberg (Missouri DOT) Alabama's Flexible Pavement Design Implementation Effort | Nam Tran (National Center for Asphalt Technology [NCAT]) Indiana DOT's Implementation Initiative of PMED v2.6 | Kumar Dave and Nicholas Cosenza (Indiana DOT)
2:00–2:10 PM	BREAK
2:10-3:00 PM	2B. PCC DESIGN ISSUES AND APPLICATIONS Development of Concrete Material Database for Pavement ME Design in Georgia | S. Sonny Kim, Stephan Durham, and Chandler Banks (University of Georgia) Maintenance Cycles for Long-Life Concrete Pavement | John Becker (ACPA-Pennsylvania Chapter)
3:00-4:00 PM	2C. OPEN FORUM — PAVEMENT ME REALITY CHECK Michigan DOT PMED State of the Practice, Agency Issues, and Industry Concerns | Justin Schenkel (Michigan DOT) Open Forum Discussion | Linda Pierce (NCE) and Meeting Participants

Session 3—Thursday December 10, 2020

Time (ET)	Session and Topics
Noon–12:05 PM	OPENING Session Overview | Linda Pierce (NCE)
12:05-12:30 PM	3A. ME RESEARCH SUMMARIES FHWA Research Update | Tom Yu (FHWA) NCHRP Research Update | Linda Pierce (NCE)
12:30-2:00 PM	3B. SOFTWARE TRAINING SJPCP/BCOA Design | Julie Vandenbossche (University of Pittsburgh) Improved Design Procedure for Unbonded Concrete Overlays (TPF-5(269)) | Julie Vandenbossche (University of Pittsburgh)
2:00-2:15 PM	BREAK
2:15-3:15 PM	3B. SOFTWARE TRAINING (continued) Local Calibration: Example Application of CAT Tool for Flexible Pavement Design | Wouter Brink and Harold Von Quintus (ARA)
3:15-3:45 PM	3C. FUTURE USER GROUP EVENTS Overview (meetings, webinars, roadmap workshop) | Jennifer Albert (FHWA) Future Software Training | Linda Pierce (NCE) and Kelly Smith (APTech) 2021 User Group Meeting | Linda Pierce (NCE) and Kelly Smith (APTech)
3:45–4:00 PM	MEETING WRAP UP Concluding remarks | Linda Pierce (NCE) and Kelly Smith (APTech)

Attachment 3. Questions and Answers

Q&A (Dec 8)					
Last Name	**First Name**	**Email Address**	**Question Asked**	**Answer Given**	**Answerer**
Brakke	Chris	chris.brakke@iowadot.us	Will a list of attendees be shared?	Yes, just like in past meetings, this info will be included as part of the Meeting Summary report, which will be posted on the Pooled fund website	Kelly Smith
Brink	Wouter	wbrink@ara.com	Is this clearinghouse different than the existing MEPDG clearinghouse? And if so, will the existing information be included in the new clearinghouse?	Verbal Response---They are different. The clearinghouse discussed in previous meetings was focused solely on Pavement ME-related research.	Linda Pierce, Kelly Smith
Goldbaum	Jay	goldbaum@rocksol.com	Are you going to look at widen lanes?	Verbal Response---Not currently investigating widened lanes for concrete design as part of the trials, but it could be considered in the future	Susanne Chan, Linda Pierce
Tamrakar	Prajwol	ptamrakar@tensarcorp.com	Susanne- You mentioned about the innovative materials in the last conference. What types of innovative materials were dicussed?	Verbal Response---The innovative materials and design strategies discussed at the 2020 TAC Conference included inverted pavement design (i.e., cushion layer of aggregates between two bound layers), jointed reinforced concrete pavement (JRCP) rubblization with ground tire rubber in warm-mix asphalt (WMA), and long-life design with stone matrix asphalt (SMA) surface with lab-derived materials input	Susanne Chan, Linda Pierce
Sadeqlu	Sudeh	sudeh.sadeqlu@dot.nj.gov	Where we can register for DEc 16th Webinar again?	https://bit.ly/2VT5lXT	Prashant Ram
Behnami	Ben	ben.behnami@iowadot.us	how can I request attendence in the 12/16/20 webinar?	https://bit.ly/2VT5lXT	Prashant Ram
Goldbaum	Jay	goldbaum@rocksol.com	What is the status of foreign accounts?	https://bit.ly/2VT5lXT	Prashant Ram
Schenkel	Justin	schenkelj@michigan.gov	Was the run time for PMED v2.6 sped up or slowed down?	Verbal Response---The run time was significantly improved from v2.5.5, but there is still a legacy slow-down of about 2 to 2.5 times compared to v2.3.	Chad Becker
Schenkel	Justin	schenkelj@michigan.gov	Is there a significant known error with v2.3? Michigan industry groups assert that there is.	Verbal Response---I'm not aware of such an error.	Chad Becker
Goldbaum	Jay	goldbaum@rocksol.com	How will the local calibration be intergrated into the web application?	Verbal Response---Locally calibrated factors will be able to be imported into the agency's work space within the program.	Chad Becker
Saha	Sunil	Sunil.Saha@KY.GOV	Chad - At the end of your prsentation (if time permits), can you go over selection of MERRA2 climatic grid station? I had worked with those earlier with you for version 2.5.6. But unable to make it work with current version 2.6. Please keep in mindl am working mainly remotely to access my PAVE-ME sostware in my workstation at office.	Verbal Response---Users having issues with selecting climate data are encouraged to contact the ME Design Support Team at pavementmedesign@ara.com. The process entails entering the project location (nearest city) in the climate module (next to the Google map), selecting one of the nine MERRA2 grid points that display as red markers on the map, downloading the climate data for that grid point from the LTPP InfoPave site, unzipping the climate data file and dragging it into the .hcd folder, and refreshing the map. After refreshing, the grid point marker turns to blue and can then be selected for the design.	Chad Becker
Hee	Brandon	brandon.h.hee@hawaii.gov	Is there an input for elastic recovery for the Top-Down Cracking?	Verbal Response---Refer to NCHRP 1-52 report; information should be available there.	Linda Pierce
Hee	Brandon	brandon.h.hee@hawaii.gov	Is there a non-linear input of the variation of dynamic modulus with confinement?	Verbal Response---Refer to NCHRP 1-52 report; information should be available there.	Linda Pierce
Hee	Brandon	brandon.h.hee@hawaii.gov	Do you allow for existing poor bond in the AC layers?	Verbal Response---Refer to NCHRP 1-52 report; information should be available there.	Linda Pierce
Hee	Brandon	brandon.h.hee@hawaii.gov	Do you allow for lower modulus for tension, or is the same number used as the compression modulus?	Verbal Response---Refer to NCHRP 1-52 report; information should be available there.	Linda Pierce
Von Quintus	Harold	HVONQUINTUS@AOL.COM	Were actual creep compliance and indirect tensile strength (ITD) data for the mixes used, or were the default Level 3 mixture properties used?	Verbal Response---Test data on 65 mixes were used in the 2014 calibration and these data provided for actual ITD and quasi-measured creep compliance inputs for the analysis.	Emin Kutay
Von Quintus	Harold	HVONQUINTUS@AOL.COM	What air void values were used in the study? PMED uses in-place air voids not design air voids.	Verbal Response---This is the case, but the analysis had to be approached from a job mix formula standpoint in the absence of in-place air voids data. Some historical in-place air void data may become available in the future which could then be considered. Also, it should be noted that the E* values used in the analysis were based on in-place air voids.	Emin Kutay
Ahammed	Alauddin	alauddin.ahammed@gov.mb.ca	You can use average compaction/density data	Verbal Response---MDOT has an effort underway to identify and gather design and construction data on many pavement sections, and in-place air voids could be targeted.	Emin Kutay

Q&A (Dec 9)

Last Name	First Name	Email Address	Question Asked	Answer Given	Answerer
Goldbaum	Jay	goldbaum@rocksol.com	Did Missouri do treches to develop the rutting models?	Verbal Response---No.	Jason Blomberg
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	Did MoDOT use CAT for local calibration or they did it manually?	Verbal Response---The Consultant did not use the CAT tool.	Jason Blomberg
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	As another question, do they have the detailed process in the report?	Verbal Response---The calibration process should be available in the project report.	Jason Blomberg
Schenkel	Jason		Did Missouri DOT see any variability in the predicted slab cracking. Michigan uses the global coefficients and gets the same predicted cracking every time.	Verbal Response---Missouri DOT did see variability.	Jason Blomberg
Goldbaum	Jay	goldbaum@rocksol.com	Does Missouri use the same distress threshold values for all classes of roadways?	Verbal Response---Yes. The only thing we may change is the reliability level.	Jason Blomberg
VON QUINTUS	HAROLD	HVONQUINTUS@AOL.COM	I believe one of the C-coefficients for bottom-up fatigue cracking was extremely low. Any reason why that was the case. A very low C-coefficietn stretches the cacking out.	Verbal Response---I don't have an answer. Written Response---Slide 14 needs the following corrections under the "Local Missouri" column: C1 = 1.3349, C2(< 5 in) = 3.367, C2(>12 in) = 1.215, C2(5 to 12 in) = 4.9042-0.3074h_{ac}.	Jason Blomberg
Yu	Tom	tom.yu@dot.gov	Do you feel 10% cracking for AC is equivalent to 2% cracking for PCC? You mentioned that 2% cracking for AC was not realistic for AC, but that was for 50% reliability.	Verbal Response---The values are appropriate within the context of the agency's alternate bidding process, but a more realistic scenario is 10 percent fatigue cracking after 10 to 12 years	Jason Blomberg
Henrichs	Steven	steven.henrichs@state.mn.us	Does modot have a iri and faulting criterea for concrete?	Verbal Response---We look at it but there are no criteria. There are specs for construction.	Jason Blomberg
George	Scott	georges@dot.state.al.us	Were cores taken to verify that cracking was bottom up or top down?	Verbal Response---Yes, we took cores.	Jason Blomberg
Archilla	Adrian Ricardo	archilla@hawaii.edu	For design, one definately want to use a high reliability, but for LCA, wouldn't you want to compare what could happen for the actually selected thicknesses on average (or at least at different reliability levels)?	For the LCCA, fixed rehabilitation assumptions are made for treating the PCCP and HMA designs. These LCCA assumptions are for bidding purposes only and we have not compared the actual rehabilitation efforts or costs to the designs.	Jason Blomberg
Sivaneswaran	Nadarajah	nadarajah.sivaneswaran@dot.gov	Jason, are you using 90% reliability for structural thickness design but 50% reliability (average) for preservation/rehab treatment timing and for example LCCA?	We haven't explored preservation/rehab designs yet; but I would say the reducing the reliability for rehabs should be considered.	Jason Blomberg
Rao	Chetana	crao@raorc.com	I am happy to answer the question on the c coefficient. Please have them contact me directly. (I am not sure which c-coeffiient they are referring to).	Linda emailed Harold's question on the c-coefficient to Chetena, who said she would follow-up with Harold with an answer.	Linda Pierce
VON QUINTUS	HAROLD	HVONQUINTUS@AOL.COM	Your comments about cracking initiating in less than 10 years suggests to me that some or all of that cracking could be top-down cracking. Just an item.	---	---
VON QUINTUS	HAROLD	HVONQUINTUS@AOL.COM	Is it possible to implement both new and rehab at the same time - In my opinion yes. However, I would recommend determining the calibration coefficients for new design first, and then apply them to the rehab sections. A high percent of the error and/or bias for the cracking predictions is related to the reflection cracking transfer function and one of the major factors in predicting reflecction cracking is load transfer efficiency for the existing cracks in an asphalt pavement. For rutting, I would recommend the same thing - defining the claibration coefficients for new pavements and then apply them to the rehab sections. One of the major issues when there is a significant bais is the plastic strain coefficients or k-factors for the existing layers, some of the sections with higher measured rut depths versus teh predictions is caused by moisture damage in those existing layers.	---	---
VON QUINTUS	HAROLD	HVONQUINTUS@AOL.COM	Layer debonding is another issue for rehab calibration for both cracking and rutting.	---	---
VON QUINTUS	HAROLD	HVONQUINTUS@AOL.COM	Suggestion about new verus reflection cracks - Only one which is the total cracks (reflection plus new cracks) should be used for design. One of the reasons why this was initially included by the NCHRP team was to identify whether the predicted cracks are reflection versus new in some of the LTPP sites - debonding or low friction between the layers.	---	--
VON QUINTUS	HAROLD	HVONQUINTUS@AOL.COM	My suggestion regarding rehab input level is to not use input level 3. Most agencies have the data to use rehab input levels 1 or 2 or both.	---	---
Hee	Brandon	brandon.h.hee@hawaii.gov	Were you able to see the delamination in the GPR data used to get the asphalt thickness?	Verbal Response---We did GPR for 15-16 sites and we did find delamination in some of the sites.	Hari Nair

Q&A (Dec 9)					
Last Name	**First Name**	**Email Address**	**Question Asked**	**Answer Given**	**Answerer**
Hayden	Mary Jane	maryjane.hayden@dot.state.fl.us	Does Virginia have much top-down cracking? (I'm curious, since you indicated that you won't be calibrating for this distress type anytime soon.)	We saw the same thing with fatigue cracking with v 2.6. Do other states have the same/similar experience with v 2.6 as well? Verbal Response---Virginia does experience top-down cracking, but we don't differentiate it from bottom-up cracking.	habib affan
Goldbaum	Jay	goldbaum@rocksol.com	How close was the predicted total rutting versus the actual rutting on the project?	Verbal Response---With the local calibrations, we've gotten them pretty close. For our 1.5-in overlay cycles of 12 to 15 years, we usually observe about 0.2 in of rutting, and that is about what PMED predicts.	Nick Cosenza
Velasquez	Nat	nat.velasquez@ks.gov	Is a recalibration necessary every time a new software version is released?	Verbal Response---I would recommended that verification at least be performed every time a new software version is released.	Nick Cosenza
Zhang	Shihai	szhang2@ncdot.gov	Did INDOT simply increase the compaction requirement in 2019 to reduce in place density?	Verbal Response---We used the older traffic data due to some issues with using new traffic data in v2.6.	Nick Cosenza
Rao	Chetana	crao@raorc.com	For a given aggregate type did you observe lower CTE values with increasing coarse aggregate content?	Verbal Response---There was not much variation in the volume content of the coarse aggregates, but one of the previous research studies (RP 10-04) showed that more coarse aggregate lowers the CTE values.	Sonny Kim
Archilla	Adrian Ricardo	archilla@hawaii.edu	At what age was the CTE measured? Have you analyzed its change with age? (Note: we saw significant variation with age, higher than that between quarries.)	Verbal Response---CTE was measured at 28 days. While a previous study (RP 10-04) examined CTE as a function of age, the current study did not.	Chandler Banks
Hee	Brandon	brandon.h.hee@hawaii.gov	Do these consider the use of dowels at the transverse joints and tie bars at the longitudinal joints?	Verbal Response---The design included doweled transverse joints.	Stephan Durham
Hee	Brandon	brandon.h.hee@hawaii.gov	Did you test rapid set concrete?	Verbal Response---No.	Sonny Kim
Goldbaum	Jay	goldbaum@rocksol.com	Sorry that I may have missed this in the presentation, but what was the distance between transverse joints?	Verbal Response---15 ft.	Stephan Durham, Sonny Kim, and Chandler Banks
Armaghani	Jamshid	jamshid@bellsouth.net	How was the construction specification changed for long-life pavements. Give a copule of examples.	Standard concrete pavement specifications (as of April 2020) now require optimized mixtures and lower cement content. For LLCP the w/c ratio is incentivized. LLCP also require higher type dowels; standard pavement epoxy coated.	Becker John M
Yu	Tom	tom.yu@dot.gov	The spalling model in ME is an empirical model. Is spalling a common problem in PA? We need to consider the possible causes of spalling, rather than relying on predictions from an empirical model.	We have had projects with spalling issues. It is one reason why our specifications have targeted durability issues	Becker John M
George	Scott	georges@dot.state.al.us	Are they using a stabilized open graded drainage layer?	It's not-stabilized for Pavement ME purposes.	Justin Schenkel
Kim	Sunghwan	sunghwan@iastate.edu	What are design life of JPCP and HMA pavements in Michigan for Pavement ME to determine design thickness?	20 years for both pavement types.	Justin Schenkel
Ferrebee	Eric	eferrebee@acpa.org	For Justin - Regarding the IRI and extremely high concrete thickness issues, I think one of the problems is using the thickness as the primary parameter to mitigate increases in IRI. IRI and Faulting (and when faulting and SF are driving IRI) tend to be addressed better with changing the geometry and concrete properties rather than increasing the thickness of the concrete. This is illustrated with the widened slab examples. We know that the widened slab greatly reduces edge stresses in the pavement and also reduces pumping. This has a huge impact on faulting and cracking, but cracking has already been mitigated by the thickness values. Because of all this, the best way we have found to optimize concrete designs is to obtain a minimum thickness to mitigate cracking, and then evaluate the concrete properties, slab geometry, JPCP and base parameters to properly mitigate faulting. Increasing thickness for faulting and IRI likely is not the best approach, especially if the SF issue is so pronounced.	Agreed.	Justin Schenkel

Q&A (Dec 9)					
Last Name	**First Name**	**Email Address**	**Question Asked**	**Answer Given**	**Answerer**
Rish	Ian	irish@dot.ga.gov	If you are using 72/81 then yes class 1-3 count if ME then it's not counted, don't know how to answer the question well	Understood.	Justin Schenkel
VON QUINTUS	HAROLD	HVONQUINTUS@AOL.COM	Regarding the issue of HMA transverse cracking and thickness, I suggest looking at what actual performance data tells you in terms of the importance of asphalt thickness versus predicted transverse cracking length or the observed cracking length. Also, I would suggest that an agency never use input Level 3 (Levels 1 and/or 2 should always be used). For rehabilitation design, I recommend always basing decisions on cores. Finally, I should point out that the minimum asphalt thickness given in the NCHRP 1-37A report is only for new designs. Pavement ME is applicable for HMA overlays down to 1.5 in. thick.	---	---
Yu	Tom	tom.yu@dot.gov	Comment on Justin Schenkel's Excessive Thickness for JPCP Question – based on your presentation, it looks like the excessive thickness that you are getting from ME is a result of trying to satisfy the IRI criteria. As you know, the IRI model is an empirical model. The thickness design of JPCP should be based solely on slab cracking. We will also likely run into difficulties trying to satisfy the IRI requirement for long-life pavements, since age is one of the model parameters. We may also to have problems meeting the faulting requirement for very heavy traffic (e.g., >100 million ESALs); we don't have the performance data to reliably predict faulting for very heavy traffic. In reality, if we have large-diameter dowel bars, we probably won't see significant faulting, unless we run into issues with loss of dowel cross-section though corrosion for very long-life pavements. I would highly recommend widened-slab design for very heavy traffic to ensure good faulting performance. But, I would probably design the section as one with tied-concrete shoulder, which will give some credit for the widened slab, but not reduce the thickness excessively. I think widened slab (13-ft) is a good insurance for both cracking and faulting performance.	---	---
Yu	Tom	tom.yu@dot.gov	Comment on Justin Schenkel's Widened-Slab Design Thickness Question – the critical stress drops significantly when you prevent the load from wandering out to the slab edge (especially for bottom-up stresses). The reduced thickness resulting from widened slab is consistent with engineering mechanics and fatigue theory, but the dramatically thinner section also worries me. Again, I think this is a matter of risk. The thickness reduction may be appropriate, if the support conditions in the field were as uniform as assumed in design analysis. Non-uniform support could cause significant increases in stresses. I think a good compromise is to design the section as tied-concrete shoulder section.	---	---
Yu	Tom	tom.yu@dot.gov	Comment on Justin Schenkel's Impact of Base/Subbase/Subgrade Question – ME design is based on pavement response. Because the stiffness of the surface layers is so much greater than any unstabilized material, foundation layers have relatively minor impact on the critical stresses and strains the designs are based on (especially for PCC pavements), and this is correct, from structural mechanics perspective. But, one weakness of ME design approach is that it does not account for any changes in the material properties of the foundation layers over time. I don't believe we need a more sophisticated model to address this issue, because we have no good way of predicting how the layer properties may change over time. The results will depend entirely on assumptions. I believe a better approach is to take steps to ensure that the foundation layers retain their integrity throughout the life of the pavement. So, foundation design is very important, but we will not see the impact on design analysis.	---	---

Q&A (Dec 9)					
Last Name	**First Name**	**Email Address**	**Question Asked**	**Answer Given**	**Answerer**
Yu	Tom	tom.yu@dot.gov	Comment on Justin Schenkel's Rubblization Question – rubblized concrete can have very high modulus value, but otherwise the pavement should be designed as a new pavement. One thing to consider when rubblizing is the condition of the material below the old PCC pavement. If we are rubblizing and placing AC, what we have is, essentially, a new AC pavement. Because of the high stiffness of rubblized concrete, we could get very good performance of AC placed on rubblized concrete. But, we have to make sure that the material in place (rubblized concrete, base, and subgrade) will be stable over time. Often, we don't have a lot of base material under PCC pavements, and the material could be contaminated. Ideally, it's preferable not to ever have to replace pavement foundation, but if you are rubblizing, this is the time to consider whether full replacement is needed.	---	---
Yu	Tom	tom.yu@dot.gov	Comment on Justin Schenkel's Rehab Design Question – I fully agree with your assessment of the situation. I don't believe there is a good, rational basis for overlay design, because the conditions are too variable. The overlay performance depends on how well we address the underlying deterioration prior to overlaying. Personally, I don't see a lot of value in trying to improve overlay design procedure. Ultimately, what matters is how we treat the pavement that will affect the overlay performance. For example, if you are overlaying an existing PCC pavement, the predominant factor that affects the overlay performance will be reflective cracking. Overlay thickness has relatively minor impact on the overlay performance. In theory, by providing a thermal blanket, the underlying pcc pavement should have virtually indefinite fatigue life. Similarly, the overlay of AC pavement will depend on propagation of the underlying deterioration	---	---
Yu	Tom	tom.yu@dot.gov	Comment on Justin Schenkel's Equivalent Design Question – I would make the case that all designs developed following the best-practice to satisfy the design requirements for each type of design are equivalent, but for cost comparison, the analysis period needs to be longer than the initial performance period (the time between opening to traffic to first rehab). I think trying to determine equivalency in terms of structural capacity is problematic, because different pavements behave and perform differently. For example, a concrete pavement could be designed to perform for 50 years without resurfacing or significant amount of repairs/rehab. The structure of an AC pavement could also be designed to provide similar performance, but it will require may be at least 3 mill-and-fill to address the material issue. Design alternatives could be of the same surface type, for example, for PCC, we could have JPCP or CRCP; for AC we could have conventional AC design (which could also have a variety of optional cross-section) and inverted. We need to have a reasonable scenario for treatment requirements over the common analysis period. The analysis period should be reasonably long to include at least one major rehab cycle for all options (e.g., 40 to 50 years).	---	---

Q&A (Dec 10)

Last Name	First Name	Email Address	Question Asked	Answer Given	Answerer
Dave	Kumar	kdave@indot.in.gov	What is inverted pavemnt	Verbal Response: Pavement structure that has a very stiff layer underneath an unbound layer. Sometimes it's described as an anvil to give a chance to compact the aggregate material effectively and get a lot greater stiffness out of it.	Tom Yu
Chang	Brian	brian.k.chang@hawaii.gov	Very informative! Would this PPT availalble?	Yes, it will be made available on the pooled fund site in the coming weeks.	Kelly Smith
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	What was the name of the calculator?	FRC Calculator created by CPTech center	Kelly Smith
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	I could not locate the calculator. Can I have a link directed me to that calculator?	https://cptechcenter.org/news/new-frc-tool-and-publications-issued-by-cp-tech-center/	Prashant Ram
Speakmon	Tyler	michaelt.speakmon@cemex.com	When using fibers in PCC designs, do you have any way to account for fibers other than simply adding to the modulus of rupture? If not, have you done any research/study to account for the effects that increasing strength has on other aspects of the design? I am looking for a better way to understand fibers in design.	In addition to strength increase, fibers in SJPCP can serve as tie bars to keep slabs from floating and as joint load transfer mechanisms. While there is no direct adjustment for load transfer capacity in SJPCP design, the adjustment to MOR accounts for the overall improvement to the structure in terms of cracking performance. When a faulting model becomes available for SJPCP, then the performance benefits of FRC via increased load transfer can be accounted for.	Julie Vandenbossche
Chen	Xingwei	xingwei.chen@la.gov	For the SJPCP, is the slab width same as the joint space?	All of the design procedures assume a square slab (slab width and joint spacing are the same), but there may be times when a slight deviation is needed, such as when an adjacent curb has a 5-ft joint spacing and the slabs need to be 6-ft wide by 5-ft long to be consistent with the curb joint spacing.	Julie Vandenbossche
Dave	Kumar	kdave@indot.in.gov	Is this applicable if the existing concrete is JRCP or CRCP?	I would say yes, but it would be extending the tool beyond what it was intended for. Also, it should be recognized that it will increase the stiffness (k-value) of the cement-stabilized base layer that is modeled in the procedure.	Julie Vandenbossche
Schenkel	Justin	schenkelj@michigan.gov	Please clarify - how is the PittUBOL different than Pavement ME?	This will be covered in the next training topic (Improved Design Procedure for Unbonded Concrete Overlays).	Julie Vandenbossche
Andersen	Tim	timothy.lee.andersen@state.mn.us	Is there a widen edge for Pitt UBOL-ME?	Yes	Julie Vandenbossche
Ferrebee	Eric	eferrebee@acpa.org	Is the UBOL-ME available for free online? Can a link to it be placed in the chat and notes?	Yes. It is located at http://uboldesign3.azurewebsites.net/	Prashant Ram
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	is this the Pooled Fund Study website?	The PMEUG pooled fund is different than the one Julie is referring to. PMEUG pooled fund is TPF-5(305)	Kelly Smith
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	https://www.pooledfund.org/Home	https://pooledfund.org/Details/Study/498	Prashant Ram
Kutay	Emin	kutay@msu.edu	If faulting is measured for both transverse cracks and joints and lumped all together, is there any way to separate them out? Do you think faulting values in transverse cracks and joints should be similar in magnitude?	Faulting across the longitudinal joint is not predicted and it is not really expected since the wheel loads do not often cross this joint.	Julie Vandenbossche
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	if so, when and where can I get the materials of the MEUGM?	There's a link for the project report located near the top of the screen.	Linda Pierce
Kutay	Emin	kutay@msu.edu	I meant transverse joints in JPCP	Within the PMED JPCP faulting model, only the mean faulting at joints is considered. Faulting at cracks is not included.	Wouter Brink/Linda Pierce
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	Thanks! What about the other presentation files and notes of this year UGM?	https://www.pooledfund.org/Details/Study/549	Prashant Ram
Goldbaum	Jay	goldbaum@rocksol.com	Is Webinar 1 online now for us to review prior to Webinar 2?	Here's the link to the ME Design Webinar Series - https://me-design.com/MEDesign/Webinars.html?AspxAutoDetectCookieSupport=1	Linda Pierce
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	Can Wouter explain the process of uploading the files?	Yes.	Wouter Brink
DeVine	Nicolet	nicoletc@email.sc.edu	If you click "NEW JPCP" on the Design type and Distress Type Selections are tehre distress types you can click? I was experiencing a bug preventing me from doing so	We are aware of it and our software group is working on the fix. There should be an update before the end of the week.	Wouter Brink

Q&A (Dec 10)

Last Name	First Name	Email Address	Question Asked	Answer Given	Answerer
Tamrakar	Prajwol	ptamrakar@tensarcorp.com	What is number of minimum pavement sections?	It is used to check that you have enough sections from a statistical sampling standpoint.	Wouter Brink
DeVine	Nicolet	nicoletc@email.sc.edu	The "NEW JPCP" under Design Type and Distress Type Selections within the Experimental Design. When I have tried using it nothing shows up for distress optiosn and I want to know if it is just me or if it shows up for you also. Thank you so much	Duplicate question? Very similar to the one above that I answered.	Wouter Brink
Henrichs	Steven	steven.henrichs@state.mn.us	Does every update need to be re-calibrated?	Not necessarily. It depends on the updates made to the models. You can run the initial verification with the new version to determine if the results gives you a statistically different results. If you don't see a significant difference in the bias, standard error and hypothesis tests then you do not need to recalibrate.	Wouter Brink
Nair	harikrishnan	Harikrishnan.nair@vdot.virginia.gov	if we have dgpx files in V2.3.6 when we upload will that be changed to V.2.6?	You will first need to open those files in the desktop version of version 2.6 to convert it to the new version of the software before uploading it to the CAT. This typically includes adding new inputs that were not available in prior versions. You might also have to update the climate data, and other items.	Wouter Brink
Nair	harikrishnan	Harikrishnan.nair@vdot.virginia.gov	CAT tool work only for V2.6 correct?	Also for v2.5.5	Wouter Brink
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	if a project is archived and a new project has a same name, would it be overridden? If it is not overridden, and both are kept, will the new performance data with the same name as both project will be synchronized with the active one or the archived one? How can we figure it out?	I will have to check. Please also send it to the PMED support email so we have a work item for it and so that I don't forget.	Wouter Brink
Tamrakar	Prajwol	ptamrakar@tensarcorp.com	If some or any of the inputs (e.g., material properties) are missing, is it possible to run a parametric study to understand sensitivity of missing parameter on the local calibration coeff.?	The Calibration tool doesnt have the capability to do those comparisons. The CAT also requires a dgpx file which will have all the inputs filled out. We have done comparisons between say level 1 data and other averages to see the differences in predictions which may impact the overall calibration.	Wouter Brink
Schenkel	Justin	schenkelj@michigan.gov	I think that you make a good point about being careful about the coefficients that you select because the set of coefficients could give you a "good" answer, but there may be multiple ways to get the same "good" answer.	There totally could be multiple best ways to get an answer. There are also other numerical optimization methods and techniques that could be used but that can also result in very different coefficients that don't have practical applications. For example, numerical methods may result in the lowest error where the fatigue damage bf3 coefficient is almost 0 which will reduce the impact of that input. The CAT uses a brute force method by changing them manually instead of other optimization methods to start with.	Wouter Brink
Schenkel	Justin	schenkelj@michigan.gov	I also think that you and your team have done a nice job to take a rather complex process and break it down into consumable portions.	Thank you!	Wouter Brink
Schenkel	Justin	schenkelj@michigan.gov	What do you see as the future for the calibrator tool? To clarify, are there methods, interface, or functions that you'd like to improve?	Yes there will be updates. Most of the maintenance and enhancement dollars are tied up with the Web app but after that there will be updates and enhancements. We have a list of updates and features in the backlog that can be implemented in the future. One large improvement would be to include some way to add notes to the various runs and also a detailed report functionality.	Wouter Brink
MIRZAHOSSEINI	MOHAMMADREZA	mhoseini@purdue.edu	When one distress is calibrated and calibration coefficients were found, is it necassary to upload the new calibration coefficients to calibrate other type of distress?	No it is not necessary. You can manually change them in PMED as well based on the results. One item that we are going to update is the "export to xml" to let you have more control on the output.	Wouter Brink
Goldbaum	Jay	goldbaum@rocksol.com	is the length of a project critical or can we break projects into 5 mile segments?	It is not advisable to use long segments as there is likely to be significant variability in things like thickness and condition that will complicate the local calibration process. Recommended segment lenths are those that are reflected in pavement management, which typically range between 500 and 1,000 ft.	Wouter Brink and Harold Von Quintus

Q&A (Dec 10)

Last Name	First Name	Email Address	Question Asked	Answer Given	Answerer
Chang	Brian	brian.k.chang@hawaii.gov	With tight budget following pandemic, states face budget cut dramatically. If next annual meeting can be both virtual and in-person, some of us can atten for sure. Thank you. We use Microsoft Teams a bit now. It works well.	Verbal Response: The PMEUG Meetings task order includes provisions for live-streaming the face-to-face meetings. Thus, if participants are unable to attend the meeting in person, they can attend virtually.	Kelly Smith
Gorin	Daniel	daniel.gorin@gov.sk.ca	Question for Wouter: Can you explain bias? What is the difference between bias and trend?	Bias is the consistent under- or over-prediction between measured and predicted performance. It's determined as the average residual error.The difference between bias and trend, is that the trend is related to individual residual errors whereas bias is the combination of all the residual errors.	Wouter Brink and Harold Von Quintus
Gorin	Daniel	daniel.gorin@gov.sk.ca	Follow up question to clarify bias: if there was only one test section entered, the bias and residual error would be equal until more sections are entered?	This is not really correct. If you have one section and one measurement, then the bias and the residual error are equal. But, the MEPDG MOP generally suggests that you have 3 to 4 measurements over time, and with just one section, the bias and error might be close but wouldn't be equal.	Harold Von Quintus
Schenkel	Justin	schenkelj@michigan.gov	Yes, a great point! It's very challenging because there are several variables,so I understand. Besides, as we gain more experience and intellegence, it'll become more clear where the "automations" or process improvements can take place.	---	---
Wagner	Christopher	christopher.wagner@dot.gov	Thanks to all teh presenters and Linda and Kelly for all the prep work and MC duities	---	---
Schenkel	Justin	schenkelj@michigan.gov	I should add, if any at all! Like I said, your team doing good work!	---	---
habib	affan	affan.habib@vdot.virginia.gov	What is the scope of roadmap workshop? Sorry if I missed that...	This will be discussed by the FHWA, TAC, and the project team in the coming months.	Kelly Smith
Saboundjian	Steve	steve.saboundjian@alaska.gov	Please add my name to receive future webinar announcements. Thank you.	We have your name in the contact list.	Kelly Smith
Tanquist	Bruce	bruce.tanquist@state.mn.us	Can we claim PDH credit for attending this meeting?	Yes. Contact Kelly Smith about arranging for a PDH certificate.	Kelly Smith