

Summary Report  
Southwest Region Peer Exchange  
Lakewood, CO  
May 21 – 22, 2019

*The FHWA is providing this material for informational purposes only. This is not a verbatim transcript of the Peer Exchange. Distribution of this report is not an FHWA endorsement of views described in the report.*



### **Notice**

This document is disseminated under the sponsorship of the U.S. Department of Transportation (USDOT) in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in this document.

The U.S. Government does not endorse products or manufacturers. Trademarks or manufacturers' names appear in this report only because they are considered essential to the objective of the document. They are included for informational purposes only and are not intended to reflect a preference, approval, or endorsement of any one product or entity.

### **Non-Binding Contents**

The contents of this document do not have the force and effect of law and are not meant to bind the public in any way. This document is intended only to provide clarity to the public regarding existing requirements under the law or agency policies.

### **Quality Assurance Statement**

The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement.

---

# Contents

- Summary ..... 1
- Introduction ..... 3
  - Session Format..... 3
- Peer Exchange Notes ..... 5
  - Mission, Strategies & Barriers..... 5
  - FHWA Presentation & Open Discussion on Regulation & Policy ..... 7
  - What can FHWA do for you? ..... 9
- Current Practice Exercise ..... 11
  - Pavement Design Procedures ..... 11
    - Structural Pavement Design Use ..... 11
    - Pavement Design Methodologies ..... 11
    - Traffic Inputs ..... 12
    - Pavement Foundations ..... 12
    - Shoulder Structure ..... 12
    - Rehabilitation..... 12
    - Safety ..... 13
    - Environmental Considerations..... 13
  - Economic Analysis..... 13
    - Addresses Economic Analysis ..... 13
    - Basis for Determining Need for Economic Analysis ..... 13
    - Methodology for Cost-Effective Design ..... 13
    - Alternate Bidding ..... 13
    - LCCA Considerations ..... 14
    - Tools and Documentation..... 14
  - Policy Review & Updates ..... 14
    - Updates to Pavement Policy Manual..... 14
    - Review/Approval of Revisions by FHWA Division Office ..... 14
- Attendee List..... 15

---

## Summary

This report provides a summary of the Southwest Region Peer Exchange on Pavement Design Policy sponsored by the Federal Highway Administration (FHWA). The peer exchange took place at FHWA's office in Lakewood, CO, on May 21–22, 2019. It focused on FHWA pavement design policy as defined by [Title 23 CFR Part 626](#) Pavement Policy (the “Policy”), Non-Regulatory Supplement NS 23 CFR Part 626 Pavement Design Considerations, and Technical Advisory T5040.39A Use of Alternate Bidding for Pavement Type Selection. Attendees included staff from State departments of transportation (DOTs) and FHWA Division Offices in Arizona, Colorado, Louisiana, Nevada, New Mexico, North Dakota, South Dakota, Texas, Utah, and Wyoming.

FHWA presented several items for discussion regarding the current state of the Policy, using focus questions and prompts during moderated exchanges that enabled participants to offer comments and recommendations. Participants discussed current practices for designing new and rehabilitated pavements and for performing economic analysis. They were also provided an opportunity to express organizational needs in terms of research areas, training, guidance, etc. for future consideration by FHWA.

The participating States have similar missions and goals in providing excellent service and a safe and economically sound transportation network. This includes delivering the right projects, focusing on the customer, fostering stewardship, optimizing system performance, preserving assets, promoting safety, and valuing employees. Participants said their States are effective in pavement design and in operating pavement management systems. They noted a main focus on maintaining conditions on highways and urban areas, and that rural corridors and roads leading to recreational activities need attention due to lack of prioritization and funding.

Participants candidly discussed the Policy and regulation, the relationship between Transportation Asset Management Plan (TAMP) under Title 23 and Policy, and how each affects the other. They questioned whether there is a need for a “cost-effectiveness” section in the Policy, and whether States are using life-cycle planning. During the discussion, participants examined whether the Policy should remain in effect. They suggested the Policy language is vague and should be re-written.

Participants agreed they do not consider all factors when performing pavement design. Materials, traffic, climate, maintenance, drainage, and life cycle cost are the most common being considered. They indicated they are generally dissatisfied with current practices and the use of life cycle cost analysis (LCCA). Participants suggested there is industry pressure to use LCCA for all transportation projects. They discussed and defined the difference between “life cycle costs” and LCCA. Clarification was requested in project type selection when using LCCA to aid in cost-effective decisions.

Participants discussed both the positive and negative outcomes if the Policy is removed. They agreed that flexibility is a benefit of autonomy, but the Policy also provides benefits in helping enforce standards and having Federal Government support when pressured by industry. It was suggested that FHWA could clarify the Policy by changing words and phrasing, for example changing “which are” to “which may be.” Participants generally agreed that some guidance is good, and there needs to be some flexibility allowed by the Federal Government. It was suggested that the definitions in the policy could be deleted. Participants discussed removing LCCA from the Policy if life cycle costs are factored into the States’

pavement design policies. Overall, most participants want to keep the Policy, conditional on FHWA re-writing language to fix ambiguity and adding wording that can help prevent misinterpretation.

Participants discussed the non-regulatory supplement (NRS) in relation to their missions and strategies and to whether it lines up with Policy. There was consensus that the supplement includes too much narrative, and they suggested “sticking to the facts.” They recommended engineering judgment be left up to the States. AASHTOWare® Pavement ME was discussed as a barrier for some States due to cost and calibration of the tool. As written now, the supplement, in addition to the Policy, gives the impression that States must conduct LCCA for all pavement projects. Discussion indicated most participants thought LCCA is mandated.

In regards to LCCA programs, most of the States do not measure user cost in their processes. Participants discussed how the use of different discount rates can be an obstacle. When asked about life cycle cost, several commented they do not use life cycle cost, or use it only on a district-by-district basis. States evaluate alternative bidding and consider the consequences of the project; however, this is not accomplished by doing LCCA. It was identified that the use of LCCA is usually determined by funding availability and source. Participants discussed surface finishing and its relationship to safety in design. In the end, participants asked about ways to be more consistent in their LCCA.

Participants from the DOTs said they have dialog with their State FHWA Division Office representatives and are active with their States’ TAMP, which provide guidance and tools as needed. However, they said it would be beneficial if FHWA provided additional technical support and training opportunities for new employees. Participants considered future economic needs and discussed projected and future traffic volumes and heavier truck loads, as well as the use of autonomous vehicles.

Participants also defined and identified strategies and barriers to implementing pavement design policy. Strategy topics included design that includes sustainability and resiliency, accurate traffic/historical data, knowledge and education transfer between disciplines, increased cost-effectiveness and reliability, the need to be environmentally responsible and economically driven, and the need to provide safe public transportation for moving people and goods. Barriers identified included collecting traffic data and forecasting traffic, fluctuating industry prices, an increase in heavy-truck traffic in areas not built for the weight, and a continuing loss of top leadership positions within the DOTs. When there is a change in administrative leaders, this often results in subsequent changes to policy. Participants identified budget concerns as another barrier and discussed FHWA providing supplemental funding.

State DOT participants shared best practices and successes with the group. Several States have developed their own working plans and “best practice” manuals. One State has decentralized districts with varying pavement design policy/guidance within each district, but the State has a quality control program to help with consistency. One participant requested assistance with developing a Long-Term Pavement Program specifically related to calibration needs. Needs were identified for additional resources for training and education. Participants discussed recycling methods in terms of sustainability and maintaining pavement thickness on bridge approaches over time. They elaborated on LCCA practices and on including the industry representatives in formal decision-making, or at least during the review process.

## Introduction

[Title 23 CFR Part 626](#) establishes, “Pavements shall be designed to accommodate current and predicted traffic needs in a safe, durable, and cost-effective manner.” Regulations do not specify procedures to follow to meet the requirement. Instead, each State Highway Agency is expected to use a design procedure appropriate for its conditions.

The FHWA hosted a formal listening session in December 2018 to hear industry concerns regarding its pavement design policy and technical guidance. During the listening session, interpretations differed on how cost-effectiveness is considered in pavement design. One interpretation was that an agency must consider performing an LCCA on every pavement design project; another interpretation was that cost-effective does not necessarily mean LCCA as long as cost-effectiveness, or even LCCA, is one consideration in the decision-making process. Other issues discussed were expected service life of a design, maintenance and rehabilitation, resiliency and sustainability, and relationships with other regulations, such as the asset management rule.

The information from the listening session was used to inform five regional peer exchanges during 2019, in which State DOT and FHWA Division Office representatives were provided the opportunity to discuss and document good practices and barriers to designing cost-effective pavements. FHWA plans to use feedback from the listening session and peer exchanges when it considers the need for future agency action in the pavement design area and to help identify policy changes, program needs, and other initiatives. At the end of the five regional peer exchanges, an executive summary will be developed and used to determine next steps. The FHWA will consider information from the peer exchanges if FHWA decides to pursue actions such as revised regulations, revised/additional technical guidance, proposed research initiatives, website updates, enhanced communication, and implementation activities. The emphasis of the peer exchanges is to identify solutions to the stated challenges that will support agencies in meeting their mission while designing, constructing, and maintaining National Highway System pavements in a cost-effective manner.

## Session Format

Peer exchange participants received electronic copies of the following documents in advance of the peer exchange: the Code of Federal Regulations, Title 23, Part 626; the Federal-aid Policy Guide Non-Regulatory Supplement NS 23 CFR Part 626 Pavement Design Considerations, dated April 8, 1999; and Technical Advisory T5040.39A, Use of Alternate Bidding for Pavement Type Selection, dated December 20, 2012. These documents had also been shared with and discussed by industry and FHWA at the industry listening session.

As preparation for the peer exchange, the following five discussion topics were provided in advance to peer exchange participants along with the agenda:

1. What is working with the FHWA pavement design policy and technical guidance? What do you like?
2. What is not working with the FHWA pavement design policy? Where are you having major issues and what challenges do you have?
3. What is needed to address some of the challenges and concerns?

4. Is there anything that, in your organization’s opinion, is missing from the pavement design policy or technical guidance that is needed or needs updating?
5. Is there anything else you would like us to know, or be aware of, or add related to pavement design issues?

Each peer exchange was 1½-days long. The peer exchange format was designed to encourage participants to think outside the box when it comes to pavement design policy and to encourage interaction, dialog, and information exchange with FHWA and each other. The format was based on a “Why-How-What” structure. To start, the “Why” focused on the big picture: Why are we all here? This included the agencies’ high-level missions or goals for their transportation networks, specifically pertaining to pavements. The “How” focused on strategies needed to meet these missions and goals, as well as the barriers participants encounter to doing what is ideal, from a pavement design perspective. The “Why” and “How” helped prime participants for the central purpose of the peer exchange—the “What,” which included discussions on policy, guidelines, research needs, and other tools to achieve their agencies missions and goals.

During the morning session of the first day, following the initial welcome and introductions, the FHWA moderator presented meeting objectives and expectations from participants. The moderator mentioned that “parking lot” pads of paper were placed around the room for participants to note any ideas that needed to be discussed during the peer exchange, such as research needs, technical guidance, education or other issues. Participants were then divided into four groups for the first of three breakout sessions. To enhance dialog and offer a balanced viewpoint, moderators ensured that DOT and FHWA Division Office representatives from the same State were in the same breakout group.

During the first breakout, the groups were tasked with discussing the prompted focus question: “What is the State Department of Transportation’s mission?” An FHWA moderator was present in each group to facilitate the discussion. At the end of the breakout, one member from each group reported out the discussions that occurred within their group to the other peer exchange participants. During the second breakout, each group was tasked with discussing the prompted focus question: “What strategies are needed to meet the goals identified from the first breakout and overcome current barriers to accomplish these strategies?” Again, each of the four breakout groups was facilitated by an FHWA moderator, and one member from each group reported out the discussions that occurred within their group to the other peer exchange participants.

In the afternoon session of the first day, State DOT and FHWA Division Office representatives discussed key points made during the listening session held in December 2018. FHWA explained different tools (statute, guidelines, and future research) and summarized listening session observations. The rest of the afternoon was a moderated open discussion regarding the Policy, including whether the current Policy meets the goals and reflects the strategies discussed previously. Each participant was provided the opportunity to comment on the Policy and on what changes, if any, he or she would recommend be made to any of the Policy documents.

The morning session on Day 2, the final session of the peer exchange, was dedicated to discussing current practices at State DOTs. This took place within the same moderated breakout groups from Day 1, and the current practice information was documented by the FHWA moderators. Finally, each peer exchange participant was provided the opportunity to express his or her agency’s needs in terms of research, guidance, training, etc. and to identify how FHWA could support those needs in the future.

## Peer Exchange Notes

### Mission, Strategies & Barriers

FHWA Division Office and State DOT representatives noted and discussed their State's mission in terms of pavements and the associated strategies and barriers.

The States participating in the Southwest Region Peer Exchange have similar missions and goals in providing excellent service and a safe and economically sound transportation network. They each generally agreed that they currently have good customer satisfaction and are effective in pavement design and operating pavement management systems (PMS). Their primary focus is on maintaining conditions on highways and in urban areas, but noted that rural corridors and roads leading to recreational areas need attention.

### *Strategies*

The following strategies were identified by one or more DOT peer exchange participants:

- Focus on proper design with maintenance.
  - Requirements for a good pavement design need reliable traffic data.
  - Gathering data for future projects is challenging because the growth factors are hard to predict, for example, the recent growth in some States in the energy sector.
  - Innovation should be embraced even if some have been failures. Taking smart risks to try different innovations and new techniques is important for moving forward.
  - Recycling methods such as cold in-place, reclaimed asphalt pavement, and full-depth reclamation are being evaluated to include in designs.
  - Severe weather events have created a need to build roads with a level of sustainability.
  - Incorporation of risk-based decisions into pavement design, for example, planning and designing pavement for intense flooding events or mountain corridor avalanches: There is a need to look into how these risks and resiliency items are being incorporated into pavement design and included in LCCA.
  - Use of Pavement ME Design lends itself to building more reliability into designs.
  - Selecting the proper binder for asphalt in new construction and confirming specifications are correct in the materials.
- Increase cost-effectiveness.
  - Using the LCCA for validation of current pavement designs is very useful if there is good historical data.
  - Pavement design should provide longevity in a cost-effective manner for pavements with specifications for hot-mix asphalts, side-by-side testing with concrete, and profiling testing for smoothness.
  - Pavement ME Design can be used for efficiency during the LCCA. The program can decide what the triangular distributions are, and then the results can be required from industry.
  - One State does a 4-year LCCA for all reconstruction projects for concrete versus asphalt.



- States utilizing Pavement ME Design and designing thinner pavement saw improvement and lowering of costs on the projects.
- Using a lower-performance grade binder on the lower lift asphalt versus the top lift asphalt can save costs.
- Project bundling, an [Every Day Counts](#) item, is being used to bundle design on two or more small projects into one contract to save funds and improve quality. Be sure the prime contractor is responsible for risky portion of the project.
- Focus on safety.
  - Performing more crash analysis helps in deciding if incremental roadway improvements are needed.
  - Safety project design focuses include installing centerline rumble strips, reducing hydroplaning and tire splash (using an open graded friction course), new turn lanes and passing lanes, shoulder widening, cable barriers, correct/higher elevations, skid resistance, and high-friction surface treatments.
  - Can we have friction requirements or is this a liability issue?
  - Incentives and disincentives are being provided to achieve smoother roads.
  - Computer programs are used to route trucks to the correct highway lane designated for that use.
- FHWA can play a supportive role.
  - FHWA should take the lead on future highway needs involving changes in economics, automated vehicles, and piloted trucks.
- Take a proactive approach to education and outreach.
  - As experienced staff retire, there needs to be a procedure or plan in place for preserving levels of knowledge within the DOTs, for example of the inner workings of a software program, by passing the information on to younger engineers.
  - New software and training courses need to be identified that can help keep the staff knowledgeable of the state of the practice.

### *Barriers*

- Industry and political pressure.
  - Participants strongly agreed that administrative changeover every few years is a barrier to the pavement design system.
  - “Lack of roadmap to achieve goals” from new leadership positions hinders work.
  - With a new administration, fluctuations are involved at the Federal and State level that cause change without concern for State workload.
  - Many politicians get involved with decision-making regarding the transportation network, but most have no experience in the field.
- Budget and workforce constraints.
  - Budget concerns are a barrier.
  - Uncertainty is created about the budget when experienced staff leave and retire.

- States discussed the possibility of FHWA providing more funding for pavement design work.
- Different maintenance cycles and inflation, fluctuating prices of asphalt and concrete, and other hidden costs tend to increase cost in designs.
- Inadequate communication.
  - Loss of top leadership positions following retirements leaves a gap where there is little or no time for training or mentoring incoming or rising leadership.
- Historical data.
  - A good LCCA is useful but it relies on good historical data; however, many States do not have good historical data on file.
  - There is a challenge in using data as the right growth factors to project what traffic levels are going to be years from now. One needs to put in the best information in order for models to work and give the best information available for future projects.
- Pavement design procedures.
  - Time is a barrier on pavement design. For example, from the time of paper design until the plan is ready to go out, there might be major traffic data changes that affect the design. That really slows a project down or changes the whole design.
  - Unexpected increases in traffic of heavy trucks for areas that were not expecting a traffic boom, such as areas that oil and fuel trucks are using now but were designed to be low volume roads.

## FHWA Presentation & Open Discussion on Regulation & Policy

The following is a summary of participant comments and discussions related to the need for the Policy, and to what States are doing now and the barriers faced.

- General interpretation and overview.
  - Clarification was requested regarding the difference between rules, policy, regulations, and guidance in the eyes of the Federal Government.
  - The language in the Policy should be clarified because it is vague, for example, alternate combinations of “sub-base, base, and surface materials” should just be “materials” and not as specific as they are now.
  - Some participants said the Policy is not needed because of the standards each State has for transportation asset management. With TAMP, they do more performance based evaluation of their networks, so FHWA should leave it up to the State to implement a pavement design program.
  - One participant said TAMP programs guide project selection; the Federal Government should not dictate how this is done. At this time, this participant’s DOT does not reference back to the Policy because the State pavement design manual and policies dictate what to do. States in attendance agreed with this statement.
  - What is the role of the definitions in a policy statement? The definitions in the Policy could be deleted.
  - Clarification of when Policy applies, for which project types.

- It can be implied that life cycle costs mean an LCCA. May need to define life cycle costs.
  - Currently not enforceable. Not clear how divisions are supposed to enforce.
- Cost analysis, cost-effectiveness, and competition.
  - Participants agreed they may not consider all factors when performing pavement design. Most States are not satisfied with the “life cycle cost” portion, and how industry tells States they are not considering that factor.
  - One participant mentioned that one industry is not happy that States are not doing LCCA on network-level projects. States DOTs have TAMP and performance measures in place and are held to those standards.
  - One participant believes that competition and two healthy industries are important to ensure cost-effectiveness. As a result, they have defined corridors to be one pavement type to ensure that they have some work for both industries.
  - Life cycle costs should not become a “concrete versus asphalt” debate. Clarification was requested on whether LCCA is applied to new construction, rehabilitation, and mill and fill projects, or is it just for federally funded projects?” A participant said they could consider cost for these factors for small projects, but might not have to consider all of these factors for projects over \$5 million dollars.
  - FHWA could consider removing LCCA from the Policy if life cycle costs are factored into State design policies.
  - An agency may not perform LCCA, but select a design for network continuity.
  - At some level, the Policy helps competition.
- Agency Impacts.
  - One participant said the Policy was written about 30 years ago, and maybe at that time it was needed. Now most of the States have their own process for design in place. FHWA should provide guidance or technical advice, but not dictate pavement design for each State.
  - Some participants said the Policy provides support for the States from the Federal Government on projects when working with industry. The FHWA Policy can be used on certain projects to justify language for specifications and Federal policy requirements.
  - Some guidance is good, but there also needs to be some flexibility allowed by the Federal Government. It is good to have check and balances.
- Miscellaneous specific items within the Policy.
  - Overall, most participants would like to keep the Policy conditional on FHWA re-writing the language to clarify ambiguity and adding wording that does not lead to misinterpretation. For example, it was suggested to change “which are” to “which may be.”

Below is a summary of participant comments and discussion related to the Non-Regulatory Supplement NS 23 CFR Part 626 Pavement Design Considerations. Is there a need for this supplement? Are the States using this, or should it go away?

- General interpretation and overview.

- The NRS is too convoluted with narrative. The commentary sections need to be eliminated. “Stick to the facts” in terms of what needs to be considered. Keep it high level and reference other documents rather than getting into the details. One participant said a lot of the engineering judgments should be left at the State level.
- Software program usage, Pavement ME Design, AASHTO 93 or older.
  - For some States, a main problem with using Pavement ME Design is the cost.
  - The calibration of the tool is an additional challenge.
  - One State has a program available on its website that anyone can download that helps with LCCA. By inputting values for project activities, it will calculate the queue and everything else associated with the project.
  - Pavement ME Design is insensitive to base. As a result, one state is just requiring 18 inch of base on all designs.
- Miscellaneous specific items and future considerations.
  - Shoulder structure and considerations for shoulder widening: how can States deal with existing pavement and, when adding a shoulder, what materials should be used? Consensus was there are no true/good ways in which to approach this issue.
  - Participants were interested in how to plan for resiliency. Sustainability should also be incorporated; as there will not be any new aggregate sources to develop in the future.
  - Recommend FHWA policies should be reviewed every 10 years for updating.
- LCCA and alternate bidding.
  - A participant asked of those States that perform LCCA a lot, how is the data collected for LCCA and how much is debated by industry? One answer was that all decisions are debated, so they make the best assumptions possible with data that can back up the numbers. They have a rigorous pavement management database that backs up the data, but even that does not solve the arguments. It all comes down to funding in the end.
  - As written now, the supplement, in addition to the Policy, gives the impression that States must conduct LCCA for all projects. In the area of economic analysis, it essentially talks about LCCA.
  - Several States do not use LCCA and some do district-by-district only.
  - A participant asked how much data, resources, and knowledge is needed to have a transparent LCCA program? The participant’s State does not measure user cost in its process. Most States that do alternate bidding, and use LCCA and bid adjustment factors, do not include user costs. They include the cost along with the life of the pavement, therefore only agency costs are used.
  - One State evaluates alternative bidding and considers consequences of the project as the Policy states, but this is not accomplished by doing LCCA. Staff use historical data and engineering judgment on all decisions.

### What can FHWA do for you?

The following list summarizes discussions related to FHWA’s role in helping agency pavement designers, particularly as it relates to research, education, or guidance needs in the pavement design arena.

- Research and guidance.
  - One participant suggested FHWA could help with constructing a Long-Term Pavement Performance (LTPP) program section to help with calibration, new materials, and new construction, in addition to means of monitoring LTPP. Another participant said States can develop their own LTPP programs using the pavement program and data collection process.
  - Following a participant’s question on cold in-place recycling, representatives from other States in the region said they are testing it. They said they would share specifications, calibrated tools, and numbers from recent projects along with best practices with other peer exchange participants.
- Training and education.
  - One participant said their State has a manual that includes training and processes for personnel turnover. The manual also has step-by-step screenshots of Pavement ME Design processes, among others, to help walk staff through training. It is very helpful for new personnel.
  - Participants recognized a need for training in pavement design knowledge within the districts.
  - Sources for training include National Highway Institute (NHI) courses and developing classes in-house, as well as using Applied Research Associates or other contractors/experts to help develop training.
- Policy, supportive role, and miscellaneous needs.
  - Participant question: Is it practical to have two different contractors on the same job for plant mixed pavement and concrete pavement—is this in practice? A few States said they consistently put concrete pavement on an asphalt base and some do the reverse. Some do this as a rehabilitation measure and others on new pavements.
  - A participant mentioned problems with pavement failure at bridge approaches, especially for flexible pavement. Another State had encountered the same issue; they now require cement-stabilized fill at the bridge approach, which is part of the contract document.
  - Guidance on LCCA. Participant question: Who conducts LCCA where projects compare asphalt to concrete, and do States involve industry to review the processes? One State said they meet with industry to discuss the LCCA with accurate data for the projects. Another State said they meet with industry but there is no review by industry at the final agreement.

Participants were asked to share their best practices. Their responses are listed below.

- A participant said that for every design, their agency does a “total design.” This involves preparing a pavement design report with three parts: pavement design summary, preliminary cost, and specs and figures. It also includes a summary with the introduction, pavement history, and detailed core analysis. At any time, if someone

needs to go back to a project for review, it is possible with this report. It is a “full-picture” report.

- A DOT with a decentralized structure controls pavement design by requiring each district to develop a standard operating procedure. This is reviewed by the central office, which provides comments on ways to improve the procedures.
- One State has had success with concrete overlays, inlays, and thicker overlay projects, as they seemed to be very economical and delivered quickly by the contractors.
- Even if pavements staff have a good pavement design plan, a participant suggested they should still work closely with their State materials department or office. Pavement design construction and performance relies on the materials used for construction, therefore a good rapport between engineers, construction workers, and the materials group is necessary and can produce good results.
- A Pavement Condition Assessment Report (PCAR) includes all information on data coring, distressed-pavement data, pavement management data, and falling weight deflectometer (FWD) data. One State uses PCAR as a way to justify funding for a pavement, either by type or pavement treatment selection.
- A State DOT with a decentralized structure recently implemented a quality assurance process for pavement designs in its districts. By requiring this process, it allows the central office to see differences happening, react to them, and apply consistency statewide.

## Current Practice Exercise

The current practice exercise took place within the same moderated breakout groups from Day 1. FHWA moderators noted current agency practices in terms of pavement design procedures, economic analysis, and policy reviews and updates.

## Pavement Design Procedures

### *Structural Pavement Design Use*

In general, States in this region conduct structural design for new construction, reconstruction, and rehabilitation projects, with some limitations for rehabilitation and structural overlays. Some States will only design rehabilitation for major projects or for pavements of less than 2 inches. One State uses core data, FWD data, PMS, or visual assessments of distress to determine rehabilitation projects. Some States have guidance but no policy for structural design. Some States noted structural design for all full-depth reclamation projects. Some States use structural design for mill and fill activities, while some will only use mill and fill for pavements of 4 inches or less. States do not use structural design for preservation.

### *Pavement Design Methodologies*

The majority of States in this region use local calibrations for their Pavement ME Design software. Seven out of 10 States use it for asphalt, and 8 out of 10 use it for concrete. One State uses local calibrations for asphalt on new construction. Another State uses its own asphalt calibrations for Pavement ME Design software. One State’s statewide concrete calibrations include environment, but it moves to default values.

Seven out of 10 States use AASHTO 93. One State is using asphalt and concrete for comparison for new reconstruction projects. Another State uses AASHTO 93 for recycling and some reconstruction. One State rarely uses AASHTO 93 for jointed concrete, however, it is in the process of using Pavement ME Design for jointed concrete. One State referred to a research project that began in 2015, that was intended to move the DOT toward Pavement ME Design. Since then, there has been a lot of turnover both at the university and DOT. The research is now stalled. One State does more design work in-house, but they also use consultants.

### *Traffic Inputs*

Generally, States include traffic volume and truck classification, truck weight data, and weigh-in-motion (WIM) data in their pavement design policy, with some specific variance to practices. One participant said the State's traffic data is unreliable. The majority of States in this region use WIM data to project average daily truck traffic counts or other traffic count information.

### *Pavement Foundations*

Generally, States consider subgrade, sub-base, and base courses when designing pavement foundation. States use a variety of methods to determine subgrade conditions, including California Baring Ratio (CBR), dynamic cone penetration (DCP), and FWD. One State has invested in Pavement ME Design calibration, another uses maps for estimation. States use a variety of methods based on specific environment, tools, and available data.

States are divided on positive drainage systems. Some States have conditions outlined in policy or have a good drainage program. One State uses positive drainage systems for Portland cement concrete only. Others use edge drains on concrete interstates but do not have procedures outlined in policy or a manual.

### *Shoulder Structure*

States' pavement design policies address shoulder structure and often use the same structural capacity as mainline. One State confirmed optional structural capacity, except for on the National Highway System, including the materials used. Generally, States in this region use the same materials in shoulder structure as mainline. One participant commented that there are no shoulder separation issues, while another participant's State has drop-off and/or shoulder separation. For one State, this is not mandated by policy but by practice.

Most States in this region use shoulder rumble strips and have requirements for safety. Some do not have this mentioned in their policy. They have received complaints from bikers. A few States apply rumble strips where appropriate and exclusively by the safety office. Some States will consider safety techniques on most roads, with exceptions for urban areas due to noise, on intersections, or on all two-lane roads. In contrast, another State applies safety features to two-lane roads where the average daily traffic count is greater than 2,500.

### *Rehabilitation*

Generally, States determine current or existing conditions by using PMS; coring, boring, or trenching techniques; FWD data; and engineering and economic analysis. Not all States use FWD for evaluating the pavement structure strength or trenching for getting a visual interpretation of pavement thickness. One participant said the State needs to add PMS to its considerations. Some States are working to acquire a ground penetrating radar (GPR) system. One State does not use economic analysis to compare alternatives, while another uses initial consultant alternative.



### *Safety*

Typically, States in this region do not address skid resistance (regardless of funding source) in their policy, however, one participant commented, “all projects must address safety.” One State uses open-graded friction course. A participant stated AASHTO standards dictate criteria for all rehabilitation. One State conducts friction testing statewide. Another has drop off considerations in its pavement design manual.

### *Environmental Considerations*

States in this region use a variety of methods that address environmental considerations in their policy, though there are no formal documents/procedures in place. Some States allow for reclaimed asphalt pavement (RAP) or cold in-place recycling (CIP) and hot in-place recycling (HIP) in addition to warm mix asphalt (WMA). One State has stopped using recycled asphalt shingles (RAS), and in another State, there is no demand for RAS.

## **Economic Analysis**

### *Addresses Economic Analysis*

Nine out of 10 States have policies addressing economic analysis for pavement projects. One State has guidelines in the LCCA that specifically address timing and historical data. Another State uses economic analysis for initial costs.

### *Basis for Determining Need for Economic Analysis*

States typically determine when to use economic analysis based on the size and type of project. In this region, States have certain project requirements such as scope and predicted costs of construction and location, for example, for corridors or major rehabilitation or when a structural project has no functional overlay. This requires an LCCA to be used. One State is receiving input from industry to develop an economic analysis, while another leaves this up to the department’s discretion. One State’s economic analysis is written as a requirement, alternatively, staff determine economic analysis based on average daily traffic or truck weight.

### *Methodology for Cost-Effective Design*

States typically use LCCA to ensure cost-effective design. Some use Real Cost or encourage LCCA. Another State uses LCCA to make decisions, but if projects are within 10 percent, then a committee makes a decision. One State uses LCCA for reconstruction or new construction. However, regarding use of historical data, States do not use this as heavily as LCCA as a methodology for determining cost-effective design. One State prefers maintenance. In contrast, another State always uses historical data to justify initial construction. One State no longer uses historical data, and one State’s deputy director makes decisions based on input from the districts. One State bases exceptions on continuity.

### *Alternate Bidding*

Six out of 10 States in this region allow for alternate bidding. One State uses it on a project-by-project basis. One State allows for alternate bidding in its manual, but it has not been used yet. After LCCA, engineering analysis is performed based on project funds to allow for flexibility. Another State that allows for alternate bidding conducts LCCA on projects with less than 10 percent difference and will consider these equivalent designs. The other States have tried alternate bidding on shoulders but do not currently use the process. For one State, after conducting alternate bid for structural sections of equal thickness, there was no bid adjustment. This State is looking to the future for further use.



### *LCCA Considerations*

States consider multiple factors in their LCCA, including agency costs (initial, rehabilitation, and maintenance costs), work zone and user costs, discount rate, material price adjustments in asphalt and concrete, inflation rate, and remaining service life. These factors are considered widely and inconsistently across States. Some States will determine discount rate using the Office of Management and Budget (OMB) circular, and some base the rate on a determined percentage. States' analysis period typically accounts for at least one (sometimes two) additional rehabilitation cycles. About half of the States in this region use Real Cost and/or Excel spreadsheets as a tool to conduct LCCA. One State uses its own tool. Typically, States in this region assess uncertainty using deterministic methods. States consider results as "significantly different" ranging from 10 to 20 percent. Some look at total cost; one State has no limit. One State does not have this defined in policy. Typically, States have their LCCA reviewed by FHWA or a State committee, or both. One State has an engineer committee review LCCA. Another has industry involved with each project, and FHWA reviews the overall policy process. States usually house their LCCA policy/requirements/guidelines in their pavement design policy manual.

### *Tools and Documentation*

States in this region determine a design period on a 30- to 40-year life cycle, sometimes 40 years for new construction and 30 years for rehabilitation projects. While FHWA's LCCA Policy Statement recommends an analysis period of at least 35 years for all pavement projects, including new or total reconstruction projects as well as rehabilitation, restoration, and resurfacing projects, an analysis period of 30 to 40 years is not unreasonable. One State's 50-year design life is based on rehabilitation after concrete design life. Another State's 40-year design life is based on at least one rehabilitation cycle 10 years after concrete design life of 30 years.

## **Policy Review & Updates**

### *Updates to Pavement Policy Manual*

Generally, States update their pavement design policy manual as needed. Some States do not specify a timeframe. Two out of 10 States have not updated in the last 10 years. One State's pavement design policy manual is updated on a continuous basis. Another State has updated its policy manual within the last 2 years. One State does not include Pavement ME Design yet because it is not required for consultants. One State reported that stakeholders have the opportunity to make comments during the 6- to 12-month update period.

### *Review/Approval of Revisions by FHWA Division Office*

In this region, FHWA will review/approve the DOT's policy or manual, but States are divided evenly on whether this is needed. It is mentioned in most DOT's Stewardship and Oversight Agreements for projects on the Interstate System, the State may assume the responsibility.

## Attendee List

### **Arizona DOT –**

Reed Henry, Deputy State Roadway Engineer

Ashek Rana, Pavement Design Team Lead

### **Arizona FHWA Division Office – Ammon Heier, Area Engineer**

### **Colorado DOT –**

Craig Wieden, State Materials Engineer

Melody Perkins, Pavement Design Engineer

### **Colorado FHWA Division Office – Dahir Egal, Pavements Materials Engineer**

### **Louisiana DOTD – Xingwei Chen, Pavement Engineer Manager**

### **Louisiana FHWA Division Office – Scott Nelson, Asset Management Pavements Engineer**

### **Nevada DOT – Charlie Pan, Assistant Chief Materials Engineer**

### **Nevada FHWA Division Office – Iyad Alattar, Transportation Engineer**

### **New Mexico DOT – Jeffrey Mann, Pavement Management and Design Bureau Chief**

### **New Mexico FHWA Division Office – Luis Melgoza, Pavement Engineer**

### **North Dakota DOT – T.J. Murphy, Transportation Engineer**

### **North Dakota FHWA Division Office – Gary Goff, Transportation Engineer**

### **South Dakota DOT –**

Travor Diegel, Pavement Design Engineer

Tanner Fitzke, Pavement Design Engineer

### **South Dakota FHWA Division Office – Brett Hestdalen, Operations Engineer**

### **Texas DOT – Magdy Mikhail, Director, Pavement Asset Management Section**

### **Utah DOT – Jason Simmons, State Pavement Engineer**

### **Wyoming DOT – Robert Rothwell, Assistant State Materials Engineer**

**Moderators:**

Jennifer Albert, Pavement Materials Engineer – FHWA

Jason Dietz, Pavement Materials Engineer – FHWA-RC

Heather Dylla, Sustainable Pavement Engineer – FHWA

Shree Rao, Principal Engineer – Applied Research Associates

**Note-Takers:**

Jose Chavarria, Instructional Systems Designer – Applied Research Associates

Brandi Tagirs, Administrative Support – Applied Research Associates