

FHWA Pavement Design Policy National Summary Workshop

Summary Report

Washington, DC
October 24, 2019

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Executive Summary

This document provides a synopsis of the National Summary Workshop on FHWA's Pavement Design Policy held October 24, 2019, at the Federal Highway Administration (FHWA) Headquarters in Washington, DC. The workshop focused on FHWA's Pavement Design Policy as defined by Title 23 CFR Part 626; Pavement Design Considerations Non-Regulatory Supplement NS 23 CFR Part 626; and Technical Advisory T5040.39A, Use of Alternate Bidding for Pavement Type Selection. The workshop was held as a follow-on to an industry listening session held December 14, 2018, and five regional peer exchanges held in locations throughout the United States from March through July 2019.

The National Summary Workshop attendees included participants from the industry listening session and five peer exchanges, FHWA staff, and other stakeholders. Following initial introductions, the moderator recapped the industry listening session and peer exchange discussions regarding agency missions, as well as strategies and barriers to executing those missions. Next, the moderator presented several items for discussion regarding agencies' current pavement design considerations and procedures, along with prompted focus questions that enabled participants to express their views on and discuss topics related to pavement design. Participants mentioned challenges associated with cost analysis, cost effectiveness, and life-cycle cost analysis (LCCA). A discussion on FHWA's Pavement Design Policy followed. Finally, participants expressed areas of need in research, training, guidance, etc., for future consideration by FHWA.

Workshop participants stated that funding, lack of expertise, and climate change impacts are primary concerns with respect to pavement design. One participant stated that there are currently no generally accepted national standards governing pavement design, resulting in every State approaching pavement design differently. Barriers with implementing AASHTOWare® Pavement ME Design are also a concern for some States and industries.

Many States only perform pavement design for new construction and reconstruction, and in most regions, the majority of projects are rehabilitation and preservation. Across the United States, there is a mix of consultants and agency engineers responsible for performing pavement design. For those using Pavement ME Design, the challenge is not necessarily the software but its level of complexity in that it requires many inputs, characterization of materials, local calibration, and proper quantification of design reliability. While both the asphalt and concrete industries have developed their own pavement design tools, the concrete industry's preferred tool is Pavement ME Design, and it encourages universal adoption. The concrete industry also stipulated that there is no reason why an agency cannot implement Pavement ME Design for concrete pavement, simply because the agency is not comfortable with the asphalt portion of the software. The asphalt industry stated that there are discrepancies and challenges States have encountered while using Pavement ME Design. The asphalt industry supports Pavement ME Design only when it is coupled with local calibration. The asphalt industry has concerns regarding a few of the models that need additional validation, but the asphalt industry likes the concepts of mechanistic-empirical design.

During the discussion on cost analysis, cost effectiveness, and LCCA, the challenges mentioned included staffing, especially junior staff's understanding of future preservation cycles; regional microclimates that impact performance in ways that are not properly considered; and the multiple factors and inputs needed for LCCA. For some States, the challenge with LCCAs is just getting them done on many of the projects. LCCA is most commonly performed on new and major rehabilitation projects, but not on preservation

projects. State representatives differentiated LCCA from cost analysis in that LCCA is a more rigorous process with defined inputs, while cost effectiveness is less rigorous and more of an evaluation of “costs and reason for costs.” The concrete industry underscored that LCCA is the best documented and understood means of establishing cost effectiveness. While a few States maintained that LCCA is the best method for determining cost effectiveness, all States agreed that there are other methodologies that can be used in lieu of LCCA, such as historical data, past experience, and engineering judgment.

The concrete industry representatives stated that LCCAs are not being performed early in the design process, and that this is due partly to States not having the proper data, cost information, or correct maintenance and rehabilitation scenarios for performing LCCA. There is also a tendency by some States to simply assume the outcome, and therefore never actually perform the LCCA. This, in the concrete industry’s perspective, is inconsistent with requirements in the Policy. The asphalt industry’s stated concerns were focused on the challenges associated with not having quality historical data in the pavement management system and, once an LCCA is completed on a project, the lack of follow-up as to whether the LCCA assumptions were correct.

During a discussion on tools or metrics used for evaluating design cost effectiveness and whether cost effectiveness means LCCA, the consensus among the States was that cost effectiveness does not necessarily mean LCCA. State representatives indicated there is not a one-size-fits-all method for cost analysis in pavements, and performing LCCA does not guarantee the design is truly cost effective for the project. Some States perform LCCA on major investments and large projects, and for smaller projects, they use engineering judgment or consider annualized costs. The concrete industry representatives suggested that cost effectiveness means LCCA because cost effectiveness includes costs and performance outcomes, so LCCA is a metric that can be used for balanced comparison. The asphalt industry representatives stated that other techniques and methodologies, such as systematic analysis at the entire network level rather than project-level analysis, should be considered while evaluating costs.

When discussing what project types require cost analysis, most of the State participants said they perform LCCA on large projects and major investments. One of the States performs LCCA on every project; others may perform some type of cost analysis, but not necessarily LCCA. Whether LCCA is performed for rehabilitation projects differs, as policy decisions within States focus on selecting the right materials and treatments and analyzing the costs. The concrete industry representatives said that cost analysis should be performed on as many projects as possible, and it should begin during the design phase. They added that States are already spending millions of dollars on actual construction costs, and opined that the small amount of time and money used to perform an LCCA is a good investment. The asphalt industry representatives said that FHWA should provide more guidance and training on LCCA, and that a probabilistic analysis is a better way to perform LCCA, but only if the data is accurate and reliable.

Responsibility for performing cost analysis in almost all States falls on the pavement designer for that particular project. One participant said that with the new Transportation Asset Management Plan (TAMP) requirements, there is a shift in responsibility to asset managers as they are also looking at the network level to ensure strategic use of funds when selecting projects. Industry representatives stated that State DOTs should be responsible, but FHWA should ensure States are following best practices and looking at variability, uncertainties, and reasonable estimates for cost analysis of their design. Tools used by States for performing cost analysis include FHWA’s RealCost software, spreadsheets, probabilistic or deterministic analyses with different parametric evaluations, and agency-developed tools. The concrete industry has a software tool that is used for lower-volume roads and is available to the States. The asphalt

industry pavement design program also has an LCCA tool. The asphalt industry representatives also mentioned there are many software tools, but States need to know the difference between good data and bad data to input into these tools. It was suggested that FHWA should develop a guidebook with recommendations on how to use these tools effectively.

When discussing the Policy, most State participants said they would like to see the Policy and Guidance updated to address current ambiguity but would also like to see it kept flexible and not be made binding so as not to potentially stifle innovation. They indicated they do not want to be overly regulated through the Policy via too many requirements or restrictions. Regarding the CFR's pavement definition that reads, "shall be designed in a safe, durable, and cost-effective manner," States would like FHWA to better define those parameters to reduce ambiguity in the Policy. During a discussion on pavement foundations, it was recommended that foundations be properly addressed in the Policy to ensure adequate consideration of base and subbase in pavement design. Both industries agree with the content of the Policy. The asphalt industry would like FHWA to address updates to the LCCA guidelines and mention in the non-regulatory supplement that the engineering evaluation should include recycled materials, on which FHWA already has a policy. The concrete industry believes the Policy is written clearly, but also suggests that it is important for FHWA to assert its authority and ensure States are performing pavement design by considering both the engineering and economic considerations, as required by the Policy, and not just selecting combinations of materials without an adequate economic analysis. Per the concrete industry, just as FHWA would not allow for a pavement design to be performed without traffic data, they should also not allow for pavement designs to be performed without determining it is being done in a "cost effective manner."

One DOT participant responded that economic consideration is a subset of engineering consideration, rather than a separate item. Engineering encompasses many things besides materials and thicknesses; it includes economics, constructability, maintenance of traffic, and future preservation/rehabilitation. Workshop participants agreed that the non-regulatory supplement is outdated and needs to be updated.

When asked what FHWA could do to assist the States, the DOT participants suggested FHWA produce more guidelines and publish more best practices, as well as conduct more peer exchanges for face-to-face exchange of information. They also suggested FHWA establish recognition or incentive programs for various industries to work together and develop innovative ideas, design methods, and better products for the future. States would also like assistance in local calibrations, use of new technologies in construction, long-term data collection, and technology transfer. The concrete industry representatives suggested FHWA recognize and address new ideas formulated around sustainability and resiliency. They stated that industry can be leaders in developing innovative materials, ideas, equipment, technologies, and practices, but guidance documents and best practices need FHWA's leadership to present innovation in a broader perspective to the various stakeholders. FHWA policies should encourage competition between industries that can be readily implemented at the State level.

In concurrence with most of the workshop participants, those from the asphalt industry would like to see the Policy revisited more often than the 20 years it has been since the last update. The asphalt industry said that the Policy should reflect progress; however, life cycle assessment, sustainability, and resiliency are not ready for inclusion into Policy. They would like FHWA to help States develop a data program so States will have proper programmatic or network-level data to perform LCCA and compare both life cycle costs and performance of different design scenarios.

Introduction

FHWA hosted a formal industry listening session in December 2018 to hear industry concerns regarding its Pavement Design Policy and Guidance. The following documents were discussed during the industry listening session: 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.

FHWA's General Pavement Design Considerations ([23 CFR Part 626](#)) establishes the following requirement: "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. During the listening session, interpretations differed on the way cost effectiveness was considered in pavement design.

FHWA also hosted five regional peer exchanges during 2019 in which State agency representatives and FHWA Division Office representatives were provided the opportunity to discuss and document good practices and barriers to designing cost-effective pavements. During these peer exchanges, participants were provided a summary of the industry listening session, which was followed by a moderated discussion on the Pavement Design Policy and Guidance.

As a follow up to these events, on October 24, 2019, FHWA hosted a National Summary Workshop at the FHWA Headquarters Office in Washington, DC. Three representatives from each regional peer exchange (two from State DOTs and one from an FHWA Division Office) attended the National Summary Workshop. Industry was represented at the workshop by members of the American Concrete Pavement Association (ACPA); National Asphalt Pavement Association (NAPA); National Ready Mixed Concrete Association (NRMCA); National Stone, Sand, and Gravel Association (NSSGA); American Public Works Association (APWA); and staff from Applied Pavement Technology and Advanced Concrete Pavement Consultancy. The purpose of the National Summary Workshop was to summarize the findings from the listening session and the five regional peer exchanges and to discuss potential next steps with all stakeholders present. FHWA may use this information to inform priorities for future program efforts.

National Summary Workshop Format

During this 1-day session, participants were divided into groups for four breakout sessions. To enhance dialog and offer a balanced regional representation, moderators placed participants from the same industry or peer exchange region together in the same breakout groups.

Workshop Focus Areas

During the morning session, following initial welcome and introductions, the moderator presented meeting objectives and expectations to participants. During the first breakout, each group was tasked with discussing the following prompted focus questions concerning ***Pavement Design Considerations and Procedures***:

States and FHWA Division Offices

1. What are the challenges in your region with respect to pavement design?
2. What types of projects require structural pavement designs in your region? (reconstruction, new construction, rehabilitation, or preservation)
3. Who is responsible for performing pavement design?
4. Which design tools/software programs are used?

Industry

1. What are the challenges in pavement design with respect to your industry?
2. What type of projects do you think should be designed?
3. What types of tools are best to use for design?

At the end of the breakout, one member from each group reported out the discussions that occurred within their group to the other workshop participants.

During the second breakout, each group was tasked with discussing the following prompted focus questions concerning ***Cost Analysis, Cost Effectiveness, and Life-Cycle Cost Analysis***:

1. What are the challenges in your region with respect to cost analysis / LCCA?
2. Does cost effectiveness equal LCCA, or are there other techniques to evaluate cost effectiveness?
3. What types of projects are cost analyses performed on in your region?
4. Who is responsible for performing cost analysis?
5. What design tools / software are used?

Again, each of the breakout groups discussed these questions and one member from each group reported out the discussions that occurred within their group to the other workshop participants.

In the afternoon session, each group was tasked with discussing the following prompted focus questions on the ***FHWA Pavement Design Policy***:

1. What were the discussions in your peer exchange relevant to the Policy?
2. What were some ideas/suggestions?
3. What were the issues and what was the consensus (if any)?
4. Develop a list of items – did any stand out in terms of priority?

Finally, each group was tasked with discussing the following prompted focus questions that addressed ***other considerations***:

1. What were some other items discussed during your peer exchange?
2. How can FHWA help move some of these items and address your concerns relative to these items?

Each region and industry was provided the opportunity to express its needs in terms of research, guidance, training, etc., and suggest how FHWA could support those needs in the future.

National Summary Workshop Notes

The following notes summarize the four breakout sessions conducted during the workshop:

- Pavement Design Considerations and Procedures
- Cost Analysis, Cost Effectiveness, and Life-Cycle Cost Analysis
- FHWA Pavement Design Policy
- Other Considerations

Pavement Design Considerations and Procedures

Following are the inputs from workshop attendees relevant to the prompted focus questions.

What are the challenges in your region with respect to pavement design?

Southwest

Challenges in this region include funding, lack of expertise, and retaining competent staff. Additional challenges include lack of access to software tools needed for design, issues with performing local calibrations, and the amount of expertise needed for using the software tools, specifically Pavement ME Design. Most States in this region focus more on planning for the future than on collecting and properly documenting what was done on past projects. Insufficient information, especially construction quality data, is a common challenge because States often do not collect the necessary information to feed into the performance and design models.

Northeast

A consistently noted challenge is the varying climate. States in this region experience the wide-ranging ends of the climate spectrum. Freeze/thaw conditions, temperature swings, record amounts of precipitation, etc., have all wreaked havoc on pavements. Trying to maintain old infrastructure with extreme traffic volumes and limited right-of-way is a challenge. A lack of funds causes a focus on maintaining existing infrastructure rather than on building new infrastructure. In terms of pavement design, these States see the environment and resiliency to extreme weather events becoming important considerations in the future.

Midwest

A challenge in this region is the diversity of pavement design options. Since there are no generally accepted national standards governing pavement design, individual States are using different methods. These methods are often governed by both engineering and non-engineering considerations, such as designers' preferences, history and tradition, and funding.

Northwest

Challenges begin with the lack of guidance in helping State pavement engineers understand the various design software tools, which are quite different from the previous AASHTO 93 design procedures. States need to share case study-type information on rehabilitation cycle strategies that focus on the big picture of pavement design: from initial construction to rehabilitation. This should be accomplished in a manner that helps junior engineers know the history of the work involved with existing pavement sections. One State is opposed to adding sustainability to the pavement design policy at this time because this could pressure agencies to use materials or techniques that could be detrimental to pavement performance, for example, introducing or mandating different recycled materials be added into the pavement that could potentially worsen performance.

Southeast

Challenges include the various design procedures used within the States and the many barriers to implementing Pavement ME Design. One of the keys to successfully implementing Pavement ME Design is understanding which items are sensitive and focusing on them. In terms of allocating resources on a system-wide basis, a suggested goal for agencies is to move toward a perpetual pavement-type system where the focus is on “permanent” foundations for all or most of their pavements. Challenges with measuring costs include evaluating costs in terms of dollars per lane mile and years of service. A critical step in pavement design is selecting goals while optimizing allocation of resources. The group discussed whether, strategically, they should only temporarily fix certain roads to focus on properly designing other roads. In some States, reconstruction is moving to the construction manager/general contractor (CM/GC) method, where the pavement design process is being taken out of the hands of the States altogether and handed over to the construction manager.

Asphalt

The asphalt industry’s primary concern with Pavement ME Design is that the asphalt models must be locally calibrated, but one of the challenges that States are having is calibrating the continually changing models. The industry recognizes that States need available funding for and expertise in pavement design. Mandates on certain pavement types are not warranted—individual States have different methods that they must tailor to their local regions, so flexibility is the key to success. However, good historical data is needed to calibrate pavement design, extend pavement design life, and properly use Pavement ME Design software.

Concrete

The foremost challenge is the States’ reluctance in adopting Pavement ME Design. The concrete industry would like to see Pavement ME Design be fully adopted, but believes States are holding back on adopting it for concrete pavement design because of their reluctance to adopt it for asphalt pavements. For concrete pavements, the national calibration factors have been shown to be very reasonable. Pavement ME Design should be adopted for concrete pavement design because it is the best tool for it. By not using Pavement ME Design, States are missing the opportunity to optimize design for joint spacing, load transfer, and other efficiencies that would help make the concrete pavement designs more cost effective. The industry would like to see adoption of concrete overlay design, in particular, bonded concrete overlay of existing asphalt pavements. The design procedures for this are available in Pavement ME Design, but there are difficulties in getting States to adopt this design. In terms of pavement preservation, effective consideration of the cost of performance in the design of preservation strategies is a challenge. There is a double standard between the two ways of doing business: designing for a higher-level project versus designing for other types of applications. The industry would like to see resiliency addressed by FHWA within pavement design. There are currently challenges with collaboration between pavement designers and construction management personnel. This lack of communication between the two groups can affect constructability. Probabilistic economic analysis should be performed, and life-cycle strategy needs to be part of the design consideration. Another challenge is constructability especially as it relates to maintenance of traffic (MOT). It is important to ensure that traffic management is optimized for the pavement type; i.e. approaches need to be different for concrete and asphalt, as the materials characteristics and construction methodology are different. Another challenge is not using as-builts as an input for performance data rather than design inputs. This leaves a lot of opportunity on the table as it relates to design improvements.

What types of projects require structural pavement designs in your region? (Reconstruction, new construction, rehabilitation or preservation)*Southwest*

These States are mostly designing for new construction and reconstruction. Only a few are designing for preservation. For rehabilitation projects, some States perform rehabilitation design for overlay thickness greater than 2 to 4 inches, while others have no established standards.

Northeast

This region has very few new construction or reconstruction projects. This area is highly developed, so new right-of-way acquisitions are very difficult. A lot of current work is rehabilitation and preservation, and agencies are “just trying to widen areas where they can.”

Midwest

In this region, the types of projects that are designed vary across the board with no consistent pattern. Some pavement design is performed for major construction, reconstruction, and even smaller projects. One State uses Pavement ME Design for all projects and performs pavement design on anything more than a half-inch thick.

Northwest

This region does mostly rehabilitations through chip sealing and concrete repairs, rather than spending lots of money on pavement design. By not performing a proper evaluation and design, there may be lost opportunities to avoid doing the wrong treatment at the wrong time, especially if there are material-related issues.

Southeast

During this breakout session, this group did not directly address this question but mostly concurred with the other regions. One State participant noted that all major rehabilitations taking place there are using the construction manager/general contractor (CM/GC) delivery method.

Asphalt

There is little new construction and reconstruction taking place, especially in the Northeast, where they are just doing preservation and maintenance. The asphalt industry would like to see more use of perpetual pavement concepts. Using perpetual pavements addresses the questions of what can we do to avoid reconstruction in the future, and how can we design the best pavement to achieve that goal.

Concrete

All projects should be designed to ensure they are cost effective, but maybe setting thresholds would be appropriate (e.g. \$1M, ESALs, project SY, etc.). To get the most out of their money, agency efforts need to focus beyond preservation. Currently most agencies never design preservation projects, they just build them. Considering the sums involved this is not advisable. Agencies should be designing for all projects so that they are making the right decisions and are considering costs in the design process. Agencies should adopt a design process where they look beyond the first design period and lay out anticipated actions or repairs for maintaining a road in subsequent preservation and rehabilitation cycles.

Who is responsible for performing pavement design?*Southwest*

States are evenly split between using in-house staff and consultants for performing pavement design.

Northeast

Most States in this region have consultants responsible for pavement design. Some States just use consultants to perform pavement evaluations, and then use the pavement evaluations to perform the designs in-house. Some States are highly decentralized, so pavement design responsibility falls to the districts. One State uses the concept of “mill 2, pave 2,” referring to mill and fill operations where they mill 2 inches of the asphalt pavement surface and replace it with 2 inches of new asphalt pavement surface.

Midwest

Generally, agency staff responsible for designing pavements are dedicated to performing pavement design. Pavement design is becoming a specialty, and if it is done by site designers or geotechnical engineers rather than pavement designers, it can result in problems associated with multitasking.

Northwest

This region has some States that are centralized (in terms of performing pavement design) and some that are decentralized, wherein the designs are being done at the district level. It also depends on category of road, such as type, pavement thickness, or traffic volume. When an agency decides they are not going to design a specific road, it is turned over to district maintenance, “which has its benefits and drawbacks.”

Southeast

During this breakout session this group mostly concurred with the answers from other regions.

Which design tools/software programs are used?*Southwest*

Seven of 10 States still use AASHTO 93 for pavement designs, but 7 of 10 States also use Pavement ME Design, with some States using both. Two States are exclusively using Pavement ME Design. Issues related to Pavement ME Design are associated with performing local calibration and lack of expertise.

Northeast

Some States use AASHTO 93, while others use Pavement ME Design. One State does “mill 2 pave 2” on most projects, and does not perform pavement design.

Midwest

Design tools vary across the board, just like the design challenges. They are using in-house developed software, commercial software, industry-developed software, and design tables. There is no clear consistency when it comes to software used for design in this region. One State uses the “grandfather of MEPDG” (the Mechanistic-Empirical Pavement Design Guide) which has been updated and is still a good system, while another State said that Pavement ME Design works great for them and has been successfully used to predict failure and perform forensic analysis.

Northwest

This region uses a variety of different design methods, with Pavement ME Design being used in some circumstances. They have different microclimates in this region, so Pavement ME Design is somewhat difficult to calibrate locally. As such, they are using the nationally calibrated models included in Pavement ME Design.

Southeast

The responses from this group were consistent with those from the other regions.

Asphalt

States should use the most rigorous method given the budget, time, and effort they can put into design, which includes moving away from assumptions and using actual historical data. The asphalt industry has developed a tool to help bridge the gap for those agencies that are not yet ready to commit to Pavement ME Design, as AASHTO no longer supports AASHTO 93 Design software. The hope is that it will become a recognized tool for pavement design. A more uniform design method and a more clear understanding of all the challenges associated with Pavement ME Design is needed. The industry would like to see FHWA encourage States to make designs more efficient and modern by reevaluating AASHTO 93 structural coefficients.

Concrete

Pavement ME Design is the concrete industry's recommended tool for designing pavements. They have also developed their own design tool, which lays out design options for different types of concrete pavements including city streets and county and State roads. For advanced design, there should be a life-cycle strategy included in the design, not just an evaluation of the initial design. The process should include a probabilistic economic analysis so that designs are performed with cost considerations from the beginning (during the new pavement design phase). Moving forward, tools should accommodate means to consider resilience as well, particularly as it relates to inundation.

Aggregate and Consultant Group

Advanced Concrete Pavement Consultancy – Regarding the discussions on the need for simplified design procedures and the use of AASHTO 93 in some States: States are spending millions of dollars on a project—assuming a million dollars per lane mile, a 10-mile project would cost \$10 million—but still want to design pavements quickly in “5 minutes or 10 minutes” using nomographs, instead of using the more sophisticated procedures included in Pavement ME Design. States are just using the software as an exercise and not doing any follow-up work after performing the pavement design or doing any pre-work before performing the pavement design.

Another concern raised is the relationship between design and constructability, especially in urban areas. Constructability items that need to be considered when developing some of the design decisions in urban areas include limited access, such as the ability to use only one lane during reconstruction; use of existing base materials; and use of less than ideal base materials to allow for quick nighttime construction.

Applied Pavement Technology – In terms of Federal funding, having a long-term (30-year) vision within the Federal Government would be helpful.

Action Items for FHWA

As part of an open discussion with workshop participants, the moderator asked for suggestions of action items that FHWA could take from the preceding discussions. The following items were provided by participants during this interaction.

- Document value of engineering for design both at the executive level and at the technical level.
- Consider adoption of Pavement ME Design for the design of concrete pavements. Any concerns with using Pavement ME Design for the design of asphalt pavements should not be a barrier to adopting Pavement ME Design for concrete pavements. Proactively promote Pavement ME Design for concrete pavement design.
- Provide guidance for long-life pavements in urban corridors or in areas where strategies are limited due to other constraints (e.g. MOT).
- Provide guidance for long-life pavements focusing on pavement foundations, including subbase and subgrade. Develop a research project for designing pavements with various subbase and subgrade conditions across the United States.
- Provide guidance for quality base foundations and relate it to perpetual pavements by considering the costs associated with building a suitable base while properly considering its performance. Pavement ME Design results are not very sensitive to the base design.
- Provide guidance on the big picture of pavement design, strategies for design, initial cost of design, and benefits associated with differences in performance. Need to include LCCA and train how to do trade off analysis with LCCA (in an interactive way). For example, if a designer decides to add drainage, need to show what that expected impact will be on performance and need to determine if its added performance is worth the added costs.
- Provide guidance and support to help States develop their own guides and pavement design policies.
- Assist with training in the quality control aspects of construction to ensure that pavements are built and perform as designed. There are many issues with construction quality due to a lack of expertise in the construction industry.
- Create focus groups to identify best practices and considerations for pavement designs.
- Develop courses and workshops for specific issues relevant to pavement design.
- Develop a document related to resiliency and pavement design for sustainable pavements.
- Develop guidance on resiliency with the ever-changing environmental effects on pavement design.
- Develop guidance for integration of performance-based specifications and pavement design.

Cost Analysis, Cost Effectiveness, and Life-Cycle Cost Analysis

The following inputs from the workshop attendees are relevant to the prompted focus questions.

What are the challenges in your region with respect to cost analysis/LCCA?

Midwest

The challenge with LCCA is that there are different definitions for new and reconstructed pavements versus rehabilitation treatments, as designers consider different factors and different inputs. For new and reconstructed pavements, new performance models are used. Most of these were developed from roadways constructed with virgin materials, so pavement designers had a better sense of how the materials responded. Today's designers are using more recycled materials, and they are not always certain

how these materials will perform. The amount of recycled material that can be used in a project is typically left to the individual contractor, with agency-specified upper limits. Developing performance curves for these recycled materials can be a challenge when lesser-known or understood materials are used. On the rehabilitation side of performing cost analysis, most States are faced with budget challenges that force them to delay treatments. Depending on when those treatments are applied, performance will be impacted. This poses a challenge for designers performing cost analysis based on rehabilitation treatments, because they do not know when in the life of the pavement the treatments will be applied, and therefore they cannot quantify its performance.

Southeast

Challenges in this region with respect to cost analysis and LCCA are just getting it completed on many projects. Cost analysis is only being done on new construction, reconstruction, and major rehabilitation. Cost analysis is not being performed on preservation or similar projects.

Northeast

LCCA requires many inputs and much effort to assemble those inputs. Because there is a lot of uncertainty on inputs, there is much uncertainty on the overall output, and that has been a challenge when working with industry – resulting in “heated moments” and “pushback.” Also, changing even a single input can vastly change the end result. Without clear agreement on what the appropriate inputs are, it is a significant challenge to perform LCCA.

Northwest

Staffing is a challenge, especially junior staff’s understanding of potential future preservation cycles, as there are many different microclimates in this region that impact selection and performance of preservation treatments. Included in this challenge is the uncertainty in terms of length of analysis period needed for performing LCCA—whether it is a major investment (e.g., new construction or reconstruction in urban areas) or a project that requires comparing different rehabilitation alternatives (e.g., in-place recycling versus overlay.)

Southwest

Nine of 10 States in this region perform LCCA and have many of the same issues mentioned by other regions, such as considering multiple factors in their LCCA and whether and how to include agency costs or other inputs related to the pavement life-cycle activities. The challenge is that those LCCA results can fall within 10 percent of each other. It then comes down to committee selection of the pavement design alternative, and individual districts within a State can have their own preferences while performing pavement type selection.

Concrete

One of the biggest challenges with performing LCCAs is taking the time to get them done, because most LCCAs are not being completed as early as they should be in the design phase. This is likely due to concerns for not having the right data, cost information, performance information, or the right maintenance and rehabilitation scenarios. Variability and uncertainty are also important considerations while performing LCCA. There are ways to deal with variability and uncertainty. Agencies need to transition from a deterministic LCCA approach to a full-blown probabilistic LCCA approach, where they can perform scenario analyses and ranges of cost along with the best probabilistic outcomes. Some of the discomfort some States refer to with regard to reliability and confidence in data can be addressed with probabilistic analyses, scenario analyses and uncertainty analyses. They should not let perfection get in the way of

progress. Another concern is not following best practices while coming up with cost estimates (e.g. GAO, FHWA). The process must be focused on gathering good information for the whole LCCA process. There is currently good guidance available for gathering and using this information. Another notable challenge is having a realistic database of maintenance and rehabilitation schedules. The data States need is available in their pavement management systems and bidding databases, and should be used in performing the economic analysis using LCCA.

Asphalt

There are challenges with not having quality historical data in the pavement management system and with a lack of follow-up once an LCCA is performed. The asphalt industry would like to see some follow-up on what has been done since the LCCA has been accomplished. For example, were maintenance procedures done as expected within a certain number of years, was any rehabilitation done as modeled, and did they go back and verify the quality and sensibility of the LCCA? Another challenge is the difficulty in properly crediting innovations, such as when using different types of asphalt mixtures that perform better and capturing relevant performance data for future use.

There are also challenges on bid estimates versus actual costs; primarily, whether agencies are capturing the real costs or just using the engineers' estimates. It is important to know exactly what those costs are and to have confidence that they are being properly captured in the LCCA. Another challenge to LCCA is the assessment of salvage value. Sometimes salvage values are computed using remaining service life, but all pavements have a salvage life that needs to be addressed. When assessing salvage value, is it a salvage life value or a salvage life liability? Due to the lack of data and the effort required to collect the data or have the necessary expertise to analyze data, the asphalt industry has decided to submit a legislative proposal to assist with this process. The hope is that this legislative proposal is written into upcoming legislation and resources will be dedicated to address these issues in the next highway bill.

Does cost effectiveness equal LCCA, or are there other techniques to evaluate cost effectiveness?

Midwest

Cost effectiveness and LCCA are not the same. LCCA entails a set formula with defined inputs and a rigorous process. Cost effectiveness is less rigorous and could be plain and simple—a matter of best value and effective budgeting. There is not a one-size-fits-all method for performing cost analysis for pavements.

Southeast

Cost effectiveness and LCCA are not the same and are not necessarily equal. In agreement with the Midwest group's statement, States are getting the most "bang for their buck" with cost effectiveness and evaluating whether a treatment or design is effective and whether the treatment or design is working well for them. Performing an LCCA on a project does not guarantee cost effectiveness.

Northeast

They are not the same thing. LCCA is a tool to help get to cost effectiveness, but it does not make sense to use it on something like a chip seal or crack seal.

Northwest

The Northwest region agreed overall with the statements of the other regions. They perform LCCA for major investments and large projects. For smaller projects, they either use engineering judgement or compare alternatives using annualized costs. They discussed the purpose of TAMPs and documenting

thought processes and strategies. One thing that is missed if pavement management takes over the preservation program is knowing whether the materials are deteriorating or fatigue is happening. Pavement management sets a preservation strategy, and then pavement design confirms or changes that strategy.

Southwest

Agree that they are not the same. Some States like to look at a network corridor level versus a project level and assess Federal funding to ensure their network is increasingly improving through their TAMPs and State Transportation Improvement Program.

Concrete

Cost effectiveness is essentially the same as LCCA. We are not aware of any better tools to establish cost effectiveness. Cost effectiveness is looking at the cost and corresponding outcomes, and the answer from performing LCCA is a metric (e.g., Net Present Value [NPV]). Other metrics can be used, but they have to be consistent and follow a rigorous process. LCCA has a good process set up. There should not be any difference between the LCCA process for new construction, rehabilitation, or preservation, but it does need to be considered over a long analysis period.

Asphalt

Other techniques should be considered as LCCA is currently conducted in the context of a single project. Agencies should look at a systematic, network-level analysis rather than a project-level analysis. Specific tools could be developed to look at the network level versus just individual projects, or an asset management tool that looks at the broad picture and connects LCCA to that network-level perspective.

What types of projects are cost analyses performed on in your region?

Midwest

Within this region, every State is looking at some type of LCCA or cost analysis for new or reconstructed pavements, and then selecting that pavement type. When it comes to rehabilitation, it is less consistent. Some States use policy decisions for rehabilitation treatment selection, while other States look to enforce the process of picking the right treatments and analyzing the costs of that treatment.

Southeast

States are performing cost analyses on their designs, but they are not necessarily looking at comparing pavement alternatives. They may be looking at different treatment or material alternatives within the same type of pavement selection.

Northeast

Some States do not perform cost analysis on everything, and with preservation projects, they just use their experience with the various preservation treatments. One State performs LCCA on every project, but the consensus is that LCCA is only for larger projects, new construction, reconstruction, or major rehabilitation.

Northwest

Major investments and big projects have LCCA performed.

Southwest

Most have a dollar amount or a scope of work that is established to determine whether LCCA is performed.

Concrete

Cost analysis should be performed on as many projects as possible. It should start in the design phase, and an honest analysis needs to be conducted to look at various alternative designs and evaluate what option is going to provide the best performance for the project and network. “States are spending a million dollars a mile, so \$20,000 to get the answers from an LCCA is a good investment.”

Asphalt

The asphalt industry discussed how to capture perpetual pavement in LCCA and suggested FHWA should provide some guidance on that process, along with overcoming the challenges with training in best practices for performing LCCA. A probabilistic analysis is a better way to perform LCCA, but only if the data is reliable and accurate. Once the variability is properly considered and agencies have performed a probabilistic analysis, agencies should have the in-house expertise to properly interpret those results.

Who is responsible for performing cost analysis?

Midwest

Typically, it has been the pavement designers, but with the TAMP requirements there is a shift to asset managers evaluating the cost effectiveness and cost analysis. The asset managers are looking at the network level to ensure agencies are being strategically economical in terms of how they spend funds in selecting projects and designs.

Southeast

Similar to the Midwest region, shifts are occurring in terms of responsibility, particularly when looking at options for pavement preservation. More preservation evaluations are being performed at the district offices, whereas pavement designers at the central offices are performing LCCA for new construction and reconstruction.

Northeast

It is the responsibility of the pavement designers.

Northwest

Depending on whether the State is centralized or decentralized, it is the responsibility of the pavement designer to perform cost analysis.

Southwest

For the most part, the pavement designer is responsible for performing cost analysis.

Concrete

State DOTs should be responsible for performing LCCA. FHWA has a large monetary investment in the highway infrastructure, and it should be looking at DOTs to ascertain whether they are following best practices, considering variabilities and uncertainties, and using reasonable estimates for their designs. There needs to be a formal process established by FHWA. Performing LCCA is about information and not about “do I do a paper exercise” to come up with a predetermined solution. LCCA should be performed to get information and should be made as robust as possible so an agency can make the most informed decisions possible moving forward.

Asphalt

Designers would primarily be responsible; this could be an agency designer, a consultant designer, or a contractor designer.

Which design tools/software are used?

Midwest

Most are using their own agency-developed tools to perform LCCA or other types of cost analysis. As far as the tools that are available, some are aware of them, but how much use is actually occurring is unknown.

Southeast

Different States have their own tools to perform cost analysis.

Northeast

States use RealCost and agency-developed spreadsheets and perform probabilistic cost analysis for LCCA.

Northwest

States use RealCost or a spreadsheet that functions similarly for either probabilistic or deterministic analysis, with different parametric evaluations counting for different ranges of product pricing.

Southwest

Most use either RealCost or some type of agency-developed system when it comes to the design tools and software used for cost analysis.

Concrete

Something as simple as a spreadsheet is fine for use, but coming up with new design tools would be helpful if they were looking at probabilistic scenarios to help with entering the proper cost information. RealCost is a good program but does not help with the initial cost scenario, as you have to pull from other sources.

Asphalt

In addition to RealCost, an asphalt industry-developed program that can be used for lower-volume roads is available to the States. Current programs to perform cost analysis are adequate, but the challenge is for the State DOTs to have someone available who knows the difference between good data to input into the program and bad data. FHWA should formalize guidance on how to better use these tools.

Action Items for FHWA

As part of an open discussion with workshop participants, the moderator asked for suggestions of action items FHWA could take from the preceding discussions on LCCA and cost analysis. The following items were provided by participants during this interaction.

- FHWA could provide better guidance on user costs, and not just typical user costs, but also user costs in relation to the pavement interaction and how they can affect the LCCA. The user costs should be considered separately from agency costs. The LCCA of a project does not matter as much now with the TAMP and may not survive any practical assessment of reality if all user costs are included. “We need to address it, as opposed to putting it in the closet, closing the door, and acting like it is not there.” (ACPA Note: The analysis in the TAMP and the LCCA provide different things. Both are needed and one does not take the place of the other.)

- FHWA should not mandate that LCCA needs to be completed on every project, maybe just the larger projects. It is too cost and labor intensive to have to perform LCCA on every project. (ACPA Note: ACPA disagrees with this assessment. Per ACPA, three states (IL, MN, and MI) have legislated LCCA on all projects greater than a certain threshold. Once it is part of the process, the costs are minimal.)
- Performing LCCA would be better through probabilistic analysis rather than deterministic analysis. FHWA could assist DOTs by providing some strong recommendations or guidance on performing probabilistic LCCA.
- Update Cost Estimating practices per GAO recommendations from their 2013 report (<http://www.gao.gov/products/GAO-13-544>).
- Update RealCost spreadsheet.
- Provide guidance on how to work LCCA and cost analysis into pavement design rather than as a “comparison tool only” after the designs are done.

FHWA Pavement Design Policy

The following inputs from workshop attendees are relevant to the prompted focus questions.

What suggestions, issues, or concerns do you have that are relevant to the FHWA Pavement Design Policy?

Northwest

The CFR is good the way it is; it just needs a few tweaks. The guidance needs some major updates. Some States need more requirements included in the CFR, but others want to keep it flexible. It should not cause States to be too regulated or put too many requirements on them. The Policy should be flexible so that it allows the engineers to be engineers and not be restricted by stringent requirements.

Sustainability should not be part of the CFR. Sustainability could be an overarching part of design, which could be considered before completing the pavement design for that project. It is good to have the feedback from materials and quality systems.

The Guidance provides good information in terms of agency requirements. It might be good to have a project-level FHWA design checklist that could be reviewed throughout the overall design process.

Southeast

The Policy should not be too binding; the primary concern is to keep the Policy flexible. Where the CFR states “pavement shall be designed in a safe, durable, and cost-effective manner,” FHWA could better define those parameters so that there is consistency across the country. What may be considered safe and durable to one agency may not be the same for another agency. This ambiguity in the Policy drives the request for more definitive CFR guidance.

Midwest

FHWA needs to revisit the Policy because of how quickly things are evolving in pavement design and materials. Revisions made should not stifle innovation and the associated benefits of innovation. Review the definition of pavement design regarding what needs to be redefined or clearly defined, such as base and subbase. Keep it flexible and not overly prescriptive, because that would stifle innovation.

Northeast

The group discussed what types of projects this Policy should apply to. The Policy should stay flexible. Terminology could be clarified, including on base and subbase materials and cost effectiveness. Cost effectiveness does not equal LCCA; other options can be used to consider cost effectiveness in designs. One State participant noted that agencies should consider the full life cycle of a pavement when performing the initial pavement design. In the Policy, “factors which are considered include” might be better changed to, “factors which may be considered.” This would be helpful with projects that might not consider all of the factors in the overall Policy. Some of the States in this region are highly affected by weather events, but there was not agreement as to whether resiliency should be included in the Policy. The non-regulatory supplement is outdated and needs to be revisited as well. One participant mentioned that some States don’t even have pavement design policies and maybe it should be in the Policy, that it is required of a State to have pavement design policies.

Southwest

The consensus was to keep the Policy, but with some updating. The conversations primarily revolved around the definition of “pavement design.” On the definitions part of the Policy, the terms base, subbase, and materials need to be defined further. The wording in the definition of the Policy that states “shall include” and “may include” should be addressed. One participant said there is no need for the Policy because of the TAMP requirements and suggested that as long as States have a pavement design policy, then leaving it to the States to implement the policy is good enough. The consensus, however, was to keep the Policy. One reason for this is that States can use the Policy as part of the regulatory process when working with local agencies.

Asphalt

As written, the Policy does a good job of balancing the engineering analysis with the economic analysis without placing unnecessary burdens on the State DOTs and allows them the flexibility they need. It should not be mandated, but FHWA needs to address updates to the LCCA guidelines.

The non-regulatory supplement specifies that the engineering evaluation should include recycled materials, on which FHWA already has a Policy. Therefore, the industry supports FHWA Policy to use recycled materials with the engineering and economic analysis.

An Executive Order from the Secretary of Transportation states that the Secretary shall not require a State to conduct an LCCA for any project based on its recommendations. This strikes the balance between making recommendations for LCCA without mandating it.

Regarding the Technical Advisory on alternate design/alternate bid: while it is obvious that FHWA is trying to balance work between the concrete and asphalt industries, sound guidance on alternate bids is needed. The Technical Advisory should be reviewed and evaluated by an economic expert and an engineering expert for recommendations. In addition, clear language is needed from FHWA in front of all technical guidance that states the guidance is purely advisory and not mandated. This would help clarify whether States must do things a certain way because it is mandated by FHWA.

Concrete

There is a lot of commonality between all of the parties involved here. It is relevant and clear that the States have flexibility to develop procedures that are appropriate to their conditions. It is important that

FHWA assert its statutory authority to ensure the States are doing pavement design by considering both the engineering and economic considerations, and not just combinations of materials.

The concrete industry also believes that this is not entirely a discretionary matter for FHWA. Under 23 USC 112(a) FHWA is required to ensure that Federal-aid projects are let subject to competitive bidding, which the agency has interpreted to apply not only to the award of a contract but also to the materials used. If FHWA intends to stay true to this threshold obligation the agency must ensure that no Federal-aid project is bid using only one pavement design. As a result, FHWA is compelled to develop the economic and engineering tools necessary to make meaningful distinctions and measurements concerning the relative cost and value of the competing designs. Moreover, since Federal money is being spent, agencies should be engineering roads in such a way that they take advantage of all the materials—concrete, asphalt, and maybe a third material—that can serve in each of these layers of the system and look at it through the entire pavement life cycle. “This has been a tenet of FHWA’s and AASHTO’s posture for decades – including AASHTO’s 1960 Informational Guide on Project Procedures (with particular attention to Contract Construction, Pavement Type Selection and Right of Way Acquisition) and FHWA’s 1981 Pavement Type Selection Policy Statement (Fed Reg Vol 46, No 195, October 8, 1981).” These assets are not meant to last for just one year; they are sometimes meant to serve at least a generation or more. It should be viewed as an investment for the taxpayers, and this message should be conveyed to the taxpayers. This is in effect FHWA’s stewardship responsibility as it pertains to expenditures of Federal-aid funds.

In response to the discussion that cost effectiveness analysis takes place at the network level and as such, the idea of doing some type of analysis at the project level is unnecessary the concrete industry believes that both need to be done. The network analysis is essentially an allocation exercise to determine how much money goes into reconstruction, or preservation and what sections will be worked on first and what can be delayed until later. However, there also needs to be an analysis at the project level to determine which “reconstruction activity” is most cost effective on that specific project. As FHWA’s pavement design Policy and Guidance are all project specific, it is important that it not get lost that the requirements are for what needs to be done at the project level.

The definition of pavement design can be tweaked to reinforce that both engineering and economic values are included in pavement design. There should be a connection between the Policy and the non-regulatory supplement linking pavement design and pavement performance. Right now it is too generic.

The non-regulatory supplement is 20 years old and needs to be updated. The concrete industry believes that using Pavement ME Design is the most scientifically rigorous way to design a concrete pavement; this should be reflected in the non-regulatory supplement.

Regarding the Technical Advisory, it could be improved but it does provide some clarity and guidance for the States on how to perform an alternate design/alternate bid, with an attempt to get at the unequal sharing of risk with different materials in a low-bid environment. The concrete industry also has information and guidance on their website.

Aggregate and Consultant Group

Applied Pavement Technology – The non-regulatory supplement pre-dated MAP 21 [The Moving Ahead for Progress in the 21st Century Act, P.L. 112-41] and was basically the policy prior to ISTEA [The Intermodal Surface Transportation Efficiency Act, P.L. 102-240]. When ISTEA mandated the management systems, a comprehensive pavement management system would encompass many of the details of the

pavement policy. The National Highway System Designation Act cancelled the management system mandates and then the existing policy was created in its shorter version. TAMP requirements including a comprehensive pavement management system could meet the goal of the pavement policy. Unfortunately, most of the states are not there.

Further Discussion on Design Life or Expectations

One agency's pavement design manual includes, for example, a different design service life for urban settings versus rural. This was done primarily because in rural settings they can more easily raise the pavement grade (or surface elevation) in the future, whereas this would be a challenge in urban settings (due to the much larger number and sizes of overpasses).

Discussion followed about whether it is a "crutch" to say an agency is designing for 9, 10, or 12 years, because it is an economic optimization question that has philosophical internal and external pushback. Agencies should find the optimal spot on the curve and identify a design life where the costs, including some user costs, are minimized.

Action Items for FHWA

As part of an open discussion with workshop participants, the moderator asked for suggestions of action items that FHWA could take from the preceding discussions on the Policy. The following items were suggested by participants during this interaction.

- Provide better guidance on the term "equivalent design" for looking at differentials and stresses in the surface materials when using or comparing two different alternatives. Equivalent design is a very difficult thing to define, and better guidance is needed as to what that actually means.
- Clarify what items the Policy does and does not apply to, for example, whether it applies to incidental construction items. In some States, incidental construction repairs depend on purpose and project needs. Mostly it is up to the DOTs' district offices to interpret, and each district office may interpret the usage of the Policy differently.
- More discussion could be provided on research and guidance on preservation, including how to incorporate preservation into design. In at least one agency, preservation is a growing portion of overall expenditures. In some States, funds are allocated for preservation with the assumption that it provides a return on investment by extending project life.
- FHWA should have a review group to help put all this together (sort of like being done with the LCA tool development).

Other Considerations

The following inputs from the workshop attendees are relevant to the prompted focus questions.

How can FHWA help address your concerns relative to issues such as environment, innovation, research, and future needs?

Northwest

Life-cycle assessment is a good tool, but it should not be incorporated into the pavement design process at this time.

When handing pavement preservation-type projects over to consultants, the consultants do not understand the State DOT's risks or the DOT's pavement management strategies, which can lead to inconsistencies between designs and DOT needs.

FHWA should develop an incentive or recognition program for the different industries to work together to come up with innovative ideas or design methods that will produce better products for the future.

More peer exchanges for the State DOTs would be valuable. The States find it very helpful to exchange ideas, and for those who have recently joined the DOTs it is a great resource for knowledge. There is great value in sharing information both from State DOTs to FHWA and from FHWA to State DOTs.

More guidance on how pavement design is incorporated into asset management and the TAMP would be helpful to the States, but not another regulation.

Southwest

It would help to have a means of communicating and sharing information in a systematic manner between FHWA and State DOT pavement design groups.

Southeast

Nothing else belongs in the Policy. More guidelines and best practices would be beneficial, but none of the guidelines and best practices should be included in the Policy regulations.

Midwest

Promoting joint industry efforts—where concrete, asphalt, and other industries work together for a better product or method—is a great idea. More peer exchanges would also be helpful.

States are having issues with work zone crashes. It would be helpful to get FHWA's perspective on how it can assist in reducing and mitigating these crashes (e.g. full closures in lieu of workforce exposure).

Northeast

It would be good to have a pavement design partnership meeting every year at the practitioner's level that could be facilitated by FHWA. It would be a way to meet, share ideas at the practitioner level, and discuss what is working and what is not working. This would be similar to the pavement preservation partnership that is active now.

FHWA should assist with training and research on long-term pavement performance specifications. At least one State is having a problem with joint failures, so more research on this supported by FHWA is desired. Assistance is also needed in calibrations, new technologies in construction, long-term data collection, and technology transfer.

The long-term pavement performance (LTPP) program should continue with more sections, particularly to perform local calibration using the LTPP data. Look at automated collected data as less of a report card and more of a learning tool for the future using 3D data collection technology.

FHWA could help with databases and associated software. It is difficult at the State level to design code and develop databases, as they do not have the research and information technology funds.

Concrete

It is becoming evident that States are going to need the ability to recover from fires, floods, and other natural disasters. This requires FHWA to recognize and address the new ideas formulated around sustainability and resiliency. Will this be addressed at the State level or the Federal level, and where does the leadership come from for this? While keeping the Policy flexible, the ideas of sustainability and

resiliency can be incorporated sufficiently to where it does not feel as though it is a mandate or it is dictated at the State level.

FHWA has a leadership role in adaptability of the pavement infrastructure when it comes to transporting people and goods from one place to another. With the high cost of real estate in urban areas, it will be hard to dedicate a single corridor for just one purpose. There are many different things that pavements are going to be asked to do (self-driving vehicles, storage capacitor for energy, etc.), so FHWA should provide some guidance as to how adaptability of the pavement infrastructure to these changing needs is going to be addressed.

Industry can be leaders in developing innovative materials, ideas, equipment, technologies, and practices, but guidance documents and best practices need FHWA's leadership to present innovation in a broader perspective to the various stakeholders. FHWA policies should encourage competition between industries that can be readily implemented at the State level.

Regarding the circular economy and recyclability, there are incredible waste streams coming out of the cities, and people are looking for places to put that in infrastructure. With sustainability in mind, how do States and industry deal with the use of these materials in pavements? Can industry take on this challenge of using recycled materials and still meet performance requirements expected of pavements? FHWA could do more research and provide more guidance on this issue.

How can FHWA help DOTs deal with big data and interpret results? There is a need to become better at dealing with large amounts of information.

Asphalt

Nothing more needs to be in the Policy at this time, but the Policy should be revisited more often than the 20 years it has been since the last update. Things are more fluid now, and science might be faster moving in the years to come than in the last 20 years. More progress will come in the areas of sustainability, life-cycle assessment, and resiliency.

More guidance from FHWA will help States develop a program to get the data they need to perform the LCCA. This data could be used at a programmatic level to evaluate networks and compare performance of different scenarios.

Concerning resiliency, it is important to design to withstand major events, but risk management is also an aspect, because one cannot design every pavement in the country to a critical level; but they should be design for a high level. Given that some adverse events just cannot be designed for, it would be useful to have information on how agencies should react to the event when it happens to get the network back open and functional as quickly as possible.

Innovation is very important, especially most recently with the repeal of the Proprietary Products Rule. FHWA needs to provide information to States on the innovations coming their way, how to evaluate them, and how they may affect States from the standpoint of design and performance and network management.

Aggregate and Consultant Group

Advanced Concrete Pavement Consultancy – FHWA could put aside funds to help with the adoption of new innovations and product testing when opportunities are presented by industry. Something like FHWA’s former Highways for Life program would help when industry is proposing a new product or innovation.

Something that is very fundamental but needs to be addressed by FHWA is guidance on linking design with construction specifications. This is not currently being done. The specifications tend to be thought of last.

Regarding innovation and advanced concrete materials, one problem the concrete industry sees is that the high cost of implementing a new design and test section on the highways is a burden for which nobody wants to be responsible. FHWA should have a funding system or new programs that support funding innovative ideas coming from industry. Programs such as the former “Highways for Life” could be helpful with this situation. However, there should be historic consistency between the programs across various administrations or highway bills, similar to the National Cooperative Highway Research Program’s Highway IDEA (Innovations Deserving Exploratory Analysis) program.

Next Action Items by FHWA

The industry listening session and peer exchange reports for the Midwest, Northeast, Northwest, Southeast, and Southwest regions are currently posted on FHWA’s website. FHWA, as of now, does not have a tentative timeframe for “next steps,” but is committed to working expeditiously on solutions for issues heard during this workshop.

Attendee List

Northwest Peer Exchange:

Shin-Che Huang, Transportation Engineer – Nebraska FHWA Division Office

Justin Moderie, State Pavement Engineer – Oregon DOT

Mark Russell, Pavement Design Engineer – Washington State DOT

Southwest Peer Exchange:

Dahir Egal, Pavements Materials Engineer – Colorado FHWA Division Office

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

Jason Simmons, State Pavement Engineer – Utah DOT

Southeast Peer Exchange:

Affan Habib, Pavement Program Manager – Virginia DOT

Clark Morrison, State Pavement Design Engineer – North Carolina DOT

John Steele, Pavement & Materials Engineer – Tennessee FHWA Division Office

Midwest Peer Exchange:

David Holtz, Pavement Engineering Director – Indiana DOT

LaDonna Rowden, Bureau Chief, Research – Illinois DOT

Mike McGee, State/National Pavement & Materials Engineer – Missouri FHWA Division Office

Northeast Peer Exchange:

Jennifer Albert, Pavement and Materials Engineer – Pennsylvania FHWA Division Office

Robert Blight, Supervising Engineer, Pavement Design – New Jersey DOT

Geoff Hall, Chief, Pavement and Geotechnical Division – Maryland DOT

Asphalt Industry:

Audrey Copeland, President and CEO – National Asphalt Pavement Association

Danny Gierhart, Regional Engineer – Asphalt Institute

Richard Willis, Vice President for Engineering, Research & Technology – National Asphalt Pavement Association

Concrete Industry:

Brian Killingsworth, Executive Vice President, Local Paving – National Ready Mixed Concrete Association

James (Jim) Mack, Director of Market Development – CEMEX
Chairman – American Concrete Pavement Association

Gerald (Jerry) Voigt, President and CEO – American Concrete Pavement Association

Leif Wathne, Executive Vice President – American Concrete Pavement Association

Other:

Max Grogg, Senior Engineer – Applied Pavement Technology

Joe Kroboth, Director, Transportation and Capital Infrastructure – Loudoun County, Virginia
Board Member, Mid-Atlantic Chapter – American Public Works Association

Michele Stanley, Vice President, Government & Regulatory Affairs – National Stone, Sand &
Gravel Association

Shiraz Tayabji, President – Advanced Concrete Pavement Consultancy

FHWA:

Gina Ahlstrom, Team Leader – FHWA

Heather Dylla, Sustainable Pavement Engineer – FHWA

Brian Fouch, Director, Office of Preconstruction, Construction, and Pavements – FHWA

LaToya Johnson, Team Leader – FHWA

Hari Kalla, Associate Administrator for Research, Development, and Technology (RD&T) and
Director of Turner-Fairbank Highway Research Center (TFHRC) – FHWA

Janet Myers, Office of the Chief Counsel – FHWA

Milena Rangelov, Visiting Sustainable Pavements Engineer – FHWA

Nadarajah Sivaneswaran, Senior Research Civil Engineer – FHWA

Tom Yu, Program Manager, Pavement Design – FHWA

Moderators:

Shree Rao, Principal Engineer – Applied Research Associates

William Vavrik, Principal Engineer – Applied Research Associates

Note-Taker:

Jose Chavarria, Instructional Systems Designer – Applied Research Associates