Standing Committee on Design and Rehabilitation of Asphalt Pavements (AFD60)
Dr. David H. Timm, Chair

Design and Rehabilitation of Asphalt Pavements: History and Future

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HISTORY AND BACKGROUND OF THE AFD60 COMMITTEE

The committee was originally established as Flexible Pavement Design (D-4) in 1939. In 1970, the committee was reorganized as A2B02 under the direction of the Chair of the pavements section, Dr. Carl Monismith. In 1982, the committee was reclassified as A2B03 and then changed back again in 1986 to A2B02. The committee officially became AFD60 in 2003. Original members of the pavements committee included esteemed practitioners and researchers such as Dr. Carl Monismith, Dr. Fred Finn, Dr. Matthew Witzcak, Prof. Elton Yoder, Mr. Ronald Hudson, and Dr. Marshall Thompson, to name a few.

In 2015, the scope of the AFD60 Committee was changed to reflect the aspects of pavement rehabilitation and design that are specific to asphalt pavement structures. Henceforth, the AFD60 committee adopted the asphalt-related activities previously handled by the AFD70 committee on Pavement Rehabilitation.

MISSION AND PURVIEW OF THE AFD60 COMMITTEE

In the past, the primary focus of the Standing Committee was Flexible Pavement Design and the long-standing mission was to apply the outcomes of the AASHO Road Test and advance the design, theory, and performance of flexible pavements. A common goal from the committee's inception in 1939 was to move the state-of-practice of pavement engineering towards the state-of-the-art, and continually support the move towards the implementation and adoption of improved methods for designing and predicting the performance of flexible pavements. As part of that goal and the improvements made in pavement monitoring technology and computing techniques, the Committee's focus shifted to the advancement of mechanistic-empirical flexible pavement design, including all factors that influence the physical behavior, service life and economy of flexible pavements. Among the factors of interest are dimensions and mechanical properties of the pavement layers, shoulders and supporting layers or systems, traffic loadings and characterization, materials characterization, environmental conditions and economics. At the present time, the committee's scope was expanded to include the design and rehabilitation of asphalt pavement structures. Areas of interest include design, performance modeling and the selection of rehabilitation strategies.

Empirical to Mechanistic Design of Flexible Pavements

The flexible pavement committee, as well as other TRB committees, supported and participated in two sponsored workshops in Syria, Virginia (1993) and in Irvine, California in 1996 to lay the foundation for developing a mechanistic-empirical pavement design procedure that could be adopted by state highway agencies. From this workshop, the original NCHRP 1-37 problem statement was developed.

The Committee first had a role in exploring empirical design (such as the AASHTO 1993 version which is based on statistical models from road tests) and then spent many years supporting research related to mechanistic empirical design (which includes the calculation of stresses/strains combined with empirical pavement performance models, like the MEPDG approach). Specifically, in 2002, the Flexible Pavement Design committee began efforts supporting the implementation of NCHRP 1-37A results (Mechanistic Empirical Pavement Design Guide [MEPDG]). This was done through the sponsorship of workshops and sessions. Recognizing the long-term effort required to implement the MEPDG, the committee's primary goals stated in the 2005 Triennial Self-Evaluation were to facilitate, support and sponsor related tasks, sessions, workshops, conferences and research efforts to achieve implementation.

The continuum shown in Figure 1 qualitatively summarizes pavement design practice as it existed just five years ago. Note the distance between the current practice and state-of-practice and between the state-of-practice and state-of-the-art. As of 2010, most agencies (approximately 90%) were using AASHTO-based empirical design procedures (72, 86, or 93 versions).

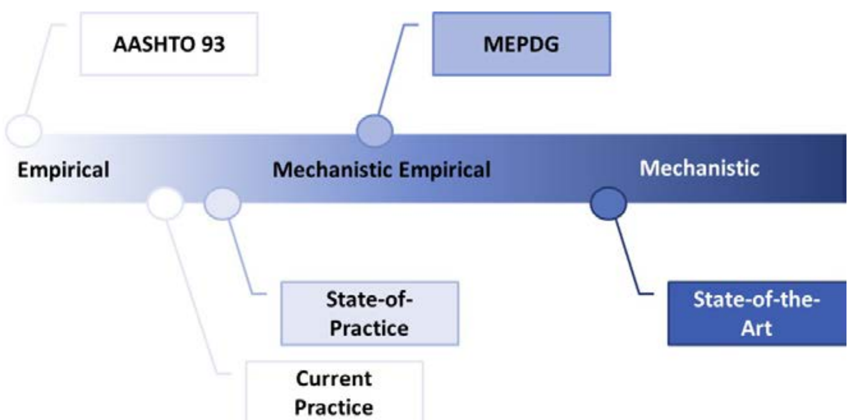

FIGURE 1 – Pavement Design Continuum (*1*).

A national survey was conducted by the Committee in 2010 regarding aspects of the implementation of mechanistic-empirical flexible pavement design. It led to a TRB Workshop organized by the Committee at the 89th Annual Meeting in 2010 and the publication of the TRB e-Circular, E-C155 (*2*). The workshop was developed to provide information for transportation agencies in the process of, or considering the implementation of, the interim AASHTO Mechanistic–Empirical Pavement Design Guide (MEPDG) and shared experiences from transportation agencies that had performed various sensitivity analyses using the MEPDG software. The subsequent TRB e-Circular captured information from the survey and workshop such as which input factors are important to the final pavement designs, so that agencies can focus their research accordingly during the implementation process.

Perpetual Flexible Pavements

Starting in the early part of the 21st century, the Committee also focused on the exploration and advancement of the perpetual pavement design concept. The idea behind perpetual flexible pavements is to extend the 20-year life expectancies of hot-mix asphalt pavement to greater than 50 years with no deep structural distresses such as bottom-up fatigue cracking. Research was done to explore combinations of rut-resistant, impermeable, and wear-resistant top structural layer with a rut-resistant and durable intermediate layer, and a fatigue-resistant and durable base layer. Figure 2 shows an early rendering of the perpetual pavement design concept.

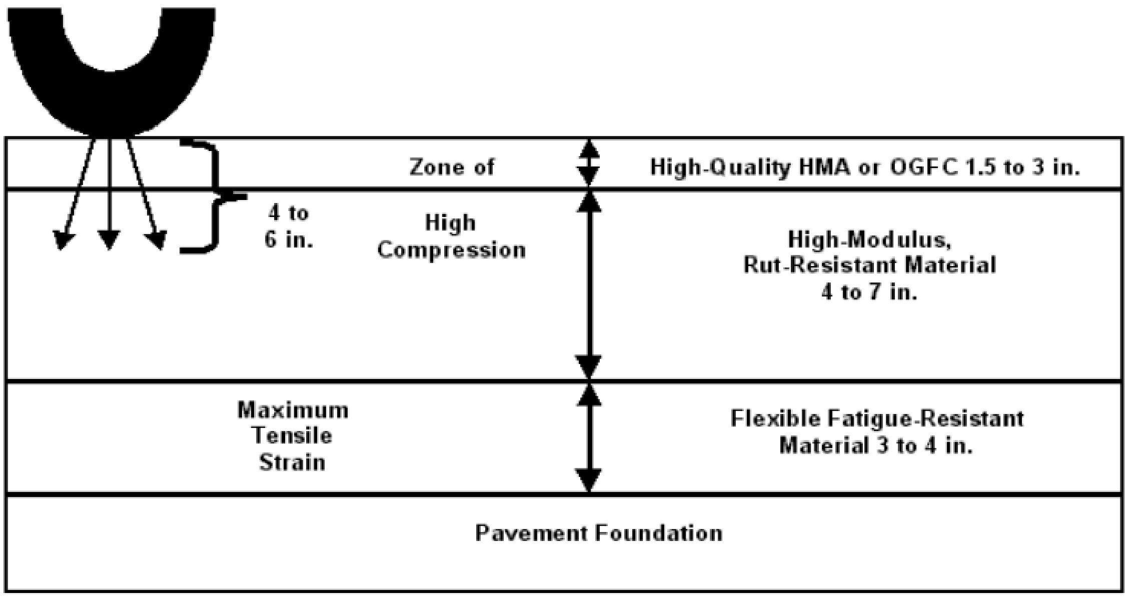

FIGURE 2 – Perpetual Pavement Design Concept (*3*).

In the perpetual pavement concept, only periodic surface restoration is necessary, which would result in accelerated construction and reduced user delay and construction costs associated with flexible pavement design. As part of this effort, the Committee also co-sponsored a two-part session on the concept of perpetual bituminous pavements at the 2001 Transportation Research Board Annual Meeting which was sponsored by the TRB Committee on General Issues in Asphalt Technology (A2D05). As a result of these sessions, the TRB Circular 503 was published (*4*). These efforts helped integrate perpetual design into mainstream pavement design approaches such as the MEPDG, develop new design programs such as PerRoad and implement perpetual concepts in design codes used by state agencies (e.g., *5*, *6*).

Workforce Development and Flexible Pavements

Another critical area that the committee has focused on was the large turnover and retirement of state agency personnel in the latter 1990s. Specifically, the number one long-term goal outlined in the 2002 TSP was dealing with issues associated with the loss of experienced and educated pavement professionals in state departments of transportation. This was found to be a more challenging issue since it goes went beyond the confines of TRB. Many members volunteered their time in their communities to share their knowledge with young people. A specific goal was to attract more participation from younger members in the committee, which continues today.

EVOLUTION OF THE AFD60 FOCUS

The Flexible Pavement Design committee has taken an active role to integrate asphalt pavement structural design, mixture design, and construction. The integration of asphalt structural and mixture design was initiated in the latter 1980's as an outcome from the Long-Term Pavement Performance (LTPP) program and the implementation of the SUPERPAVE™ asphalt mix design procedure initiated in the early 1990's. Over the past 15 years, advances in laboratory experimental equipment has led to the opportunity for testing fundamental material properties that offer the potential to better predict post-construction performance. The results from these tests provide more direct, reliable inputs for mechanistic-empirical design methods; in many cases, these properties were only estimated from more simplified tests. A mechanistic design would include mechanistic-based pavement performance models and is the area in the continuum where researchers are pushing forward toward the future of pavement design. Recognizing the importance of integrating design-materials-construction, the implementation of the MEPDG was the primary focus for AFD60 and many other committees within and outside the AFD00 section.

Integration of Materials Advancements and Flexible Pavements

After SUPERPAVE™ was deployed and the MEPDG software package was delivered to AASHTOWare in 2004, the Flexible Pavement Committee started to focus more on the importance of data that was needed to calibrate and/or confirm features of the design models. During the tenure of Mr. Kenneth Fults as the committee chairperson, committee members turned their attention to the use of accelerated pavement testing to confirm the impact of structural features and asphalt mixture properties on flexible pavement distress.

AFD60 identified areas for improvement in the MEPDG by issuing calls for papers and sponsoring TRB sessions related to top-down cracking in asphalt surfaces, reflective cracking modeling and mechanisms, and pavement performance prediction based on sensitivity analysis. Since these topics, as well as many others, are related to traffic, soils, asphalt materials properties, climatic influences, etc., AFD60 sponsored or co-sponsored with other committees many sessions in exploring the inter-relationships of these factors on pavement performance and validity of any analysis results. In addition to co-sponsoring sessions/workshops, the committee built a relationship with AFK50 (Structural Requirements of Asphalt Mixtures) through the joint subcommittee located in AFK50. The active relationship with AKF50 certainly improved the coordination with pavement design and bituminous material requirements in the MEPDG. AFD60 and AFK50 co-sponsored a workshop on integrating asphalt mixture and structural design which resulted in an E-circular document published in 2009 (*7*).

One limiting factor in the development of the Mechanistic-Empirical Pavement Design Guide (MEPDG), as executed through projects NCHRP 1-37A and 1-40, was the restriction to use/incorporate *existing* (at the time) mechanistic models for the prediction of rutting and cracking in flexible pavements. As implementation of the MEPDG began to increase, a new focus emerged concerning the development of new predictive models, building on work related to advances in materials technology and better understanding of the effects of climate on pavement properties. Subsequently, models related to reflection cracking and surface-initiated (“top down”) fatigue cracking (NCHRP 1-42, 1-42A,1-52) have been developed for the MEPDG system.

Influence of Truck Loads and Configurations on Flexible Pavements

Another related area of concern to flexible pavement design was the changing truck and tire characteristics and increase in pavement-tire contact pressures than were used at the AASHO road test. As an outcome from the changing truck features, the committee encouraged and facilitated "cross-over" between the trucking industry and highway community. The committee in the latter 1980’s pursued more permanent technical activities or liaisons between both groups which continued into the mid-2000s. Two outcomes from this coordination was to better understand how heavy trucks damage pavements, and to understand how rough pavements can damage trucks.

MAJOR ACCOMPLISHMENTS OF AFD60

The Committee typically sponsors or co-sponsors two to three podiums sessions and one to two poster sessions at the TRB Annual Meeting. Each podium session includes four presentations related to flexible pavement research and implementation, while the poster sessions typically include six to ten presentations. As an example, the list of activities from the 2014 annual meeting is shown below:

2 sponsored (S) Podium Sessions

- *Session 493* –Impacts of Tire and Truck Loads on Pavement Performance
- *Session 820* – So You Are Trying to Implement the “MEPDG”?

1 Poster Session

- *Session 372* – Advanced Analysis of Flexible Pavements and Performance

5 Sponsored or Co-Sponsored Sessions and Workshops

- Session 497: Past, Present and Future of Pavement Design
- Session 830: Tire Pavement Noise and Quieter Pavements (ADC40)
- Session 851: Programs for Quieter Pavements in the United States (ADC40)
- Workshop 868: Integrating Asphalt Concrete Mix Design, Structural Design, and Construction Quality Control (AFK50)
- *Workshop 870* – Prep-ME: Status of Pooled-Fund Project TPF-5 (242) and Implementation Experience of Software Users

In addition, each annual meeting of the AFD60 committee typically hosts two to five technical presentations which are not included as part of the TRB Annual Meeting general podium or poster sessions. Attendees at each annual meeting of the Committee range from 60 to 125 professionals.

Historically, there have typically been around 30 to 40 technical papers submitted to AFD60, reviewed by six to seven members or friends of the committee, and on average about six papers are recommended for publication annually in the Transportation Research Record journal.

The committee has also hosted or co-hosted 13 TRB Webinars over the past five years. These webinars typically attracted an average of 386 viewers from around the world and received an average satisfaction rating of 93%. Each year, the committee has drafted about two NCHRP Research Needs Statements and one to two NCHRP Synthesis statements, to be considered for agency sponsorship and funding.

AFD60 TODAY

The Standing Committee on Design and Rehabilitation of Asphalt Pavements current scope is, "The design and rehabilitation of asphalt pavement structures. Areas of interest include design, performance modeling and the selection of rehabilitation strategies." While this is quite broad, with some overlap with various other committees, structural pavement design (both new construction and rehabilitation) is a major area of emphasis for AFD60.

Asphalt pavement structural design in the U.S. in 2018 is an amalgam of empirical, mechanistic-empirical (M-E) and perpetual design procedures. AASHTO currently supports and endorses M-E design, with an allowance for perpetual pavements. The current edition of AASHTO pavement design is the Mechanistic-Empirical Pavement Design Guide (MEPDG) with accompanying software, AASHTOWare™ Pavement ME Design (Version 2.5), but many agencies continue to use older empirically-based methods (e.g., AASHTO 1972 or AASHTO 1993). Additionally, some agencies have developed their own empirical or M-E approaches separate from AASHTO.

A survey of states completed in 2014 (*8*) showed that 56% of states were using some form of empirically-based design, 22% used both their pre-existing empirical method and the MEPDG, while 14% were using an empirical method along with some other form of M-E design. Figure 3 shows pavement design usage by state, as of 2014. Data presented in 2017 (*9*) showed significant progress toward implementing the MEPDG (Figure 4) with 13 states (26%) having implemented and 35 states (70%) planning to implement for asphalt pavements and/or overlays.

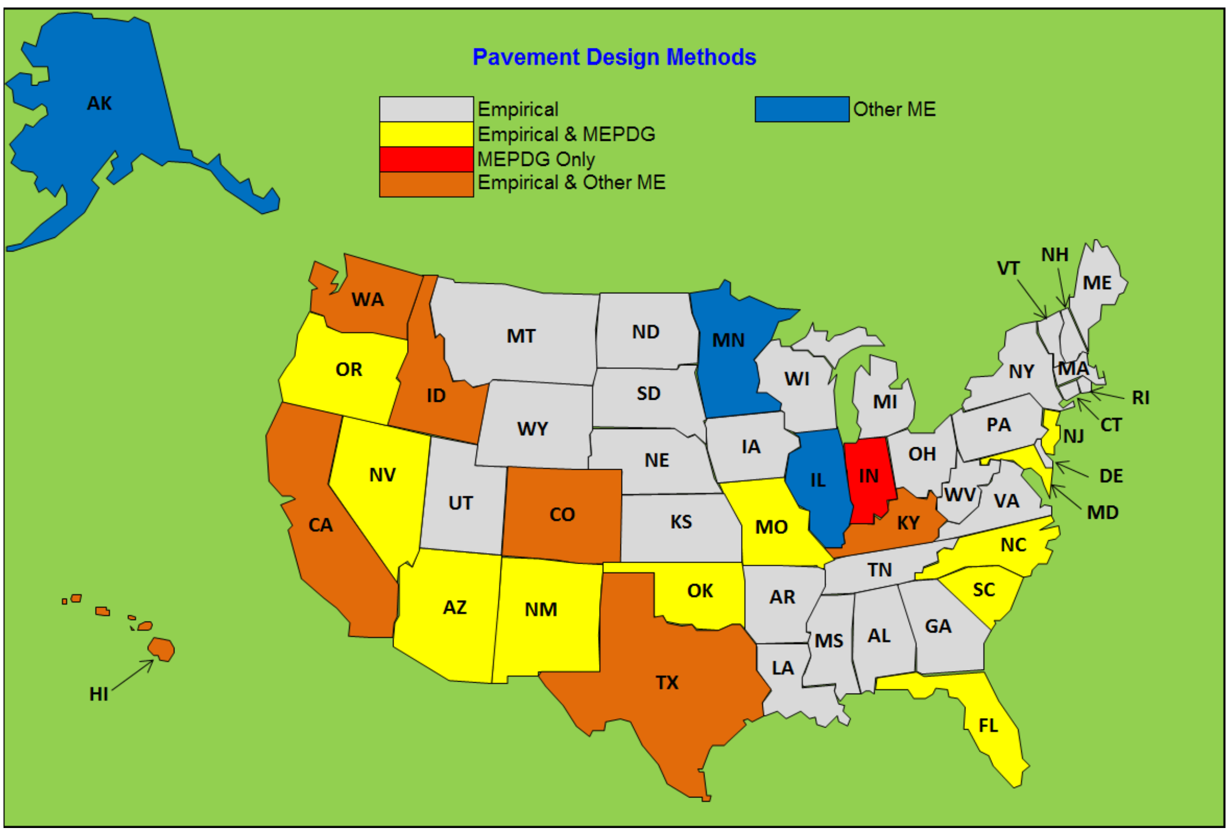

FIGURE 3 Pavement Design Methodologies by State in 2014 (*10*).

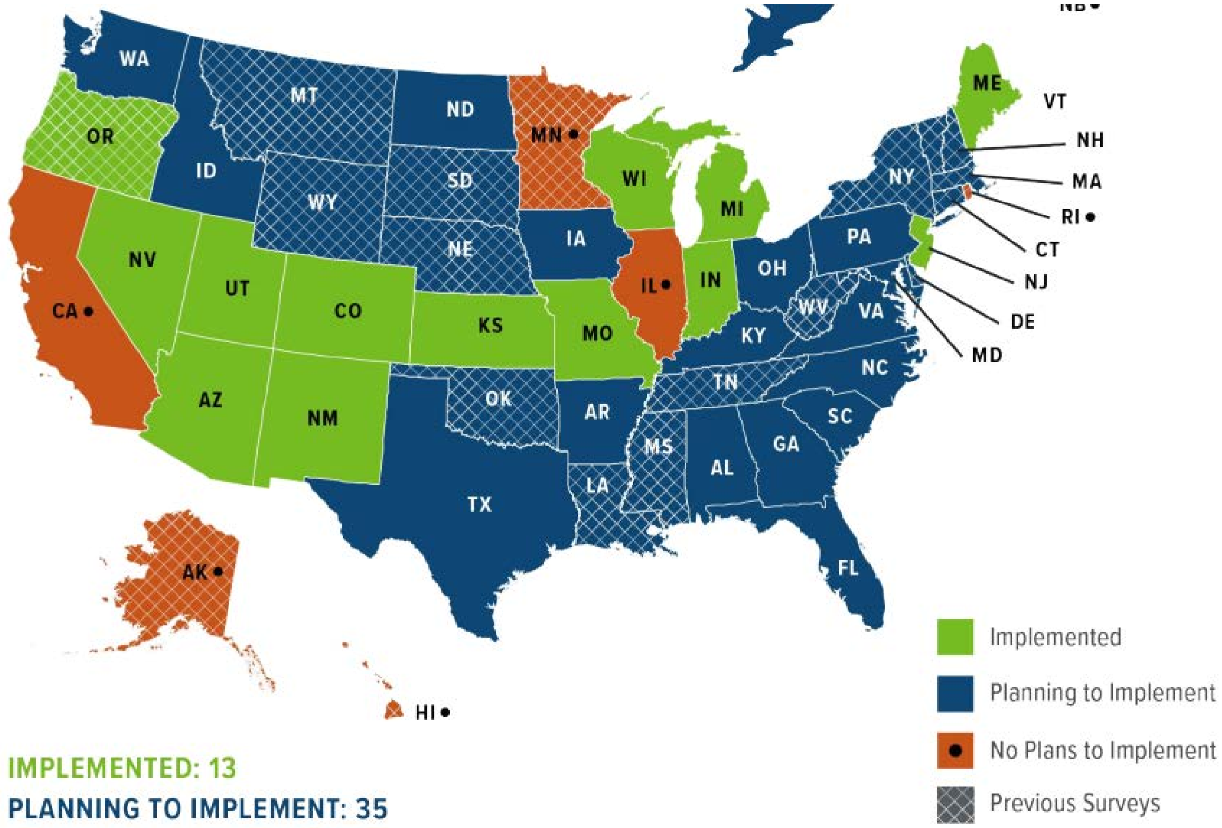

FIGURE 4 MEPDG and ME Design Software Implementation in 2017 (*9*).

The major shift in philosophy from empirical to mechanistic-empirical and perpetual has put many issues at the forefront of structural design research and investigation. These include materials characterization, climate modeling, load spectra characterization, transfer function development/calibration and training. These current issues have encouraged productive cooperation with other committees with the aim of working toward more efficient pavement design approaches.

Development of improved procedures and models to characterize material properties is a critical need for the advancement of M-E design. This relies on interactions with committees in the Asphalt Materials section (AFK00) to research and provide the necessary fundamental properties for structural pavement modeling and design. The Geological and Geoenvironmental Engineering Section (AFP00) is critical in developing knowledge of unbound materials for asphalt pavements.

Performance modeling of flexible pavement materials and systems continues to be an area of emphasis. AFD60 interacts with the other committees in the AFD00 section (Pavements) for critical information regarding transfer function development and calibration. The committees on Pavement Management Systems (AFD10) and Pavement Condition Evaluation (AFD20) have direct input on the quality of data collected for these activities. AFD40 (Full Scale Accelerated Pavement Testing) has been a valuable resource for best practices and studies regarding transfer function development. Collaboration with AFB30 (Low Volume Roads) has also been important toward addressing structural design issues on lower trafficked pavements.

M-E design requires much greater level of detail regarding load and environmental characterization. The Truck Size and Weight committee (AT055) and committees within the Data and Information Systems section (ABJ00) are helpful in developing knowledge pertaining to traffic. Several other Design and Construction Group (AF000) are important toward characterizing climatic effects on flexible pavements. These include AFS60 (Standing Committee on Subsurface Drainage) and AFP50 (Standing Committee on Seasonal Climatic Effects on Transportation Infrastructure).

Pavement rehabilitation was recently added to the scope of AFD60 with the sunset of AFD70. Therefore, AFD60 is now working on placing greater emphasis on this topic, with particular emphasis on materials and performance characterization of recycled materials within structural overlay design. This has facilitated more cooperation with AFH60 (Asphalt Pavement Construction and Rehabilitation).

While interactions and cooperation with the above-mentioned committees has been important to the advancement of M-E design, it is anticipated that the relationships will continue to deepen and expand as more states move toward implementing M-E design approaches and integrate M-E concepts within overlay design.

FUTURE OF AFD60 AND FLEXIBLE PAVEMENT DESIGN

Previous sections have reviewed key areas of interest for the committee –design of new and existing pavements, performance modeling as well as selection of rehabilitation strategies. The reviews cover both past achievements of the committee in the area as a discussion on the current well state-of-the-art design of new and rehabilitation schemes.

Mechanistic-Empirical (M-E) design became the official structural design approach of AASHTO in 2011 with the commercial release of the AASHTOWare® Pavement ME software. Deployment of the new design methodology was the culmination of decades of research and development and many state agencies are currently working through the implementation process that includes evaluation, local calibration and validation. These efforts will continue for the foreseeable future and the implementation of M-E design as an ongoing critical issue for asphalt pavement design and rehabilitation. Much of the focus has historically been on new design, but with the vast majority of work in the U.S. being rehabilitation, focus must switch over to rehabilitation design in the short term.

Within the M-E design framework are various models to predict pavement distress, climate, traffic and material properties throughout the anticipated pavement lifetime. Continued emphasis on improving, enhancing and updating these models is critical to future improvements to M-E systems and will remain a focus of the committee. A challenge will be to simplify often complex models into usable tools for the pavement engineering community. Additionally, in the ever-increasing world of design-build, P3s, long-term warranties, etc., the primary responsibility for design is often shifted to the contractor rather than the agency. Pavement design tools have to be suitable for implementation across various end-users. This is of particular importance to the AASHTOWare® Pavement ME software as some agencies and groups still view it primarily as a research tool rather than a day-to-day design program.

With advances in faster computers, it is expected more agencies will use the M-E approach for the design and rehabilitation of asphalt pavements. One of the major hinderances to the widespread use of M-E techniques and software is the current process of “local calibration” of the performance models. In the future, more robust but less cumbersome systems for calibrating distress models need to be developed. With current automated distress data collection and storage technologies capable of sub-millimeter resolutions, it may be possible to develop systems for distress models “calibration on the fly” and thus over real potential of seamless integration of pavement design and performance prediction.

The materials and processes used to construct, reconstruct and rehabilitate pavements have changed significantly over the last 100 years. Traditional approaches of constructing pavements with materials such as virgin aggregates and straight asphalt binders have given way to the use of reclaimed asphalt pavement (RAP), polymer-modified asphalt, bio-binders and processing systems like warm-mixes. Today, many of the materials used to construct or reconstruct pavements use recycled products such as full-depth reclamation and cold central plant recycled asphalt. In the coming years these materials will become more commonplace and existing M-E design process will need to be modified to accommodate these novel materials. New and better asphalt pavement design tools that are sensitive to the unique engineering properties of sustainable materials used for in-place pavement recycling including the capability to model the combined effect of moisture, temperature and time are urgently required.

Another emerging issue for the committee is the expansion of applications for porous asphalt pavements. Limited use of porous in States such as Georgia and in countries such as The Netherlands, suggest the use of these multifunctional material will become more and more widespread. Porous asphalt with air void levels approaching 20% have been used for stormwater management, improving wet weather safety and for reducing noise. New design techniques should be developed to enable the unique properties of porous asphalt to be captured in existing design software. Techniques for maintaining porous asphalts (e.g., desilting) and durability (combined effect of moisture and traffic loads) are urgently needed before these sustainable materials could become commonplace. Requirements to balancing sustainability, storm water management and limited real estate is bringing porous asphalt pavements from parking lots to mainline use. Current structural pavement design procedures were not meant for use with porous asphalt pavements and moving from static loads such as cars to heavily loaded trucks presents a challenge for pavement designers who must also understand the relationship between open graded asphalt mixtures, aggregate reservoirs and heavy tire loads. Likewise, design procedures must be developed to assist pavement designers in addressing the impacts of non-standard tire configurations and superheavy loads on permeable flexible pavements.

In the future, sophisticated procurement and delivery mechanism where, for example, contractors take on a more substantial design and material selection roles will become more commonplace. Current practices largely segregate the engineering of asphalt concrete mixtures from the engineering of the pavement structure itself. The analytical tools that accurately link mixture material composition and design to pavement structural performance, such as those being developed under the current FHWA Performance Related Specifications efforts among others, such as AMPT performance tests, Excel-based FlexMAT™ for the material level analysis, and FlexPAVE™ for the pavement performance analysis, will need to continue to be further developed so that mixture design could be optimized for pavement performance.

Another area of critical concern is how to prepare for the imminent introduction of connected and autonomous vehicles (CAVs) or trucks (ACTs). About 95% of all new vehicles sold will be fully autonomous or connected vehicles by 2040. For pavement design, enormous challenges and opportunities are presented by connected vehicles (i.e., vehicles that are fitted with communications devices that provide information to either the driver or the vehicle, allowing them to collaborate with other road users and parts of the road infrastructure) and the possibility of dedicating lanes for only trucks. For example, connected groups of trucks that can form platoons of up to 10 trucks spaced about a meter apart have been trialed in Europe and the USA. The level of randomness of the lateral position of ACTs will be significantly reduced creating more channelized loading patterns. The aforementioned features of ACTs will lead to accelerated damage accumulation. Design standards that can account for the unique loading levels and loading distribution (wander) and guidance on optimal platoon size will need to be developed in medium to long-term (*11*). An appropriate and extensive use of preservation treatments to delay the application timing of heavy rehabilitation techniques is recommended for the optimization of limited funding resources of transportation agencies. Therefore, future decision-making processes can be accelerated or even automated using pavement management databases supported with the data collected from sensors embedded in CAVs and vehicle-to-infrastructure (V2I) communications.

Engineers have worked diligently to develop standards and methods that accurately account for the climatic effect on pavement performance, but many of these methods look to the distant past to characterize the climate, essentially adopting an assumption of stationarity. Emerging climate science suggests that this assumption may not hold in the future and has the potential to cause major disruptions to major infrastructure systems. In pavements, a failure to consider this potential impact may have far reaching consequences in the form of reduced durability and increased maintenance or rehabilitation activities. Pavement engineers are recognizing this potential and have begun to utilize more frequently updated historical climate records. In the future this recent history may need to be augmented with predictions of future climate, which will introduce yet another layer of uncertainty that will need to be considered.

Development of next generation structural design tools is a longer-term critical and emerging issue. Although the contribution of Pavement ME to making mechanistic pavement analysis a state-of-the-practice for state highway agencies is widely acknowledged, the pavement community continues to desire more mechanistic analyses and less empirical adjustments. Since 2004, when the Mechanistic-Empirical Pavement Design Guide (the previous version of Pavement ME) was first released, mechanistic-empirical models have been developed and improved. For instance, FlexPAVE™ is a three-dimensional finite element program for viscoelastic moving load analysis was developed at North Carolina State University and verified using over 60 pavements from the United States, Brazil, Canada, South Korea, and China (*12-15*). Texas Transportation Institute developed the three-dimensional computational code called the Pavement Analysis Using Nonlinear Damage Approach (PANDA) as part of the Asphalt Research Consortium (ARC) led by the Western Research Institute (WRI). PANDA considers the impact of moisture intrusion, aging, healing and temperature on mixture and pavement response under traffic and environmental loads (*16, 17*). Another product of the ARC project from University of Nevada-Reno was the 3D-Move pavement analysis and design software, 3D-Move can account for moving traffic-induced complex 3D contact stress distributions of any shape, complex loading patterns, and the viscoelastic material response of the flexible pavements (*18, 19*). Finally, the University of Nebraska-Lincoln pavement research group is investigating the concurrent mechanistic pavement-mixture design (MPMD) approach that directly links the properties of mixture components and mixture design to pavement thickness design. Movement toward purely mechanistic design, with little (if any) reliance on empirical calibration, will greatly advance asphalt pavement structural design. AFD60 will strive to be at the center of promoting development of these more advanced models.

Fundamental research and advancements in material modeling, fracture mechanics and probabilistic analysis will provide the underlying support structure for these advancements. The challenge again will be to transform sophisticated methods and technologies into usable design tools. An additional challenge will be to reduce the time lag from development to practical implementation. Systematic education on pavement design, preservation, and rehabilitation is necessary to reduce the gap between academic research and current actual practices and to help achieving future sustainable pavement rehabilitation design.

Current pavement design techniques are based on linking critical pavement responses at discrete locations within the pavement to damage in the bulk of the pavement. Similarly, during construction, the key quality control parameter – mix density – is evaluated at only discrete locations. Thus that the complex relationship between pavement responses and damage as well as construction quality and damage are not currently being holistically evaluated. Techniques such as domain analysis being developed at the University of Illinois may have an impact on the future of pavement design (*20, 21*).

Finally, all the aforementioned issues are complex cross-cutting problems that will require techniques from diverse fields like big data analytics and cloud storage (e.g. storage of daily pavement distress and pavement response data from connected pavements), probabilistic techniques (e.g. predictions of "real-time" pavement conditions) and cloud computing (e.g. platform-independent pavement design apps) (Figure 5).

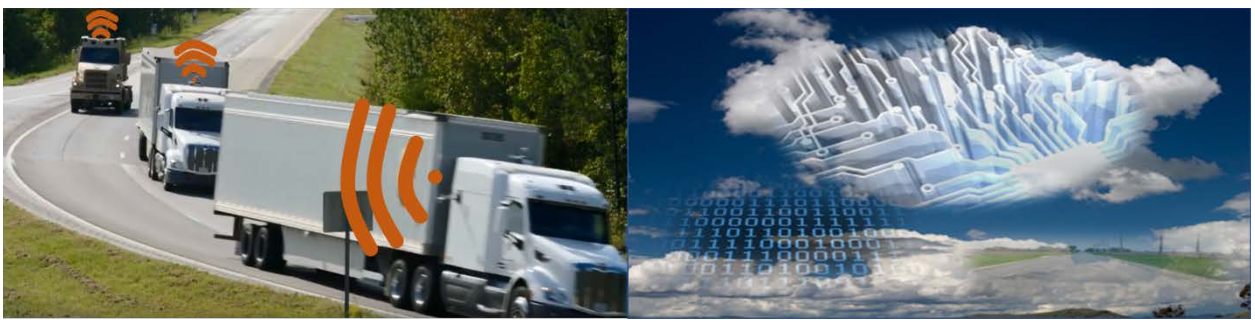

FIGURE 5 Pavement design of the future will combine techniques in cloud computing and storage, internet of things and autonomous and connected vehicles.

Artificial neural network (ANN) models may be more fully utilized in advanced modeling of the future (*22*). For example, ANN models trained over comprehensive datasets could be successfully incorporated into the AASHTOWare pavement mechanistic-empirical (ME) design. The ANN-based models are used by several research groups, such as Iowa State University pavement research group, to examine several variables at once and the interrelationships between them (*23, 24*). ANNs could also be used to develop or improve models for complex and non-linear problems associated with flexible pavement distress behaviors such as thermal cracking, fatigue cracking, block cracking, rutting, delamination, and so on. One of the biggest advantages of ANNs is the ability to successfully map complex models (e.g., three dimensional comprehensive finite element based models which can take into account nonlinearity, stress-dependency, and anisotropy of pavement layers along with the ability to incorporate fracture mechanics and crack propagation to model reflection cracking behavior of composite pavement systems under mechanical and climatic loadings, and so on) and produce highly accurate predictions from such complex models in real time. Advanced AI based models will improve the reliability and speed of the pavement performance predictions under complex loading conditions and can increase the mechanistic component of the mechanistic-empirical pavement analysis and design tools.

SUMMARY

Asphalt pavement design and rehabilitation has seen many advancements over the last century. AFD60 has helped develop and deploy numerous structural design systems ranging from empirical to mechanistic-empirical and will work toward more advanced fully mechanistic systems in the future. Underlying these efforts are the well-supported and well-executed studies that turn research into practical design tools.

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