



TECH SNAPSHOT

UNR-TS-26-0420

AUTHORS

Derek Nener-Plante
(ORCID: 0000-0001-7642-326X), DNP Infrastructure LLC

Elie Y. Hajj (ORCID: 0000-0001-8568-6360),
University of Nevada,
Reno

DISCLAIMER

This document is disseminated under the sponsorship of the U.S. Department of Transportation (USDOT) in the interest of information exchange under the cooperative agreement No. 693JJ32350026. The U.S. Government assumes no liability for the use of the information contained in this document.

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

All AASHTO and ASTM standards mentioned in this document are non-governmental, voluntary standards and are not required under Federal law.

APRIL 2026

Innovate to Elevate—AIEI in Action

Texas Two-Step: Better Performance through Balanced Mix Design

This document explains how the Texas Department of Transportation (TxDOT) and multiple university research centers have advanced Balanced Mix Design (BMD) of asphalt mixtures from research into pilot acceptance, and how the Federal Highway Administration's (FHWA) AIEI effort helped accelerate implementation through structured resources and peer learning.

Performance Challenges: Impetus for Change

Texas operates one of the nation's largest asphalt paving programs across wide variations in climate, traffic, and locally available materials. TxDOT's 25 districts must deliver asphalt mixtures that resist both rutting and cracking consistently while also supporting efficient construction and responsible use of recycled materials.

TxDOT and Texas Transportation Institute (TTI) recognized that traditional volumetric approaches do not always provide enough confidence in long-term field performance. They pursued BMD to add performance-focused checks that help ensure asphalt mixtures are durable, and appropriate for Texas conditions, while keeping the specification practical for real-world implementation.

At the same time, TxDOT has continued to expand the use of reclaimed asphalt pavement (RAP) to manage costs and promote the responsible use of material resources. Increased infrastructure construction activity due to population growth in Texas has placed additional pressure on material resources, making increased RAP usage even more attractive. Because RAP content and source can influence mixture cracking susceptibility, and those effects can vary across districts, TxDOT and TTI sought a more direct way to confirm mixture durability before scaling changes statewide. Moving toward BMD provided a practical path to keep using recycled materials while introducing objective performance checks that help manage cracking risk and maintain consistent field performance.



TxDOT's BMD Journey

TxDOT and TTI organized their BMD effort as a deliberate implementation program built around field projects, stakeholder alignment, and repeated refinement of guidance and specifications. TxDOT has utilized mechanical testing for its specialty asphalt mixtures for decades, but its recent BMD work has focused on the introduction of IDEAL-CT (ASTM D8225) and IDEAL-RT (ASTM D8360) tests that can be performed more rapidly in both mix design and production phases of projects.

Gisel Carrasco is the Flexible Pavements Section Director for TxDOT, where the Materials and Tests Division is responsible for materials specifications across all 25 districts, encompassing a wide range of traffic levels, climates, and soil conditions. Gisel describes TxDOT's approach to BMD implementation as the "Texas Two-Step," which combines (1) early, targeted field test projects to build confidence and validate thresholds, and (2) multi-day production "shadow" field projects to demonstrate feasibility under real-world plant and paving variability. The current team, a partnership between TxDOT, TTI, Center for Transportation Research at University of Texas Austin (CTR), and industry, is completing work in multiple three-year phases, moving from learning to pilot acceptance and ultimately to broader deployment.

"The collaboration and the peer exchanges that have been facilitated by AIEI have been invaluable."
– Amy Epps Martin, TTI

AIEI Product Highlight: Eight Tasks for BMD Implementation Tech Brief

- Document detailing the tasks and subtasks for BMD implementation.
- Audience: agency and industry stakeholders.
- Based upon successful practices from lead states implementing BMD.

The Texas team engaged in AIEI efforts early on, with TxDOT being highlighted as a lead on BMD in case studies performed in 2020.⁽¹⁾ Dr. Amy Epps Martin, Professor at Texas A&M University, has led much of the TxDOT research into BMD. Epps Martin described TxDOT's BMD work as a "parallel effort," where national AIEI resources evolved alongside Texas-specific initiatives, helping them to compare approaches and close gaps as they emerged. These resources included AIEI's **Eight Tasks for BMD Implementation Tech Brief**,⁽²⁾ which provides a structured framework to support agency implementation of BMD. In addition, the Texas team has participated in multiple AIEI peer exchanges (lead states and mega states) where they were able to learn from other agencies' experiences.^(3,4)

Through use of AIEI resources and participation in peer exchanges, the Texas team revised their original BMD plans and adopted the tasks outlined in the Tech Brief as the framework for implementation efforts. The tasks have provided Texas a roadmap that can help them effectively track progress while maintaining a vision of the final implementation. TxDOT BMD implementation staff have also kept up to date by attending **AIEI webinars** where they can learn about national findings and trends. TxDOT has maintained momentum in their



BMD implementation efforts by advancing in three phases:

- **Phase 1: Targeted field learning.** Nine single-day projects with 33 test sections were constructed to learn quickly, compare options, and establish preliminary BMD targets.
- **Phase 2: Production shadow projects.** Four multi-day shadow projects (eight test sections) were used to stress-test sampling and testing during production and confirm contractors can meet expectations consistently.
- **Phase 3: Lead-district pilots.** TxDOT is now moving into lead-district pilot projects that will utilize the pilot acceptance specification while continuing performance tracking of all field projects toward specification refinement.

AIEI Product Highlight: Peer Exchanges

- Forums for agencies to share effective practices, lessons learned, and challenges.
- Available for groups based upon common technical topics; findings and trends documented by AIEI.

A TxDOT-Industry BMD Working Group was established as the implementation effort kicked off in 2019, and they meet regularly to review results, resolve practical issues (sampling, variability, and training), and maintain alignment between districts and contractors. TxDOT also uses a district forum, with subject matter experts from each district, to review specification updates and guidance to help ensure a consistent approach across diverse climates and construction conditions statewide.

A key outcome of this iterative process was TxDOT's pilot acceptance special specification (SS 3024), issued at the end of 2025. The pilot retains familiar mix design checks while adding BMD-based acceptance elements to confirm asphalt mixtures are not overly prone to rutting or cracking. The Texas team emphasized that repeated revisions were essential to make the specification workable for both TxDOT and contractors. TxDOT and its partners are targeting a statewide implementation of BMD by 2028.

AIEI Product Highlight: Webinar Series

- Year-round webinars, recorded for on-demand viewing.
- Topics include BMD and other asphalt innovations.
- Learn more:
www.unr.edu/wrsc/asphalt/webinars.

Benefits

Through more than six years of work, TxDOT and TTI report growing evidence that a practical BMD program is achievable at Texas scale. The program has evaluated 41 asphalt mixtures across 13 field projects, with sections currently ranging from about 1 to 6 years in service.

- **Mixture Performance.** Performance checks provide added assurance that BMD mixtures are resistant to both rutting and cracking before widespread use. Test projects and mixtures have demonstrated increased RAP usage is possible without sacrificing performance, which is key to unlocking the benefits desired by TxDOT and Industry (e.g., cost savings, resource responsibility, and more durable mixtures). Other accelerated loading experiments



sponsored by TxDOT have shown significant life extension with BMD.⁽⁵⁾ The team noted that even a one-year life extension on TxDOT's asphalt pavement would result in hundreds of millions of dollars in savings each year.

- **Feasibility.** Shadow projects demonstrated that BMD sampling and testing can be completed consistently over multiple days with typical Texas plant operations.
- **Constructive collaboration.** Test-section data supports clearer conversations about tradeoffs with stakeholders (sampling effort, test variability, and practical specification language).

AIEI's Impact

TxDOT and TTI emphasized that AIEI resources helped them accelerate progress by providing implementation-ready frameworks and opportunities for direct peer learning. Texas used AIEI products throughout the effort to structure tasks, compare approaches, and communicate lessons learned. Table 1 summarizes the impact of AIEI support on BMD implementation in Texas.

"We want to make data-driven decisions. One state, no matter how big it is, isn't going to have enough resources to do that alone. We need structured resources like AIEI to help us mine what's already known."
– Jon Epps, TTI

When asked about what advice they would give to other agencies, Carrasco and Epps Martin recommended States and stakeholders engage in national efforts and

learn from others. They noted that AIEI helps the asphalt paving community stay current on the effective practices and emerging challenges nationwide, while also reinforcing the value of partnerships among agencies, industry, and academia.

The "Texas Two-Step" approach illustrates how collaboration can elevate the quality of asphalt pavements, with AIEI resources helping to shorten the learning curve and avoid common pitfalls.

Table 1. Impact of AIEI Support.

Area	Before AIEI	After AIEI Support
BMD Implementation planning	Internal planning and local research design.	Eight Tasks framework provided a shared checklist and progress-tracking tool.
Peer learning	Limited bandwidth to benchmark BMD approaches across states.	Peer exchanges enabled direct comparison and reduced reinvention.
Stakeholder alignment	District / contractor concerns required repeated clarification and iteration.	Peer examples and AIEI summaries supported consistent messaging.
Training and consistency	Need to scale understanding as the pilot expands.	Webinars and national discussions supported shared vocabulary and practical guidance.

Learn about how the AIEI resources can help you realize [benefits](#) like you read about [here](#)!

Follow the AIEI Program on [LinkedIn](#) to keep current with the program's efforts!



References

1. Hajj, E.Y., Aschenbrener, T.B., and Nener-Plante, D. (2021). *Case Studies on the Implementation of Balanced Mix Design and Performance Tests for Asphalt Mixtures: Texas Department of Transportation (TxDOT)*. Report No. WRSC-TR-21-07, University of Nevada-Reno, Reno, NV.
2. Hajj, E.Y., Aschenbrener, T.B., Nener-Plante, D., West, R., Yin, F., and Musselman, J. (2022). *Balanced Asphalt Mix Design: Eight Tasks for Implementation*. Report No. FHWA-HIF-22-048, Federal Highway Administration, Washington, D.C.
3. Sufian, A., Bittner, J., Hajj, E., and Aschenbrener, T. (2024). *Accelerated Implementation and Deployment of Pavement Technologies (AIDPT) Pooled Fund Peer Exchange on Balanced Mix Design (BMD)*. Report No. FHWA-HIF-24-066, Federal Highway Administration, Washington, D.C.
4. Yin, F., Hajj, E., Aschenbrener, T., Harman, T., and Nener-Plante, D. (2024). *Lead States Balanced Mix Design (BMD) Peer Exchange: Outcomes Summary*. Report No. FHWA-HIF-25-007, Federal Highway Administration, Washington, D.C.
5. Hajj, E., Boz, I., Diefenderfer, S., and Yin, F. (2026). *Benefits of Balanced Mix Design: Evidence from State Implementation Efforts*. Report No. UNR-TB-26-0120, University of Nevada-Reno, Reno, NV.

AIEI Resources Related to Balanced Mix Design

- [Balanced Asphalt Mix Design: Eight Tasks for Implementation](#)
- [Benefits of Balanced Mix Design: Evidence from State Implementation Efforts](#)
- [Balanced Mix Design of Asphalt Mixtures: Challenges & Opportunities](#)
- [Effective Practices, Lessons Learned, and Challenges When Implementing Asphalt Balanced Mix Design: Site Visits 2025 Follow-Up](#)
- [Adjustment of Asphalt Mix Design/Job Mix Formula to Satisfy Mechanical Test Properties](#)



U.S. Department of Transportation
Federal Highway Administration

AIEI

ASPHALT | INNOVATE | ENLIGHTEN | IMPLEMENT

AIEI

ASPHALT | INNOVATE | ENLIGHTEN | IMPLEMENT



**Connect with us on our LinkedIn page to keep current with
all team member events and program progress!**

UNR-TS-26-0420

**Connect with us on our LinkedIn page to keep current with
all team member events and program progress!**

For other cooperative agreements materials, information, or technical assistance, please visit:

<https://www.fhwa.dot.gov/pavement/asphalt/coopmaterials/>
<https://www.unr.edu/wrsc/tools/asphalt>

This material is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange under agreement number 693JJ32350026 Development and Deployment of Innovative Asphalt Pavement Technologies. The U.S. Government assumes no liability for the use of the information in the non-FHWA-branded documents.