



TECH SNAPSHOT

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Innovate to Elevate—AIEI in Action

North Dakota's Path to Better Performance

This document explains how the AIEI program helped North Dakota Department of Transportation turn persistent cracking and raveling into a momentum-building shift toward durable, cost-effective asphalt mixtures. The AIEI program's purpose is to address the ongoing challenges faced by the transportation community to adopt new technologies and reduce the time to implement them in business practices, specifications, and construction methods relating design, production, testing, control, construction, and investigation of asphalt pavements.

Performance Challenges: The Impetus for Change

North Dakota's climate places significant demands on pavement performance, with long, bitter winters and large temperature swings. The North Dakota Department of Transportation (NDDOT) observed increasing pavement distresses, especially longitudinal joint cracking, thermal cracking, and early-age raveling. Low asphalt content mixtures and early distresses added maintenance costs and shortened pavement service life. While specifications had remained largely unchanged for years, State DOT staff wanted to address performance but lacked resources to move quickly. The AIEI program filled that gap with targeted support and technical assistance—catalyzing a shift toward innovation, including Balanced Mix Design (BMD).

NDDOT's BMD Journey

Tyler Wollmuth, Assistant Materials Engineer for NDDOT's Materials Division, oversees asphalt testing, specifications, and research. "We had issues with our asphalt pavements, and lacked the tools to address them," he recalls, detailing the challenge that NDDOT faced with tackling their pavement performance problems. Along with Aaron Perez, Pavement Sections leader responsible for design and mix type selection, the team steers the full lifecycle of the asphalt program. The BMD journey began with a Mobile Asphalt Technology Center (MATC) visit to North Dakota in 2021, where



the BMD mechanical tests were demonstrated.⁽¹⁾ BMD is a modern approach to designing and specifying asphalt mixtures that relies upon mechanical testing of mixtures to encourage innovation and cost-effectiveness. During an Indirect Tensile Cracking Test (referred to as IDEAL-CT) demo, a mixture from another State measured around 120, while a North Dakota mixture measured under 30.⁽²⁾ Wollmuth recalls a key takeaway from that demonstration: “We have to do something – and we have a long way to go.”

With growing interest in BMD, the AIEI program delivered a **BMD Implementation Workshop** to NDDOT and contractors in January 2023. The workshop delivered information on the tasks developed under AIEI for agencies and their contractors to implement BMD based upon experiences from other States.⁽³⁾ “The workshop got us going and gave us momentum with our contractors to try something new,” says Wollmuth. The workshop provided NDDOT with access to national-level experts through AIEI who were able to provide technical assistance both during and after the workshop.

NDDOT then participated in two BMD peer exchanges supported by AIEI, a Midwest peer exchange (December 2023) and a national peer exchange (March 2024), to learn what’s working (and what’s not) from other agencies.^(4,5) NDDOT staff connected and collaborated with representatives from other State DOTs to directly compare test protocols and validation approaches, accelerating the design of their own pilot BMD specification.

AIEI Product Highlight: BMD Implementation Workshop

- One-day, in-person workshop.
- Audience: agency, industry, academia, others.
- Built on real-world examples from other States.

The pilot BMD specification is targeted for 2027. Meanwhile, the agency is using Hamburg Wheel-Track testing (HWTT) to mitigate moisture damage in selected regions and applying insights from BMD benchmarking to make incremental specification adjustments that improve durability.⁽⁶⁾

NDDOT staff have remained engaged with the AIEI program since the delivery of the workshops and attendance of peer exchanges. AIEI team members have assisted NDDOT in the development of their BMD validation project and NDDOT has attended recent **AIEI webinars** on the topic, including the 5-part BMD series from 2025.⁽⁷⁾

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

NDDOT has seen multiple positive changes in their asphalt pavements since they started their movement to BMD—and not only in the performance of the



mixtures. NDDOT's shift to embracing innovation in their asphalt program has resulted in several benefits, including the following:

- **Mixture Performance.** Although BMD specifications have not been widely implemented by NDDOT yet, the information test results are shaping other specification changes. For example, HWTT identified stripping and brittleness in certain areas, enabling immediate adjustments. "We would not have found or addressed these materials issues without going through the process to investigate BMD," recounts Wollmuth. NDDOT is also using softer grade asphalts and allowing higher asphalt binder contents to encourage more durable mixtures to resist raveling and cracking based upon the BMD investigation. Though it is early, maintenance crews for NDDOT are reporting that BMD mixtures are "passing the eye test" and they are less concerned about the dryness of the mixtures.
- **In-Place Density.** In conjunction with the materials adjustments based upon their BMD work, NDDOT has observed a significant increase in the measured in-place density of their asphalt mixtures during construction. National work has commonly cited in-place density as the most critical measure of quality asphalt construction to attain adequate performance.^(8,9) NDDOT testing has observed an increase in the average in-place density during construction from 92.9 percent in 2017 to 94.0 percent in 2024.
- **Cost.** As a State with relatively small population and limited resources, NDDOT is justifiably concerned about the cost to deliver its asphalt program with any change or innovation.

However, NDDOT is seeing no appreciable impact on their costs with the improved performance. Wollmuth summarized their experience by stating that "NDDOT is paying the same price but getting better asphalt mixtures."

- **Workforce.** An unexpected benefit to NDDOT work on BMD has been the positive impact on its workforce. The culture shift to embracing innovation has reenergized the materials staff. Both Perez and Wollmuth describe the shift as "refreshing". Team members have reported that being part of a national conversation has kept them engaged and has encouraged them to identify other opportunities for innovation and improvement.



Figure 1. NDDOT technician Bobby User running the BMD IDEAL-CT test.

AIEI's Impact

NDDOT, as an agency serving a small population with limited resources, prioritizes using staff time efficiently by



focusing on information and resources that are direct and high value. The support provided by AIEI, including workshops, webinars, and peer exchanges, has consistently met this NDDOT standard. Table 1 illustrates the state of four areas prior to AIEI support versus the change after.

Table 1. Impact of AIEI Support.

Area	Before AIEI	After AIEI Support
Mix Design	Traditional volumetric design.	Developing BMD validation project.
Performance	Early cracking, lower in-place density.	Softer binders, higher in-place density, fewer distresses.
Workforce	Limited exposure to innovations.	Engaged, motivated, collaborative.
Cost	Static budgets.	Same cost, better performance.

Wollmuth and Perez noted that AIEI resources assist them with answering a common question from their upper management when considering new innovations—“*What are other States doing?*” This shared knowledge fosters collaboration among agencies. For instance, NDDOT is actively working closely with the Montana and Wisconsin DOTs who are also working on BMD implementation utilizing similar testing equipment.

“AIEI has certainly accelerated the process of investigating and implementing BMD for us.”
– Tyler Wollmuth, NDDOT

NDDOT plans to move forward with their investigation of BMD, to usher in even more benefits like allowing contractor flexibility in their asphalt mix designs. North Dakota has limited aggregate supply, and they hope to allow more natural aggregates in future specifications while maintaining performance with BMD. When asked about what advice he would give to other agencies, Wollmuth recommended States and stakeholders take advantage of the national resources available to them through AIEI and to get plugged in to the national efforts. He also encourages agencies to involve industry by sharing these resources with contractors and respective State Asphalt Pavement Associations (SAPA).

“Even as a small state, using the technical resources available to us through AIEI has allowed us to advance our asphalt program and provide better value to the public.”
– Matt Linneman, Chief Engineer, NDDOT

North Dakota’s story shows that even States with limited resources can achieve large performance gains through collaboration, data-driven design, and national partnerships like AIEI.

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!



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