



TECH SNAPSHOT

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Innovate to Elevate—AIEI in Action

Wisconsin's Asphalt Partnership Pays Off

This document explains how the AIEI Program helped Wisconsin successfully tackle systemic pavement performance issues costing the State significant resources. 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 related to the design, production, testing, control, construction, and investigation of asphalt pavements.

Confronting Costly Pavement Failures

Premature pavement failures not only lead to costly maintenance interventions but also disrupt the flow of traffic and erode public confidence. The Wisconsin Department of Transportation (WisDOT) faced premature cracking and degradation of longitudinal construction joints, particularly on its high-volume interstate and expressway systems. These joints were consistently the most vulnerable areas, where failure initiated and led to widespread, expensive and disruptive maintenance cycles. Barry Paye, Bureau of Technical Services Director at WisDOT saw this issue firsthand. "A lot of projects were needing mill & inlay at the joint to repair weak and cracked pavements, which were expensive and creating potential safety issues for us," Paye recalls.

A deeper investigation revealed several factors contributing to the problem and that addressing them would take significant resources. WisDOT recognized that a simple fix would not suffice and there was a need for a comprehensive overhaul of its approach to asphalt mix design, construction, and quality assurance. The Federal Highway Administration (FHWA) and AIEI program were ready with targeted support, successful examples, and technical assistance to help Wisconsin address the gaps in its specifications.

A Collaborative Blueprint for Change

WisDOT, together with its industry partners, realized that the issues they were observing were caused by several factors. Rather than developing specification changes in isolation, WisDOT consistently



met with industry and the Wisconsin Asphalt Pavement Association (WAPA) to develop a multi-faceted solution designed to systematically target the root causes of the observed pavement failures and build quality into the process from the ground up. Representatives from FHWA and individuals now part of the AIEI team were present at many of these meetings to help give perspective on the leading specification tools that other states use to address the problems Wisconsin was experiencing. The examples provided to WisDOT are now captured in the **AIEI Enhancing In-Place Density Tech Brief** series.⁽¹⁻⁴⁾

AIEI Product Highlight: Enhancing In-Place Density Tech Briefs

- Series of four documents summarizing how to achieve better density.
- Audience: agency, industry, others.
- Based upon successful practices that have demonstrated excellent results.

Beginning in 2015, over several years, WisDOT and WAPA piloted and subsequently implemented a new approach to achieve higher quality asphalt pavements that included the following:

In-Place Density: WisDOT increased the lower specification limit for in-place density in its standard specification from 92.0% to 93.0% minimum as well as the way it is measured. The new specification mandated the use of nuclear gauges correlated to physical cores providing more accurate in-place density measurements.

Percent Within Limits (PWL): WisDOT transitioned from an average-based quality system to a statistical PWL specification. Instead of just meeting a minimum target,

PWL created powerful financial incentives for producing a consistently uniform pavement mat by minimizing variability, while also applying disincentives for failing to meet those goals.

Asphalt Mix Design: WisDOT implemented a regressed air voids system for mix design⁽⁵⁾, resulting in mixtures with higher asphalt content to help industry achieve the higher in-place density targets.

Importance of In-Place Density

A review of the technical literature suggests that the minimum in-place density of an **asphalt mixture should be 92.0 percent**, as field density below this critical level could have a detrimental effect on the long-term performance of the mixture.⁽¹⁾

Recognizing that industry buy-in was essential for success, WisDOT brought partners from WAPA to the table from the get-go. Deb Schwerman, Executive Director of WAPA, shares that this historic culture of partnership was a key success factor. “WisDOT has had a true partnership with industry, allowing the agency to avoid the ‘we versus they mentality,’ and it goes a long way to where we are with our specifications,” she adds.

Benefits

WisDOT has seen multiple positive changes in their asphalt pavements since they changed their approach. Quantitative analysis comparing projects under the new PWL system to those under the old specification system revealed statistically significant gains in quality across multiple years. The PWL program achieved a clear and statistically significant increase in mean



pavement density. Figure 1 summarized the data WisDOT collected in 2017, where PWL projects showed almost a 1 percent increase in in-place density. Though this amount seems small, studies have documented that a 1% increase in in-place density can correspond to roughly a 10 percent increase in service life.⁽⁶⁾ In addition, PWL projects demonstrated less variance in their results. This reduction in variability means a more uniform pavement structure, which is critical for long-term performance and the prevention of localized failures.

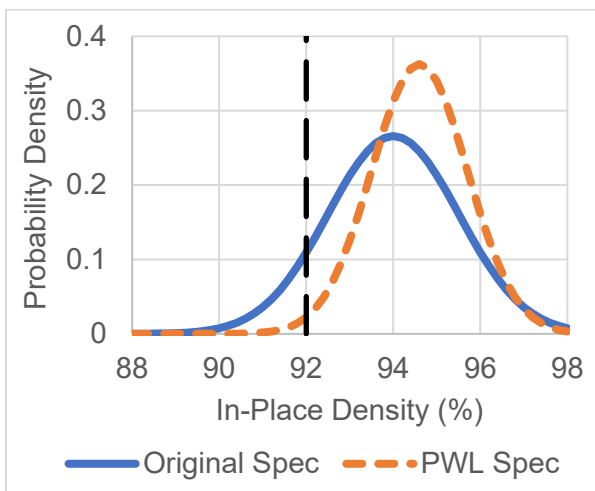


Figure 1. 2017 In-Place Density – Original versus PWL Specification Projects.

These technical improvements translate directly into tangible economic benefits. While the new specification added costs for elements like test strips, manpower, and equipment, it ultimately proved more cost-effective. A 2018 analysis showed that although the base mix price for new specification projects was lower, the combination of incentives and extended pavement life resulted in superior long-term value.

Beyond the data, the improvements were visible on the roads themselves. WisDOT

engineers observed a marked reduction in fatigue cracking and, most notably, a dramatic improvement in the performance of longitudinal joints—the very problem that initiated the changes. Pavements constructed under the new specifications are showing far greater resilience and service life. Dan Kopacz, Statewide Asphalt Pavement Engineer at WisDOT, spends a lot of his time reviewing projects around Wisconsin. "We're not seeing the longitudinal joint and cracking distresses after four or five years; our pavements are immensely better," said Kopacz.

Finally, the team observed benefits beyond the technical improvements. The team at WisDOT found that, despite the significant amount of work, the effort was a very rewarding for their staff. "You could look back now and realize what a serious accomplishment it was for Wisconsin and for the greater good," recalls Paye. Since the implementation, many team members from both WisDOT and WAPA have moved on to new roles and some credit the impactful work undertaken to help them get there.

AIEI Product Highlight: Enhancing In-Place Density Workshops

- One-day, in-person workshop.
- Available by request.
- Built on proven specification strategies and emerging measurement technology.

The comprehensive specification changes had successfully delivered on their promise, producing better, more consistent, and longer-lasting pavements for the state of Wisconsin. This success was also enabled by a critical external support system that provided potential tools to make improvements.



AIEI's Impact

State DOTs often face significant hurdles when implementing large-scale innovations. This is where external support programs like AIEI act as powerful catalysts, providing critical access to national expertise, peer-to-peer knowledge sharing, and technical guidance that can dramatically shorten the learning curve. For Wisconsin, this type of support was an indispensable component of its success. The FHWA and AIEI support was not a one-time consultation, but a sustained, multi-year engagement involving frequent workshops, site visits, and on-demand technical guidance.

The ability to learn from the experiences of other States was a massive advantage. Instead of reinventing the wheel, WisDOT was able to review what other DOTs were doing, adopt proven concepts, and adapt them for their state and systems. A prime example was the PWL analysis spreadsheet, a critical tool for implementation on early projects. The team was able to adapt an existing spreadsheet from Kansas DOT, which saved an immense amount of time and effort.

“Having knowledgeable staff is important to make quality improvements, and resources provided by AIEI is huge to help keep our staff informed.”
– Dan Kopacz, *WisDOT*

When asked what would have happened without this external help, the consensus from the WisDOT team was that the process would have been slower and the outcome less certain. Kopacz remarked that if not for the support “the change we made would have taken a lot longer... and we may not

have gotten to the point where we are today”.

“Having knowledge about what other States are successfully doing is always a helpful resource.”
– Barry Paye, Bureau of Technical Services Director, *WisDOT*

WisDOT is not resting on its past successes either. WisDOT and WAPA are currently examining the implementation of Balanced Mix Design (BMD) to usher in even more benefits like enhanced durability and allowing contractor flexibility in their asphalt mix designs. When asked about what advice he would give to other agencies, WisDOT recommended that States communicate with the industry partners and stakeholders often and listen to their perspectives. Paye remarked that though keeping all stakeholders involved in specification changes may result in a slightly longer implementation period, it will result in a better all-around specification.

The support provided through programs like AIEI was not just helpful; it was a critical accelerator. It empowered WisDOT to implement a more robust and effective solution in a shorter timeframe, ensuring that the benefits of higher-quality pavements were delivered to the public sooner.

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. Aschenbrener, T., Tran, N., Leiva, F., & Hand, A. (2020). *Density Demonstration Projects and Related Specifications*. Report No. FHWA-HIF-21-020, Federal Highway Administration, Washington, D.C.
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3. Hand, A., Aschenbrener, T., Tran, N., & Leiva, F. (2020). *Overcoming Obstacles to Achieving Density*. Report No. FHWA-HIF-21-022, Federal Highway Administration, Washington, D.C.
4. Hand, A. J., Aschenbrener, T., & Buncher, M. (2020). *Improving longitudinal joint performance*. Report No. FHWA-HIF-21-023, Federal Highway Administration, Washington, D.C.
5. Tran, N., Turner, P., and Shambley, J. (2016). *Enhanced Compaction to Improve Durability and Extend Pavement Service Life: A Literature Review*. NCAT Report No. 16-02R, National Center for Asphalt Technology, Auburn, AL.
6. West, R., Rodezno, C., Leiva, F., & Taylor, A. (2018). *Regressing Air Voids for Balanced HMA Mix Design*. Report No. WHRP 0092-16-06, Wisconsin Department of Transportation, Madison, WI.

AIEI Resources Related to In-Place Density

- [A Review of Specifications and Measurement Methods for Asphalt Pavement Density](#)
- [Summary of strategies for improving asphalt pavement density: one-pager](#)
- [Enhanced in-place density: demonstration project: one-pager](#)
- [Tech brief 1: density demonstration projects and related specifications](#)
- [Tech brief 2: techniques and tools for improving density](#)
- [Tech brief 3: overcoming obstacles to achieving density](#)
- [Tech brief 4: Improving longitudinal joint performance](#)



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