# WTBA Contractor Engineer Conference

## Bureau of Technical Services
## And
## Wisconsin Asphalt Pavement Association

January 16, 2025

WISCONSIN DEPARTMENT OF TRANSPORTATION

WAPA
WISCONSIN ASPHALT PAVEMENT ASSOCIATION

# Introduction

- Presenters
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  - Debbie Schwerman, WAPA Executive Director

# WisDOT BTS HMA STAFF

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# Overview

- WisDOT
  - MOTP Update
  - Coring for Density Acceptance
  - PWL for SMA and AC Content
  - BMD Overview
- WAPA
  - Perpetual Pavement
  - Successful Testing Protocols
  - E-ticketing
  - Project Highlights
  - Efficiencies

# MOTP Updates for 2025

## New Gmm procedure for nuclear gauge density testing

- Will use Gmm from actual paving day.
- Officially Starts with the January lets.
- Consider a change order to implement for all 2025 construction.

## Core Dry procedure T79 – 2022 version

- Previously: Run the cores until the CoreDry machine says it is complete.
- Now: Must run cores twice for constant mass.
- This was always in the procedure, just not enforced.

# Coring for Density Acceptance

- Only for PWL projects
- SPVs available on QMP website
- Mixture use table needs to show “Core Only” for acceptance
- Projects can use both gauges and cores if desired
  - Must clearly show in mixture use table
  - Both STSP and SPV must be in special provisions
  - Examples
    - Small segments where it doesn’t make sense to do a gauge-core correlation.
    - Changing underlying conditions that would require multiple correlations.

# PWL for roundabouts

- Mixture testing: PWL
- Density with cores.
- Designer will calculate the area for incentive for legs and circle.
- Need a minimum of 3 cores for PWL calculation.

# Mixture Use Table

- Currently required for all PWL contracts
  - See FDM 19-21
- Future (AWP Spec) - will be required for all HMA contracts
  - Clearly shows in plans which quality program will be used for acceptance

*FDM 19-21 Quality Management Program*

***Table 5.3 HMA PWL Mixture Acceptance***

PWL Mixture Use Table

The following acceptance criteria are applicable for this project:

| Location | Station | Mixture Use: | Underlying Surface | Bid Item | Tons | Thickness | Quality Management Program to be used for: | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Mixture Acceptance | Density Acceptance |
| 12 foot Driving Lane | 1+00 to 20+39 | Upper Layer | 3 MT 58-34H | 4 MT 58-34H | 12,000 | 1 ¾ " | PWL Incentive Air Voids HMA Pavement 460.2010 | Incentive Density PWL HMA Pavement 460.2005 |
| 12 foot Driving Lane | 1+00 to 20+39 | Lower Layer | Milled Existing HMA Surface | 3 MT 58-34H | 15,400 | 2 ¾" | PWL Incentive Air Voids HMA Pavement 460.2010 | Incentive Density PWL HMA Pavement 460.2005 |
| 3 foot shoulder | 1+00 to 20+39 | Upper Layer | 3 MT 58-34H | 4 MT 58-34H | 2,450 | 1 ¾ " | PWL Incentive Air Voids HMA Pavement 460.2010 | Acceptance testing by the department; Not eligible for incentive or disincentive |
| 3 foot shoulder | 1+00 to 20+39 | Lower Layer | Milled Existing HMA Surface | 3 MT 58-34H | 3,850 | 2 ¾" | PWL Incentive Air Voids HMA Pavement 460.2010 | Acceptance testing by the department; Not eligible for incentive or disincentive |
| Various | | Culvert patches | Base Aggregate | Asphaltic Surface | 550 | 6" total | QMP as per SS 465. | Acceptance by ordinary compaction |
| 12 foot Driving Lane | 20+39 to 23+00 | Upper Layer | 3 MT 58-34H | 4 MT 58-34H | 1000 | 1 ¾ " | QMP as per SS 460. | Incentive Density HMA Pavement 460.2000 |
| 12 foot Driving Lane | 20+39 to 23+00 | Lower Layer | Existing Concrete Pavement | 3 MT 58-34H | 1,570 | 2 ¾" | QMP as per SS 460. | Incentive Density HMA Pavement 460.2000 |
| 10 foot shoulder | 20+39 to 23+00 | Upper Layer | 3 MT 58-34H | 4 MT 58-34H | 830 | 1 ¾ " | QMP as per SS 460. | Incentive Density HMA Pavement 460.2000 |
| 10 foot shoulder | 20+39 to 23+00 | Lower Layer | Existing Concrete Pavement | 3 MT 58-34H | 1,310 | 2 ¾" | QMP as per SS 460. | Incentive Density HMA Pavement 460.2000 |

# AASHTOWare

- Will begin pilot project selection this winter once Bureau of Project Development (BPD) is finished with their review.
  - Looking to pilot projects in 2025 and 2026.
- Expected Full Implementation in 2027.

# New HMA QAP Programs

Normal PWL for higher tonnages

- Contracts with bid item 9,750 tons or greater

Lower tonnages

- PWL Lite (contractor data used)

Replacement for QMP

- Department Acceptance (no contractor data used)

Small tonnage (500 tons or less)

- Visual Inspection

# Density / Correlation Test Strips

- **Future (AWP Spec) will either be Correlated Gauges or Cores ONLY.**
- Correlation Strips (Test Strips) will be required **when** using a nuclear gauge.
  - Density Correlation/Test Strips to be either 2 density sublots (3,000 LF) or 750 tons.
    - Use 750 tons when performing combined volumetric/density test strip.
    - Use 2 density sublots otherwise.

# SMA (Stone Matrix Asphalt)

- Consider use on important corridor (backbone) routes with heavy truck traffic (HT).
- Can be used on new construction or resurfaces.
- Performs very well on the rutting and cracking tests.
- Performs well where reflective cracking is expected.

# Additional Guidance for Selection of SMA

- Only use as an upper layer.
- Should be considered for divided highways, freeways and interstates (i.e. backbone projects) in addition to ESAL recommendations.
  - Consider especially when lower maintenance is beneficial (high-traffic areas).

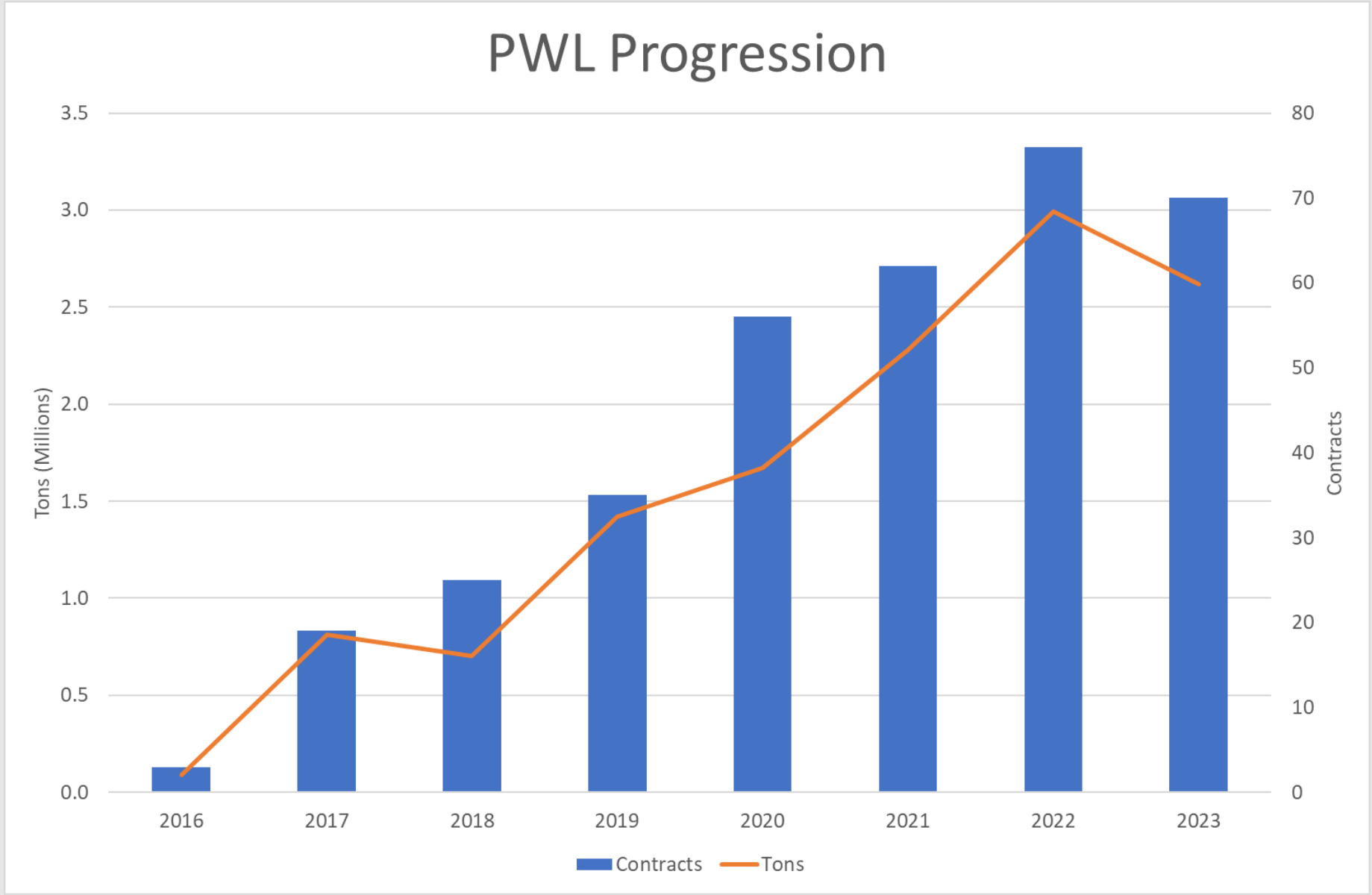
# SMA Spec. highlights

- Cellulose fiber stabilizing additive required.
- Asphalt binder content testing required.
- SMA minimum density.
  - 93.0% for mainline
  - 92.0% for shoulders and appurtenances (offsets applied to all)
- SMA test strip approval criteria:
  - Correlate nuclear gauge to cores to develop gauge offset.
  - Department will test one of the two mixture split samples for volumetrics.
  - If a QV test fails Va or QV / QC test results exceed testing tolerances (0.015 for Gmm or Gmb), dispute resolution is performed by BTS.

# PWL for SMA (AWP Spec)

- Volumetric and Density Data is currently being analyzed.
- Review F&t analysis.
  - Review potential for additional dispute resolution.
- Review air void targets within context of PWL.
  - +/-1.3 from 4.5% target (3.2 – 5.7%)?
- Goal: Pilot projects in 2026.
- Working with HMA tech team.

# PWL - Percent Within Limits



# PWL - Percent Within Limits

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|
| Number of PWL Contracts | 3 | 19 | 25 | 35 | 56 | 62 | 76 | 70 |
| Tons | 91K | 811K | 701K | 1,423K | *1,673K ~55% of program* | *2,278K ~65% of program* | *2,994K ~63% of program* | *2,620K ~66% of program* |

# BMD:

## An Update on WisDOT's Current Practice and Future Plans

# BMD: A method for increasing the durability of asphalt mixtures in WI

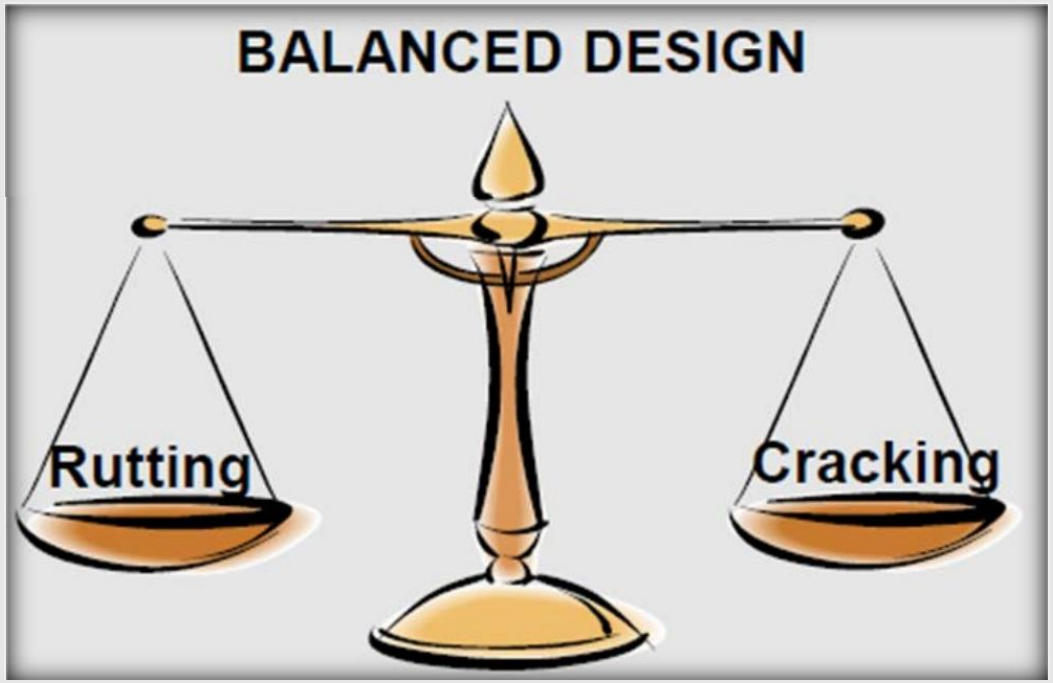
- Balanced Mix Design (BMD)
  - What is BMD?

    According to Federal Highway Administration (FHWA) Expert Task Group (ETG) BMD Task Force, BMD is "*asphalt mix design using performance tests on appropriately conditioned specimens that address multiple modes of distress taking into consideration mix aging, traffic, climate and location within the pavement structure.*"
  - Why do we need BMD?
    - Ensure performance
    - Enable innovation
    - Enable economic optimization

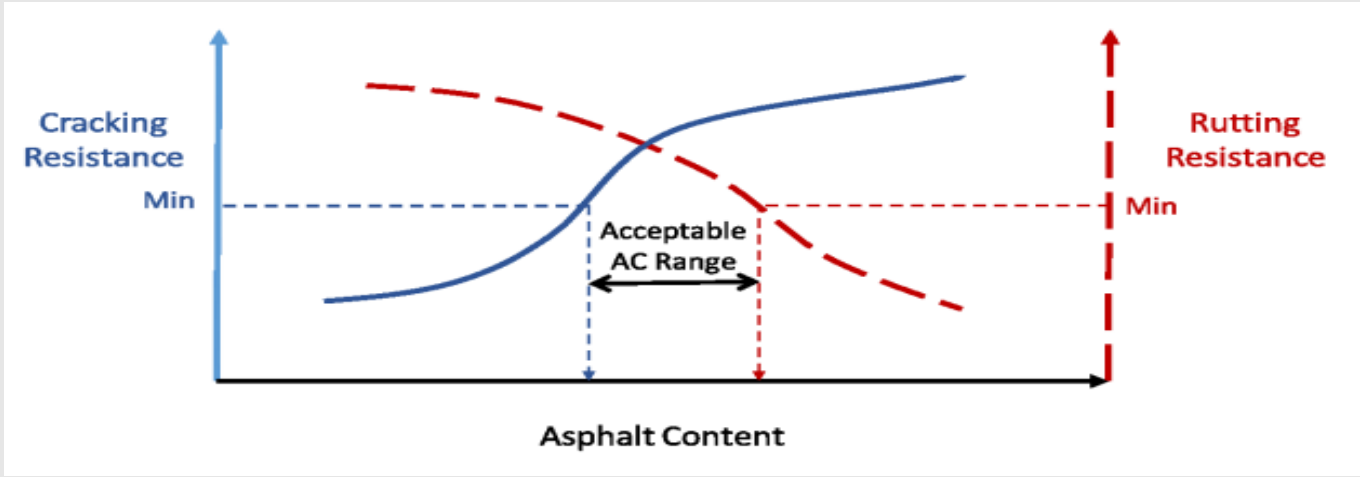
# BMD: a method for increasing the durability of asphalt mixtures in WI

## BMD concept

- A balance between cracking and rutting resistance




Buchanan, 2017




Newcomb et al., 2018

Buchanan, 2017

# BMD: a method for increasing the durability of asphalt mixtures in WI

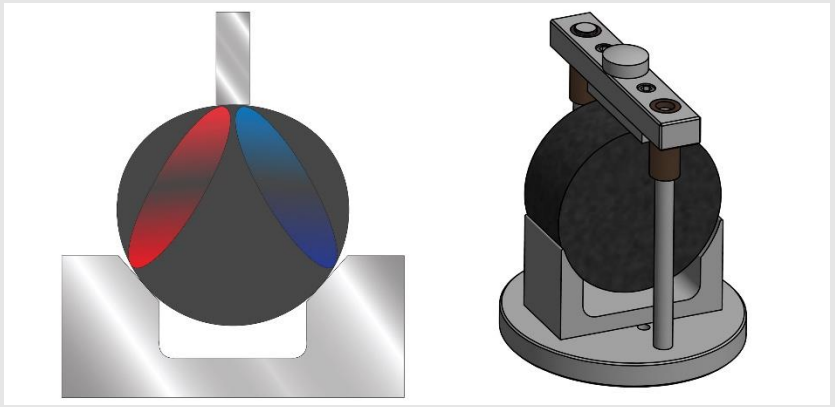
- BMD approaches (currently investigating the appropriateness of Approach A)
  - **Approach A: Volumetric Design with Performance Verification**
    - Starts with an agency approved mix design.
    - The mix design is tested with selected mixture rutting and cracking tests.
    - If the mix design is failed, the entire mix design is repeated until all the volumetric and performance test criteria are satisfied.
  - Approach B: Volumetric Design with Performance Optimization
    - Similar to approach A, except for:
      - Testing the performance at optimum binder content and two or more additional binder contents of ± 0.3 to 0.5%.
      - Selecting a binder content that satisfies the performance criteria.

# BMD: a method for increasing the durability of asphalt mixtures in WI

- BMD approaches (currently investigating the appropriateness of Approach A)
  - Approach C: Performance-Modified Volumetric Design
    - Similar to approach A, except for:
      - Adjusting the binder content or other mix component properties such as aggregates, binders, recycled materials, and additives.
      - Making sure that certain volumetric properties are in compliance with agency's relaxed requirements.
  - Approach D: Performance Design
    - An existing agency-approved mix design is used.
    - The mix design is tested with selected mixture rutting and cracking tests at three or more binder contents at intervals of 0.3 to 0.5%.
    - A binder content that satisfies both the rutting and cracking criteria is selected as the optimum binder content.

# BMD Performance Tests Used in WI

- There are many different types of performance tests, but WisDOT uses:
  - Hamburg Wheel Tracking Test (HWTT)
  - Rapid Shear Rutting Test (IDEAL-RT)
  - Indirect Tensile Asphalt Cracking Test (IDEAL-CT)



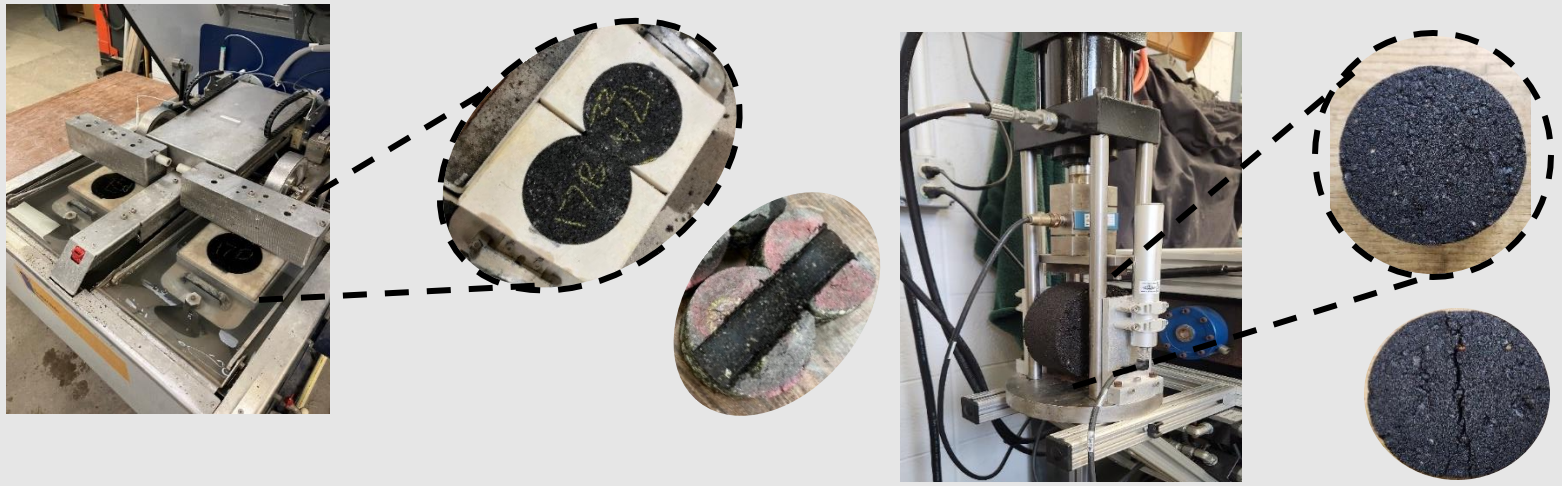


Image Source: FHWA
Load Frame performing Ideal-RT

# BMD Implementation Train is Unstoppable …

- We have invested substantially and will continue to do so.
  - External research
    1. Balanced Mix Design Implementation Support
    2. HWTT and IDEAL-RT for Rutting Evaluation of Asphalt Mixtures in Wisconsin
    3. Evaluation of Hamburg Wheel Track Test for Rutting Resistance
  - In-house research
    - BMD Aging Procedures
- In the future, it can be a tool for justifying the sustainability of unsustainable materials used at the plant.

There will be challenges…

- We are committed to collaborate with the regions and industry to make the transition as **smooth** as possible.

# Days of Future Past

- SPV used for pilot BMD project since 2020
  - BMD is incorporated at the mix design stage for certain PWL projects
  - Applies to upper layer mixtures
  - Mix designs are tested using HWTT and IDEAL-CT methods

- SPV considerations for future pilot BMD projects
  - BMD is incorporated at the mix design stage for certain PWL projects
  - Applies to upper layer mixtures
  - Mix designs are tested using HWTT, IDEAL-RT and IDEAL-CT methods
  - Production Testing using HWTT, IDEAL-RT and IDEAL-CT methods

# Next Steps

- Continue the evaluation of Wisconsin asphalt mixtures for rutting resistance using the HWTT and the IDEAL-RT.
- The validation of rutting performance by running the HWTT in both wet and dry conditions.
- Determine the correlation between existing HWTT and IDEAL-RT results.
- If necessary, proposing new thresholds for the dense graded and stone mastic asphalt (SMA) mixes.
- Propose a threshold for IDEAL-RT for the acceptance of asphalt mixtures during the production stage.

# Next Steps

- Implementing long term rutting and cracking evaluations of BMD test sections on select projects.
  - BMD test sections constructed in 2022 are not showing signs of distress. There are six test sections – one in each BMD quadrant and two of the designs with polymer added.
  - 100% of state highways are currently being scanned each year.
  - Hoping to develop appropriate protocols to eventually incorporate previous and future test sections.

# WAPA Update Overview

- Perpetual Pavement
- Successful Testing Protocols
- E-ticketing
- Project Highlights
- Efficiencies

# Perpetual Pavement

- Definition

  Perpetual Pavement is a term coined to describe a specific type of long-lasting asphalt pavement designed to endure for more than 50 years without requiring major structural rehabilitation or reconstruction. It is engineered to sustain its structural integrity over an extended period while only needing periodic surface renewal to address any distresses that are confined to the top layer of the pavement.

# Goal of Perpetual Pavement Design

- Bottom-up fatigue cracking

- Structural rutting

Design against deep, structural distress

# Characteristics of Perpetual Pavement

1. **Layered Structure**: Perpetual Pavements are constructed with multiple layers that each serve specific functions, such as distributing loads, resisting deformation, and providing a smooth driving surface.
2. **Maintenance Strategy**: The maintenance for Perpetual Pavements typically involves milling the top layer and applying a new overlay. This process allows the base to remain intact, thus significantly reducing the cost and environmental impact associated with complete pavement reconstruction.
3. **Sustainability**: The design and maintenance approach of Perpetual Pavements reduces the use of virgin raw materials and minimizes greenhouse gas emissions over the pavement's lifecycle.

# Characteristics of Perpetual Pavement

4. **Economic Efficiency**: They offer a lower life-cycle cost compared to traditional pavements by avoiding deep repairs or reconstruction and by reducing user-delay costs associated with maintenance.
5. **Environmental Benefits**: The reduced frequency of rehabilitation, combined with the practice of recycling the milled material, leads to a decrease in the environmental footprint of the roadway.
6. **Performance**: Perpetual Pavements are designed to minimize the occurrence of common distresses like bottom-up fatigue cracking and rutting, ensuring that the pavement remains smooth and functional for the long term.

# Recent Perpetual Pavement Project

Project 1of 2

| | |
|---|---|
| **Highway Name** | IH 94 |
| **Roadway Name** | Northfield to Osseo |
| **Project Termini** | Bridge on South Fork Buffalo River - Near West County Line |
| **Region** | NW |
| **County** | Jackson |
| **Functional Classification** | Interstate/Freeway |

There is a pavement section in Trempealeau County on interstate 94 near Osseo Wisconsin where a deep strength hot mix asphalt (HMA) pavement was placed in the Fall of 2023 (Figure 1). WisDOT instrumented this pavement as part of a National Road Research Alliance (NRRA) in cooperation with MNDOT to develop a fatigue transfer function that can be used in the PerRoad software for perpetual pavement design. Phase II of the NRRA research project is under development and expected to be advertised this spring. This would take data collected to develop equations or transfer functions best representing current Wisconsin HMA mixes.

# Future Perpetual Pavement Project

Project 2 of 2:

| | |
|---|---|
| Project I.D | 1130-68-71 |
| Region | NE |
| Roadway | Appleton - DePere |
| Termini | STH 96 - CTH F |
| Highway Number or indicate if local road | IH 41 |
| County | Brown & Outagamie |

NER had agreed to pilot a section of the IH 41 corridor expansion project. A one mile segment on both sides of Interstate 41 will be constructed as a perpetual pavement. The letting date for this section is 11/9/27, potentially advanceable to May 2027. This will be 10.5 inches of HMA over 7 inches of a dense graded base. The typical concrete pavement in this section was to be 10.5 inches over a 6 inch dense graded base.

# Past Perpetual Pavement Projects

2000 & 2003 STH 50 (4-lane divided highway 4 1,000 foot test sections)
2003 Kenosha Weigh Station (2 test sections +/- 1,800 & 1,100 feet)
2003 STH 17 in Oneida County
2006 Marquette Interchange

# Summary/Conclusions

- Perpetual pavements are widely used across the U.S.
- Perpetual pavements don’t have deep structural problems
  - Surface remedies make them an attractive option
  - Maintains ride quality
  - Minimal rutting
- Perpetual pavements can be designed using mechanistic principles
- Cost effective

# Successful Testing Protocols for WisDOT

1. We know variability exists within laboratories
2. We know variability exists within technicians
3. We know variability exists within testing procedures
4. We know variability exists with equipment
5. We know variability exists within materials

So what do we do…limit that variability

- For labs…Lab Qualification Program
- For technicians…Highway Technician Certification Program (HTCP), Independent Assurance Program (IAP)
- For testing procedures…Manual of Test Procedures (MOTP)
- For equipment…Approved Products List (APL), Profiler Rodeo for IRI Ride
- For materials…Round Robin Program


Round Robin Testing

# Limiting Mixture Variability

Over 100 individual labs participate (HMA)

- Gmm & Gmb is tested and analyzed

Outliers are identified from the statistical analysis

- Independently as Gmb and Gmm

Corrective action is documented, retesting of the outliers is performed until resolved

Same process is followed for the following:

- Asphalt content-asphalt analyzer
- Performance testing-Hamburg Wheel Tracker & IDEAL-CT


What's Next?

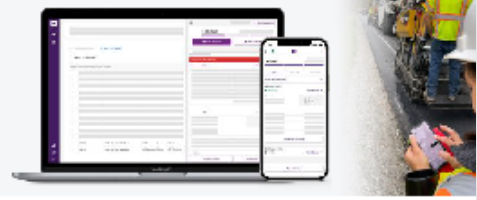
2025 Requirements

Mandatory on select projects

- HMA- 30,000 tons
- PCC- 20,000 sy
- Concrete Structures 1,300 sy

2026-mandatory for all projects*

# e-Ticketing by integrations



## WHAT'S AHEAD IN 2025?

Wisconsin DOT is moving towards an all-electronic ticketing program. As the construction industry seeks innovative ways to enhance productivity, reduce environmental impacts and become safer, we look forward to working with our trusted contractors and supplier/producers to facilitate the digital transformation of the industry.

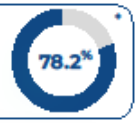
## WHAT DOES THIS MEAN FOR THE CONSTRUCTION MATERIAL SUPPLIERS?

Over 300 Suppliers across the USA connect with HaulHub to push material tickets. To meet DOT Specifications HaulHub is offering the following three options to help make this transition as seamless as possible:

**Option 1** — **For Producers seeking a hassle-free managed solution**

Wisconsin DOT has secured services to get your e-ticketing operations up and running at no cost to you. You control what data is shared with the DOT. SLA requirements are the responsibility of HaulHub

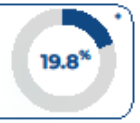
Most suppliers have chosen this path through HaulHub's simple digital connector tool.




**Option 2** — **For Producers seeking to internally manage integration**

Producers will POST data to an API with an authorized user key. HaulHub will publish technical documentation for your use. SLA requirements are the responsibility of the supplier (5 min data transmission and customer service contact with availability during project operations)

Suppliers who have chosen this path quickly integrate, most within 30 minutes.




**Option 3** — **For Suppliers with existing e-Ticketing solutions.**

Your current e-ticketing vendor will POST data to an API similar to the one above.
SLA requirements are the responsibility of the supplier or the third party e-Ticketing solution (5 min data transmission and customer service contact with availability during project operations)



* Sample size includes 100 million tickets across 400+ Suppliers as of Q3 2024 with numbers growing every new integration.

# Standard Specifications

2025 Standard Specifications

- 109.1.4.3 Add option for electronic load tickets.
- (1) Electronic load tickets may be provided as a substitute for printed tickets. Include the information as specified in 109.1.4.2 on each electronic ticket.
- (2) Automatically generate electronic tickets using a system that is fully integrated with the load-out scale system being used to weigh the material. Ensure data input cannot be altered and provide offline capabilities to prevent data loss.
- (3) Provide electronic tickets in real-time by allowing the department access to the tickets utilizing a web based or app-based system compatible with iOS and Android.
- (4) Provide the capability to record information and comments on each ticket.
- (5) For each project ID and bid item, submit an electronic daily summary of the individual tickets daily as work is completed. In the daily summary, include the unique information for each individual load ticket. Provide the daily summary data in an importable format, such as comma separated values (.csv).

# IH 41/ IH 43/ IH 894  Project 1100-45-70 Airport Freeway

## Original Schedule

- 18,000 tons 3HT
- 25,000 tons 4SMA
- Nighttime paving including milling and pavement marking
  - 8 hours Sunday-Thursday
  - 9 hours Friday-Saturday
  - No off-peak hours
  - System ramp closures 5 ½ or 7 hours

# IH 41/ IH 43/ IH 894  Project 1100-45-70 Airport Freeway

## Full Freeway Closure Schedule

- Full weekend closure of Lanes 1, 2, and 3
- Lanes 1, 2 and 3 paved in echelon
- Lane closure from 11:00 pm Friday to 5:30 am Monday
  - 2 weekends allowed per direction
  - EB and WB not allowed on same weekend
  - 2 ½ off-peak hours on weekdays and 4 hours on weekends

# Massive savings

- Original plan required nearly 40 night shifts
- Instead work completed in 8 shifts over 4 weekends
- 80% reduction in paving and milling manhours
  - Also plant personnel, QC technicians, haul trucks, traffic control, striping and inspection
- Higher quality, and more durable

# Additional Benefits

- Instead of having 8-10 cold joints in each direction of travel in the lower and upper layers
- 0 cold joints


WATER
SAKAI
RIDESHARE
INFO CALL
1-800-455-POOL

# Additional benefits

- Instead of having 8-10 cold joints in each direction of travel in the lower and upper layer - 0 cold joints
- More thorough cleaning of milled surface
- More time for tack to break/cure
  - Better adhesion than short window mill and fill operations


EXIT 58
76th St
R-32
R-32

# Additional benefits

- Instead of having 8-10 cold joints in each direction of travel in the lower and upper layer - 0 cold joints
- More thorough cleaning of milled surface
- More time for tack to break/cure
  - Better adhesion than short window mill and fill operations
- Ability to continuously run plant – high quality, consistent material production with no hot stops or short runs
- SAFETY – not only for the workers but the travelling public as well


SAKAI

- Looking for Efficiencies
  - Working with BTS and BPD to look for ways to continuously improve
    - Traffic Phasing/Closures
    - Material Selection
    - Construction/Design
- Working with Technical Teams to improve/update/clarify specifications
- Upcoming Training – Focus on PWL specifications
- Regional Going Visiting Meetings prior to start of construction season
- Here as a resource to be of assistance


THANK YOU!!!!