State	Date Last Reviewed	Agency Website	Contact
Wisconsin	07/2021	https://wisconsindot.gov/	Engineering@asphaltpavement.org

BMD Implementation Summary Table

BMD Approach	Applicable Mixture Type	Rutting Test	Cracking Test	Performance Testing for Production Acceptance
Approach A	Primary Mainline Upper Layer	HWTT	IDEAL-CT	No, Production Testing for Informational Purposes Only

STATE-OF-THE-PRACTICE

The Wisconsin Department of Transportation (WisDOT) developed *HMA Pavement Balanced Mix Design*, a draft special provision for the implementation of balanced mix design (BMD) in 2021. The draft provision requires the Volumetric Design with Performance Verification approach for the mix design of primary mainline upper layer mixes. The mixture performance tests used are the Hamburg Wheel-Tracking Test (HWTT) for the evaluation of mixture rutting resistance and moisture resistance, and the Indirect Tensile Asphalt Cracking Test (IDEAL-CT) for cracking resistance evaluation. HWTT is conducted in accordance with WisDOT-modified AASHTO T 324, which requires a test temperature of 46°C and the testing of short-term aged specimens that have been aged for 4 hours at 135°C prior to compaction per AASHTO R 30. Test criteria are based on two parameters: Passes to 12.5 mm Rut Depth ($N_{12.5}$) and Stripping Inflection Point (*SIP*). IDEAL-CT is conducted in accordance with WisDOT-modified ASTM D8225. The test is conducted on long-term aged specimens that have been aged for 6 hours at 135°C on loose mixtures in addition to the 4-hour, 135°C short-term aging procedure. Test criteria are based on the Cracking Tolerance Index (CT_{Index}) parameter.

WisDOT's BMD procedure incorporates both air voids regression and mixture performance testing efforts. The mix design starts with Superpave volumetric analysis, where the optimum binder content corresponding to 4.0 percent air voids at the design gyration (N_{design}) is determined. The optimum binder content is then calculated to a regressed air voids content of 3.0 percent for production. Finally, HWTT and IDEAL-CT, as well as the Tensile Strength Ratio (TSR) test per WisDOT-modified AASHTO T 283, are conducted at the regressed optimum binder content for performance verification. Table 1 summarizes the HWTT and IDEAL-CT criteria for mix design approval. The HWTT $N_{12.5}$ criteria vary depending on the contract specified binder designation level, while a single HWTT SIP and IDEAL-CT CT_{Index} criterion is used for all Superpave mixes. In addition to mix design, HWTT and IDEAL-CT are also required during production for projects with over 5,000 tons of mixture. The testing will be conducted by the Department during the first 10,000 tons of production, but the results are for informational purposes only. Production acceptance is solely based on volumetric parameters including asphalt content, air voids, voids in mineral aggregate (VMA), and aggregate gradation. WisDOT is planning to construct five pilot projects using this draft special provision in 2021 and 2022.

Table 1. WisDOT Performance Test Requirements for Mix Design Approval

Binder Designation Level[1]	HWTT $N_{12.5}$	HWTT *SIP*	IDEAL-CT CT_{Index}[2]
S	≥ 10,000	≥ 8,000	≥ 30
H	≥ 15,000	≥ 8,000	≥ 30
V	≥ 20,000	≥ 8,000	≥ 30
E	≥ 20,000	≥ 8,000	≥ 30

Notes:
1. Asphalt binders will be tested against the contract specified traffic level performance requirements, which may not be the same traffic level as classified by AASHTO M332.
2. For SMA, increase the minimum CT_{Index} criterion to 80 for all binder designation levels.