Validation Techniques for Setting BMD Test Criteria

CAPRI
CONSORTIUM FOR ASPHALT PAVEMENT RESEARCH AND IMPLEMENTATION

Case Study: *Virginia DOT Pilot Projects*

Setting Initial Criteria

Initial Validation

Objectives

The Virginia Department of Transportation (VDOT) is proactively advancing Balance Mix Design (BMD) through multiple strategies. This case study focuses on the field trials & pilot projects VDOT has placed to: (a) validate initial BMD thresholds, (b) exercise special provisions for standard and high-reclaimed asphalt pavement (RAP) surface mixes, and (c) build shared capacity (agency and industry) for eventual statewide implementation.

Benefits

This strategy provided VDOT with several key benefits: (1) de-risk specification changes by learning on controlled pilots before pay-factor ties, (2) accelerate practical know-how (sampling/compaction logistics, air-void targeting) across districts and producers, and (3) generate defensible Virginia-specific datasets to refine thresholds by mixture class and traffic.

VDOT Goal: Achieve systematic implementation of the BMD method through research and coordination with all stakeholders.

Background

Early Superpave volumetric deployment in Virginia revealed durability concerns associated with coarser gradations and lower binder contents. VDOT, along with the Virginia Transportation Research Council (VTRC), sought to responsibly expand RAP while improving cracking resistance and maintaining rutting resistance. Field trials and pilot projects provided a structured pathway to iterate on criteria and logistics with real-world materials, plants, and crews. (See Figure 1)

Field Trial: Research testbeds with special provisions (smaller scale).
Pilot Project: District-run production project to road-test at scale.

Methodology

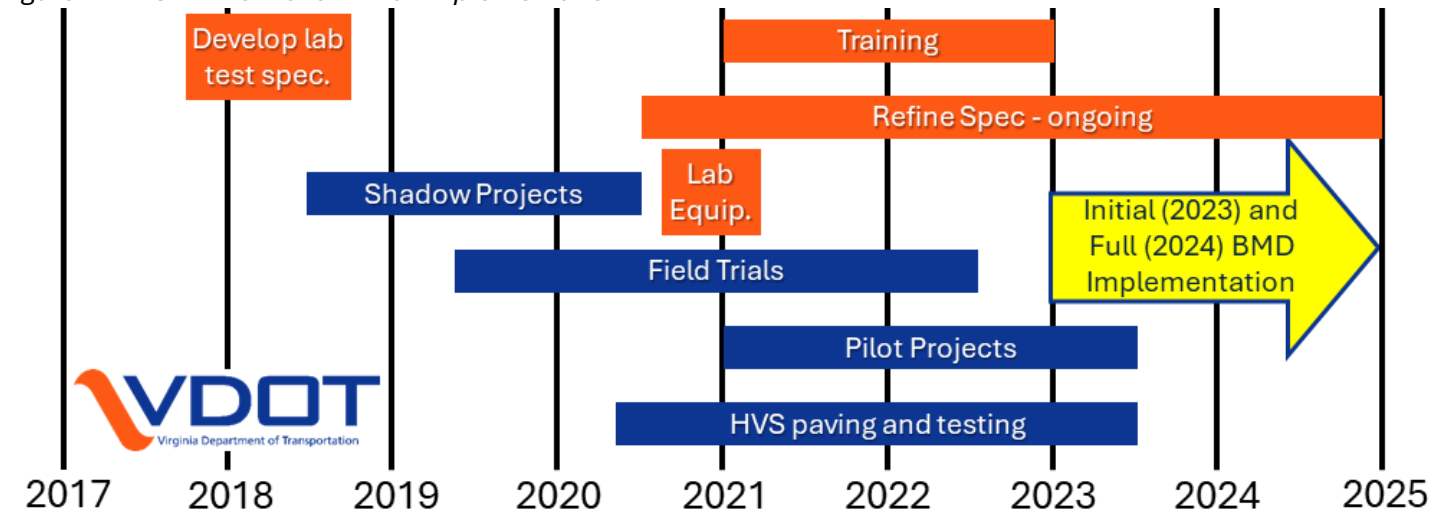
- **Identify Tests:** extensive research led to the selection of the following BMD tests: Indirect Tensile Asphalt Cracking Test (IDEAL-CT, ASTM D8225, aka IDT-CT in VA) for cracking, Cantabro (AASHTO T 401) for raveling, and Asphalt Pavement Analyzer (APA, AASHTO T 340) for rutting.
- **Conduct benchmarking** of typical plant mixes to set initial test thresholds.
- **Develop two special provisions**: (1) standard surface mixes (≤30% RAP) and (2) high-RAP surface mixes (≥40% RAP) governed by performance.
- **Project selection** across multiple districts; coordinated sampling from production with field compaction (no reheat when feasible) and lab compaction (reheated when required).
- **Distributed testing**: IDEAL-CT and Cantabro were tested at VTRC, then in district labs. APA was tested at VTRC, then at the Central Office lab and one district lab. VDOT/VTRC documented handling and temperature controls of samples.
- **Round-robins, targeted training:** VDOT conducted round-robin testing along with equipment siting to improve repeatability and turnaround. Virginia Education Center for Asphalt Technology (VECAT) conducted targeted training to ensure a uniform understanding of BMD, the tests, and VDOT's vision.

Results of the Pilot Projects/Field Trials

- **Modest binder content increases and/or gradation/VMA adjustments lifted cracking performance substantially without sacrificing rut resistance.**
- With warm mix technologies (WMT), lower binder performance grade (PG), and/or appropriate recycling agent (RA) dosing, 40% RAP mixes improved cracking while maintaining APA rut performance.

- Plant-produced non-reheated material consistently delivered higher IDEAL-CT (CT_{Index}) values than lab-produced or reheated counterparts—suggesting a correction factor or the need for distinct plant reheat versus non-reheat and lab thresholds.
- Operational lessons (cooling time minimization, compaction target discipline) reduced retests and stabilized variability over the pilot period.

Figure 1. VDOT Timeline for Initial Implementation.



Recommendations

- Phase implementation with field pilots, keeping initial criteria decoupled from pay until precision/bias is documented.
- Document plant procedures for sampling/handling/compaction; consider calibrated plant versus lab criteria or correction where warranted.
- Continue workforce development and periodic round-robins to identify challenges/issues across equipment and operators.

Challenges

- **RAP variability** and stockpile management significantly influence cracking indices.
- **Limited lab capacity and differing equipment** manufacturers introduce precision/bias and scheduling constraints.
- **Logistics** (material cooling, target air-void hit rate) can add retests without disciplined procedures.

Level of Effort / Cost

- **People:** District lab staff for IDEAL-CT/Cantabro; VTRC APA support; and producer quality control technicians for coordinated sampling/compaction.
- **Equipment:** IDEAL-CT fixtures and environmental control, Cantabro drum, and APA at the central lab & one district lab.
- **Budgeting note:** Most costs are staff-time and testing consumables; central-lab and district APA time was a bottleneck to schedule early.

References

VTRC Reports: VTRC 21-R15; VTRC 21-R21; VTRC 23-R13; VTRC 25-R16. And NAPA BMD Resource Guide.

Agency, Research, & Training Entities

VDOT Virginia Department of Transportation
VTRC Virginia Transportation Research Council
VECAT VIRGINIA TECH TRANSPORTATION INSTITUTE

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