Balanced Mix Design in Virginia:
From Development to Implementation

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Outline

- Why the move to BMD?
- Steps to implementation
- Challenges along the way
- Where VDOT is currently
- Future plans

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To improve the life and durability of our asphalt pavements in Virginia

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Why Balanced Mix Design?

Two Main Goals:

Achieve improved pavement performance; optimization of cracking and rutting resistance using Balanced Mix Design methodology.

Foster innovation; mix performance approach vs. totally prescriptive specifications, incentivize quality attributes

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Steps taken to implementation

1. Create BMD technical committee
2. Develop timeline, tasks and goals
3. Determine distresses to focus on
4. Identify, assess & evaluate performance tests
5. Benchmark current Superpave mixtures
6. Acquire Equipment
7. Training
8. Develop Special Provision
9. Conduct Pilot Projects
10. Analyze Production Data
11. Refine Special Provision
12. Full initial implementation

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Create BMD Technical Committee

- **Goal:** Establish collaboration between VDOT, VTRC and Industry on moving towards BMD implementation.
- Discuss research, performance tests, specifications, impacts & benefits
- 1st BMD Technical Committee Meeting: December 18th, 2018
- 13th Technical Committee Meeting: November 8, 2023

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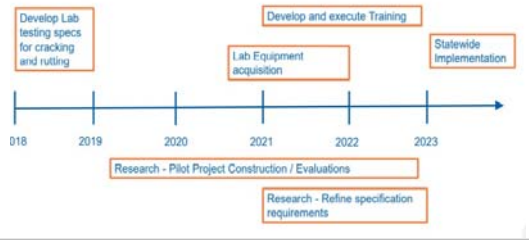
Where Virginia has been



Determine Distresses & Tests

Cracking:
IDEAL-CT/IDT-CT

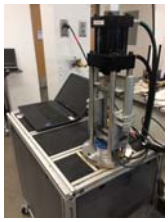
Rutting:
APA & IDT-HT

Durability
Cantabro

Benchmark Current Superpave Mixtures

- Benchmarked surface mixes against cracking, rutting and durability performance metrics
  - 13 mixes from 2018
- Used the values for these mixes to determine beginning thresholds for performance testing.

Acquire Equipment



Training

What We Have Done:

- May 11, 2021: BMD "Just in Time" Training
- Jan, Feb, March 2022: Initial certificate course with hands-on portion
- November 17-18, 2022: "Back to Basics" Workshop
- BMD was added to asphalt certification schools beginning in 2023.
- Offering online certificate course with hands-on proficiency.
- Ongoing training as needs arise.

Specification Evolution

2021 Special Provision:

Property/Test	Frequency (tons)	Total Specimens per Lot
CTindex – QC	1,000	20
Cantabro – QC	1,000	12
CTindex – VDOT QA	2,000	10
Cantabro – VDOT QA	2,000	6
Rutting – VDOT QA	2,000	8

Contractor will make VDOT specimens.

2022 Special Provision:

Testing Frequency (4,000T lot)

Property/Test	Frequency (tons)	Total Specimens per Lot
CTindex – QC	2,000	10
Cantabro – QC	2,000	6
CTindex – VDOT QA	4,000	5
Cantabro – VDOT QA	4,000	3
Rutting – VDOT QA	Once per mix	4 per mix

Contractor will make VDOT specimens.
Report results w/in 1 week (recommended 48hrs)

Testing halved from 2021

Pilot Projects/Schedules

2021: ~72,000 Tons
- 10 maintenance schedules - selected routes
- 5 districts

2022: ~222,000 Tons
- 13 maintenance schedules – all 9.5/12.5 A/D mix
- 9 districts – at least 1 BMD contract per district

2023: ~335,000 Tons
- 15 maintenance schedules – all 9.5/12.5 A/D mix
- 9 districts – at least 1 BMD contract per district

MOVING TO STEADY STATE IMPLEMENTATION

FOR 2024

Assessment of BMD to Date

Conducted review of all BMD mix results and pilot projects to analyze Balanced Mix Design and its successes and areas needing improvements.

Looked at multiple areas to assess:

1. **Mix Designs**
2. **Lab results**
3. **Field results**
4. **Quality Control Processes**

Key Takeaways

2021 and 2022 lab production performance testing shows improvement in cracking resistance when compared to their control mixes
- **Overall increase in % AC**
- **Led to increase focus on material selection and enhanced stockpile management**
- **Field density are holding steady around 94.0%**

BMD mixes are performing just as good or better than conventional mixes.

2024 Scope for BMD

- All SM 9.5 and SM 12.5 A/D mixes will be designed to meet:
  - BMD requirements for APA, IDT-HT, IDT-CT and Cantabro
  - Volumetric requirements
  - Gradation requirements.
- In production:
  - SM-9.5A and SM-12.5A mixes will have production/acceptance testing of volumetrics and gradation/AC only. (current specification requirements)
  - SM-9.5D and SM-12.5D mixes will have ALL production/acceptance testing: BMD performance testing requirements, volumetrics, and gradation/AC.

Current Approach

- BMD P+VO mix for all SM-9.5/12.5 A and D mixes
  - Superpave gradation bands (wider than Superpave requirements)
  - Design VTM: 3 - 4.5% VTM
  - Meet volumetrics & IDT-CT, Cantabro, APA test requirements

New updates for 2024

IDT-CT:

Adjust test criteria for reheat / non-reheat specimens

Reheat testing criteria: CTindex ≥ 70

Non-reheat testing criteria: CTindex ≥ 95

Contractor must select reheat or non-reheat testing on JMF and stick with it throughout production.

- **IDT-HT & IDT-CT**
  - Wet specimen conditioning

VDOT will make their own specimens during production.

VDOT BMD Production Criteria (2024)

Distress	Test	Limit
Cracking	IDT-CT (reheat)	70 (min)
	IDT-CT (non-reheat)	95 (min)
Rutting	APA rut test	8mm (max)
	IDT-HT	Report
Durability	Cantabro	7.5% (max)
Moisture	Tensile Strength Ratio	80% (min)

Challenges throughout Implementation

- Workload and Manpower
  - Industry and VDOT
  - Research
- Validation of Performance Tests & Thresholds
  - Correct thresholds?
  - Long term performance – critical aging protocols
- Production Acceptance
  - Determining precision statements
  - Turnaround time of tests

Moving Forward

Continued research efforts:

- Critical Aging
- Innovations– High RAP, RAs, additives, recycled products (plastics, rubber), different binders
- Field validation of criteria
- Benchmarking other mix types
- Polymer modified mixes
- BMD and sustainability
- Accelerated Pavement Testing
- Binder Availability and Activity in RAP Materials
- Benchmarking of Variability for Performance Tests Results During Production.

Moving Forward

Planning for next 2-3 years

Mix priorities for developing criteria and implementing

- Polymer Modified dense graded mixes, SMA, Low-volume traffic mix

Looking at acceptance

- Production tolerances, dispute resolution, test frequency

Revamping pay structure

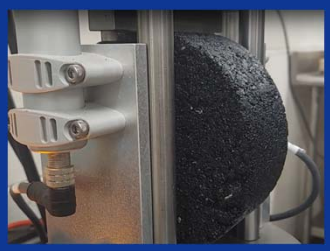
- Combined pay factor
- Statistical pay factors

Ultimate Goals of BMD

An Asphalt Mix that:

1. Achieves improved long-term pavement performance by meeting all BMD requirements while allowing the asphalt industry to design and produce a mix that maximizes innovation.
2. Is being designed to the right performance metrics and placed in the right locations.

THANK YOU!



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