Void Reducing Asphalt Membrane (VRAM) - Improving Longitudinal Joint Performance

County Engineer's Workshop

Bellaire, MI

2/14/18

Longitudinal Construction Joints

- Longitudinal construction joints
  - Commonly, the first area requiring maintenance on a pavement
- Issues
  - Can’t achieve the same density at the joint as in the mat
  - Water and air intrusion accelerates damage

Longitudinal Construction Joints

- Methods to improve joint performance
  - Joint density requirements (typically target voids at 4” from joint to within 2% of center mat voids)
  - Echelon paving
  - Notched wedge joint
  - Cut off lower density edge
  - Mill and inlay
- All the above are “mechanical” solutions

Effect of In-Place Voids on Service Life*

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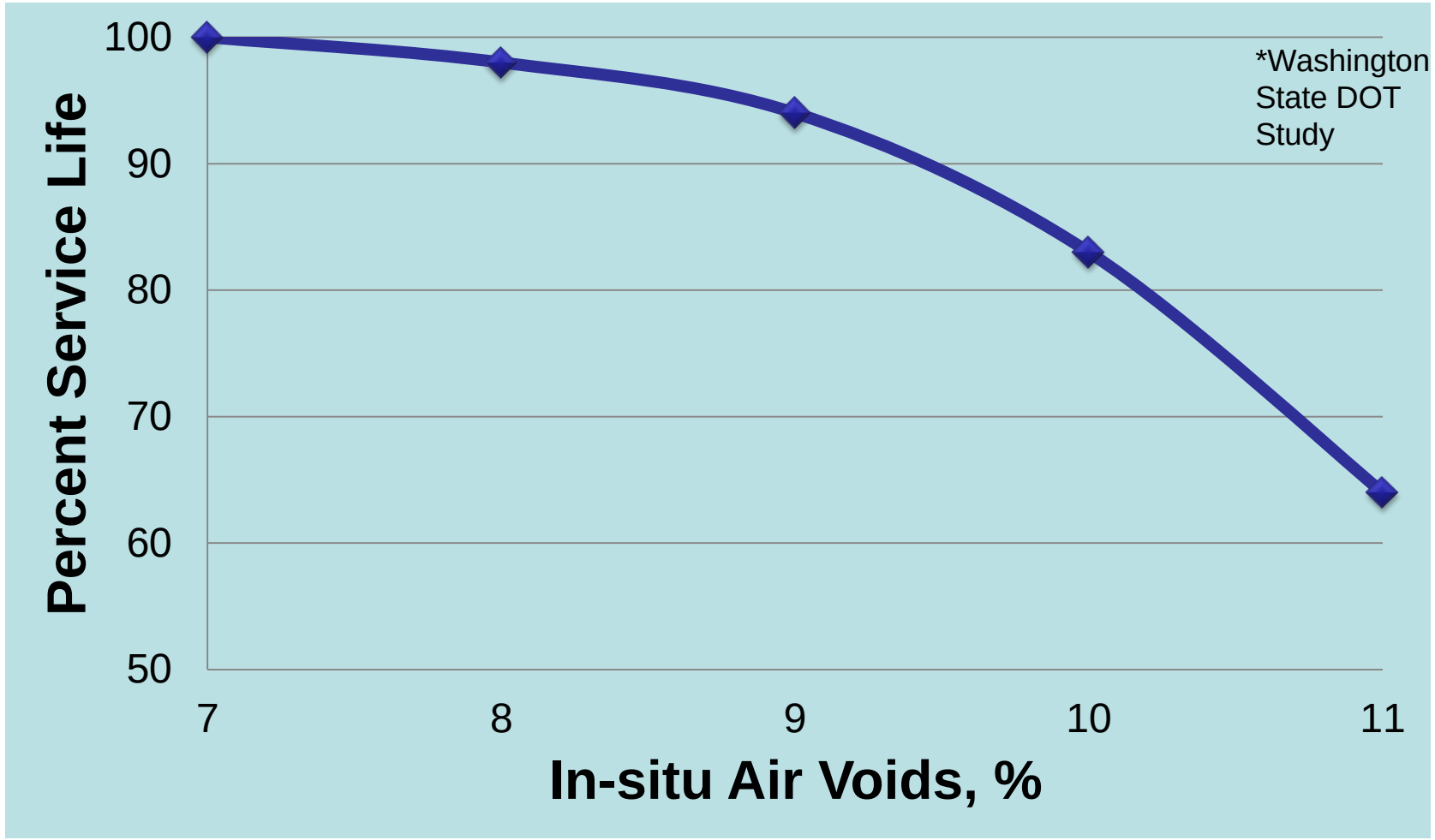

Effect of Air Voids on Pavement Service Life

- For 7% air voids, assuming 15 year service life at 100%
- For 9% air voids, 94% of service life = 14 yr service life (1 yr reduction)
- For 10% air voids, 82% of service life = 12 yr service life (3 yr reduction)
- For 11% air voids, 64% of service life = 9.6 yr service life (5 yr reduction)
- Regardless of method, the joint isn't the same air voids as the center of mat. The joint will deteriorate and ultimately fail first.

Void Reducing Asphalt Membrane (VRAM)

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- Thick application of hot-applied, polymer-modified asphalt (~ 1 gal/sq yd for 1 ½” overlay)
- Application of 12” or 18” band applied before paving in the location of the new longitudinal joint
- Fills voids and reduces water intrusion at joint from the bottom up
- Protects underlying pavement layers
- Materials approach to improving joint performance

VRAM Application

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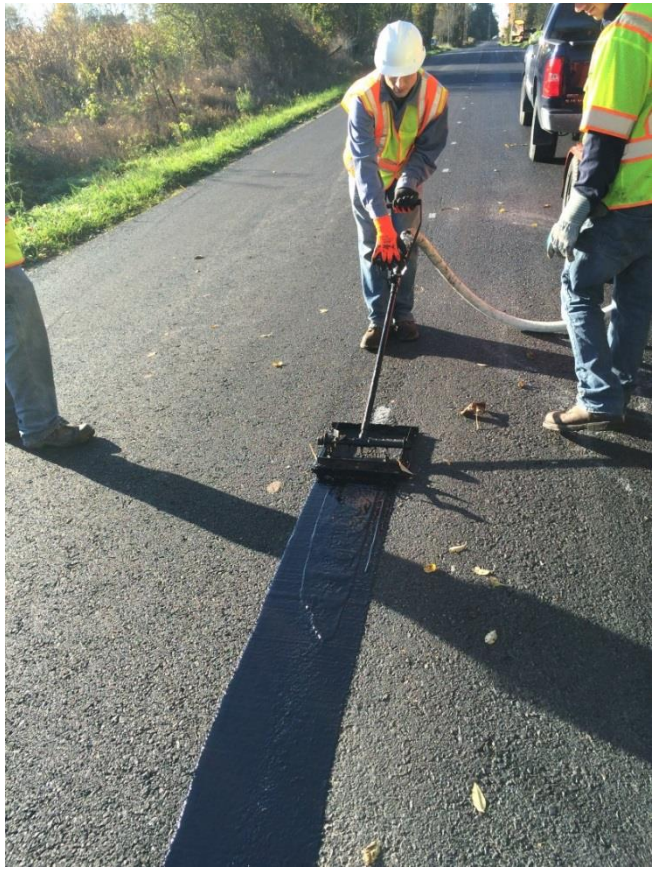
Placed by pressure distributor with mechanical agitation in tank

OR



Manual strike off box fed from melting kettle

VRAM Features

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- Material criteria
  - Migrates upward from heat of mix and compaction to reduce permeability at the joint
  - Creates a bond to the underlying pavement and a bond between paving passes
  - Imparts crack resistance at the joint
- Construction criteria
  - Fills voids in the overlay in an area 12” to 18” wide at the longitudinal joint
  - Resists lateral flow at placement
  - Provides non-tracking, no pick up from construction operation or traffic
  - Permits rapid start of paving after application
  - Allows quick release to traffic for moving construction zone

VRAM Performance History

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VRAM Experimental Test Sections Placed in 2002 – 2003

Illinois DOT

- District 7 US-51 Elwin
- District 1 US-50 Richton Park
- District 2 IL-26 Cedarville

IDOT D7 Elwin US-51 after 15 Years

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VRAM Joint transition to control

VRAM section

IDOT D2 Cedarville IL 26 after 14 years

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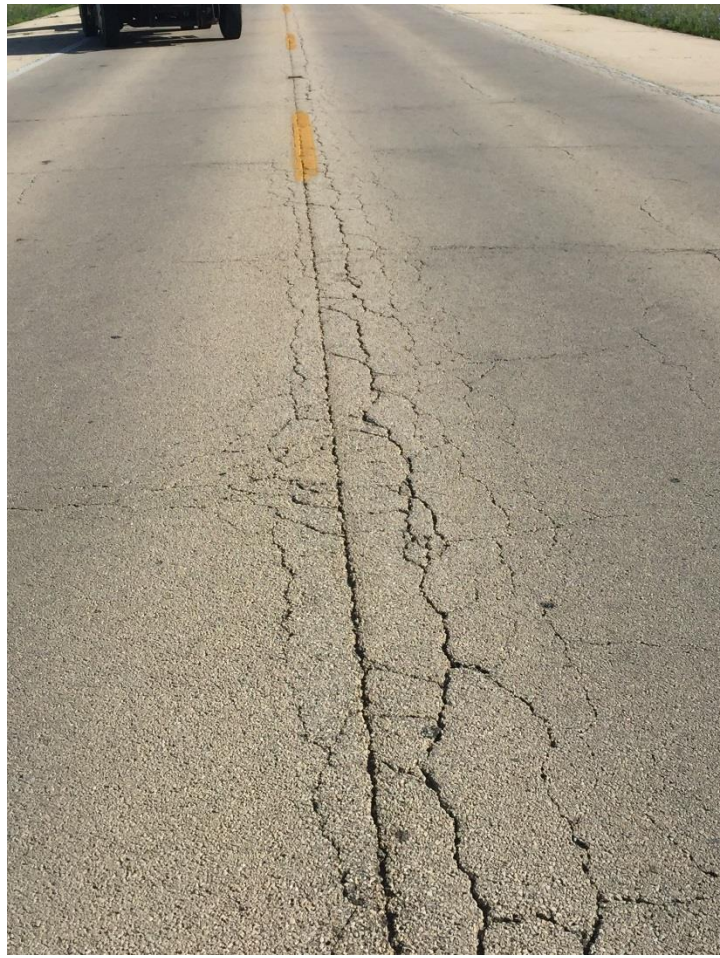
All pictures were taken in 2017

VRAM Test Section

Transition from Control Section to VRAM Section



Control Section

IDOT D1 US 50 Richton Park after 14 years

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VRAM Test Section

Control Section

VRAM Recommended Guideline Special Provision

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Test	Test Requirement	Test Method
Dynamic shear @ 88°C (unaged), G*/sin δ, kPa	1.00 min.	AASHTO T 315
Creep stiffness @ -18°C (unaged), Stiffness (S), MPa m-value	300 max. 0.300 min.	AASHTO T 313
Ash, %	1.0 – 4.0	AASHTO T 111
Elastic Recovery, 100 mm elongation, cut immediately, 25°C, %	70 min.	AASHTO T301
Separation of Polymer, Difference in °C of the softening point (ring and ball)	3 max.	ASTM D7173, AASHTO T53

VRAM Guideline Special Provision

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VRAM shall be

- … suitable for construction traffic to drive on without pick up or tracking within 30 minutes of placement.
- … be applied not less or greater than 1.5” of the width specified in the plans. The VRAM shall not flow more than 2” from the initial placement width.
- Density testing, one foot on either side of the joint, will be waived.

Application Rate and Width Table

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Overlay thickness, in	VRAM width, in	VRAM Application Rate, lb/ft*
SMA		
1 ½	12	0.83
1 ¾	12	0.92
2	12	1.00 **(= 1.05 gal/yd²)**
HMA		
1	18	1.15
1 ¼	18	1.31
1 ½	18	1.47
1 ¾	18	1.63
2	18	1.80 **(=1.26 gal/yd²)**

* Rates based on coarse-graded HMA

Effect of VRAM on Voids at Joint

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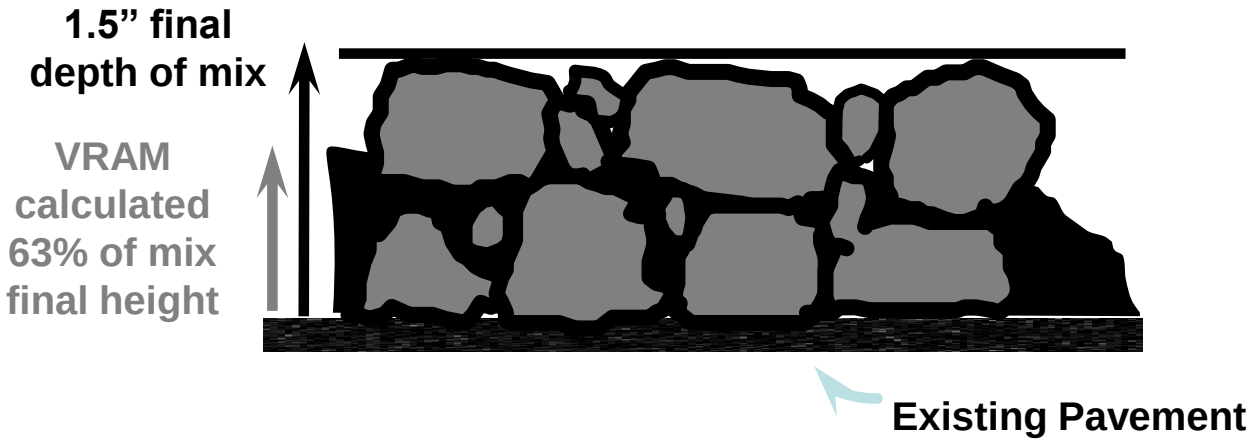
Example

- **HMA @ 5.5% AC, @ 1.5” thick/square yard = 9 lb of AC**
- **VRAM @ 1.47 lb/ft – 18” equates to 8.8 lb AC/square yard**
- **Total AC in HMA + VRAM = 10.3%**
- **For 10-13% air voids @ joint, VRAM would occupy 2/3 of overlay height**



Cross Sectional View at Longitudinal Joint

Current States with VRAM Experience

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- Illinois
- Ohio
- Iowa
- Indiana
- Michigan
- Missouri

Types of Roads using VRAM

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Interstate: ODOT I-77

State: Indiana SR-26

Urban: Indianapolis DPW 56th St

County: Champaign Co, IL Dewey-Fisher Road

VRAM Summary

- Application rate based on volumetrics (tailored to specific mix types)
- Provides a material solution to reducing air voids at the longitudinal joint
- Multiple field projects indicate improved long term field performance
- Reduces need for joint maintenance and increases the life of the pavement
- Provides improved cracking resistance


Questions?