JBAND
The Bottom-Up Joint Solution

A Proactive Solution to Improving Longitudinal Joint Performance

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How hard is it to find pictures like these?

Notice the condition of the rest of the pavement

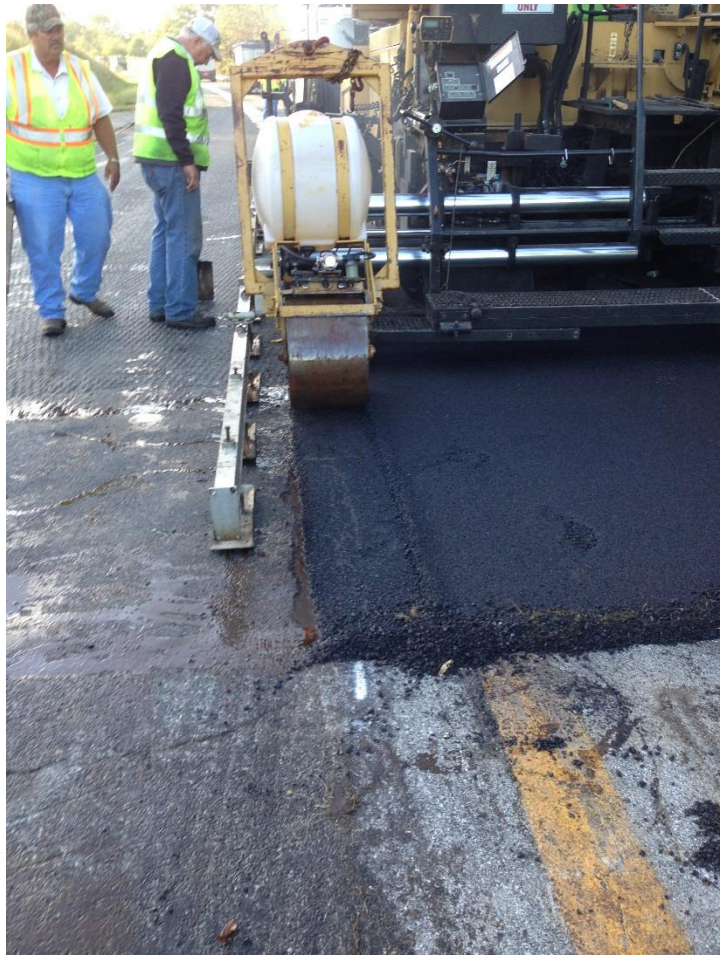
Last Winter in the Midwest

Was this winter any better?

Longitudinal Construction Joints

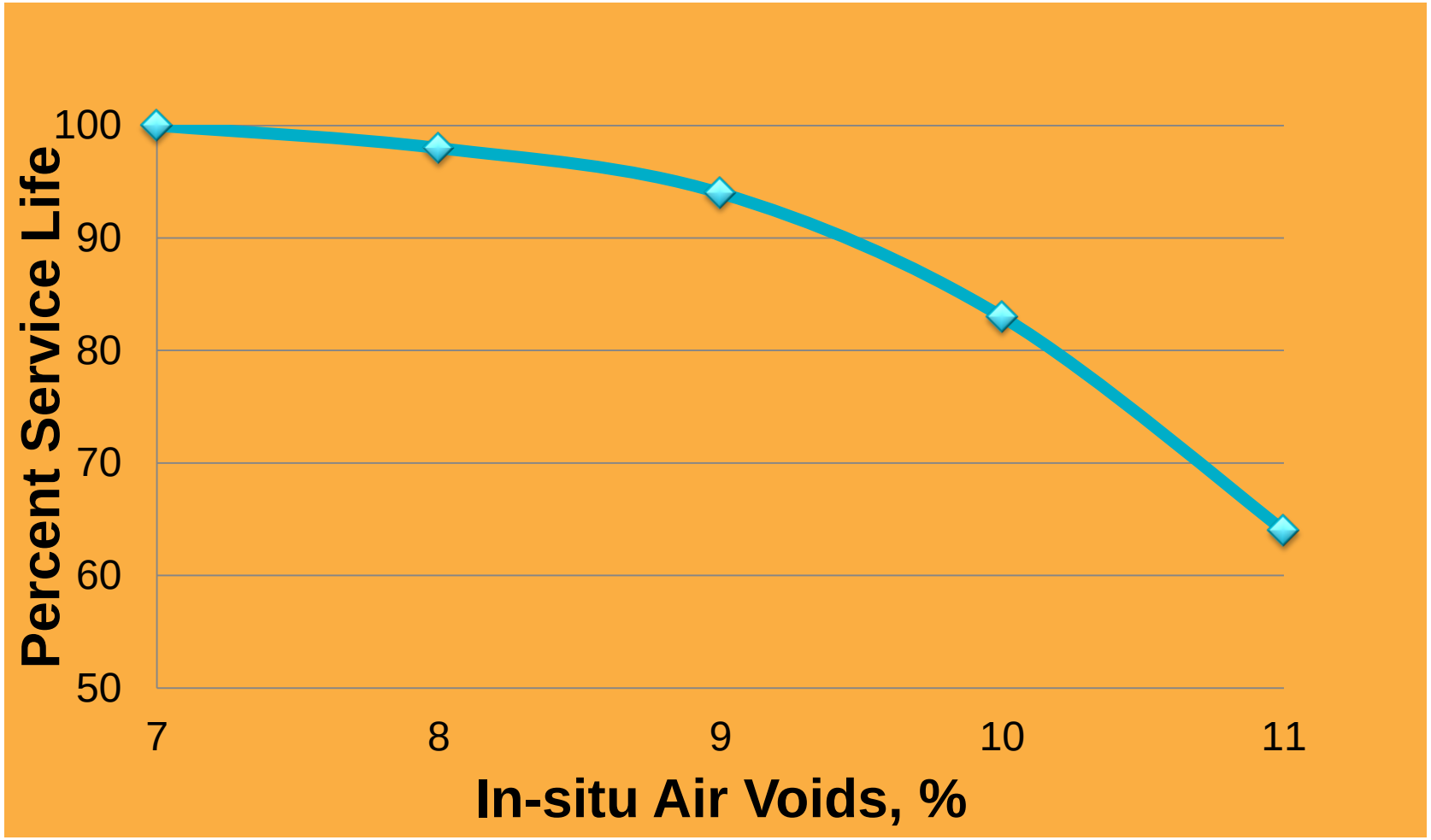
- Issues
  - Cannot achieve the same density at the joint as in the mat
  - Water and air intrusion accelerates damage
- Longitudinal construction joints
  - Commonly, the first area requiring maintenance on a pavement

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 unconfined edge
  - Mill and inlay
- All the above are “mechanical” solutions

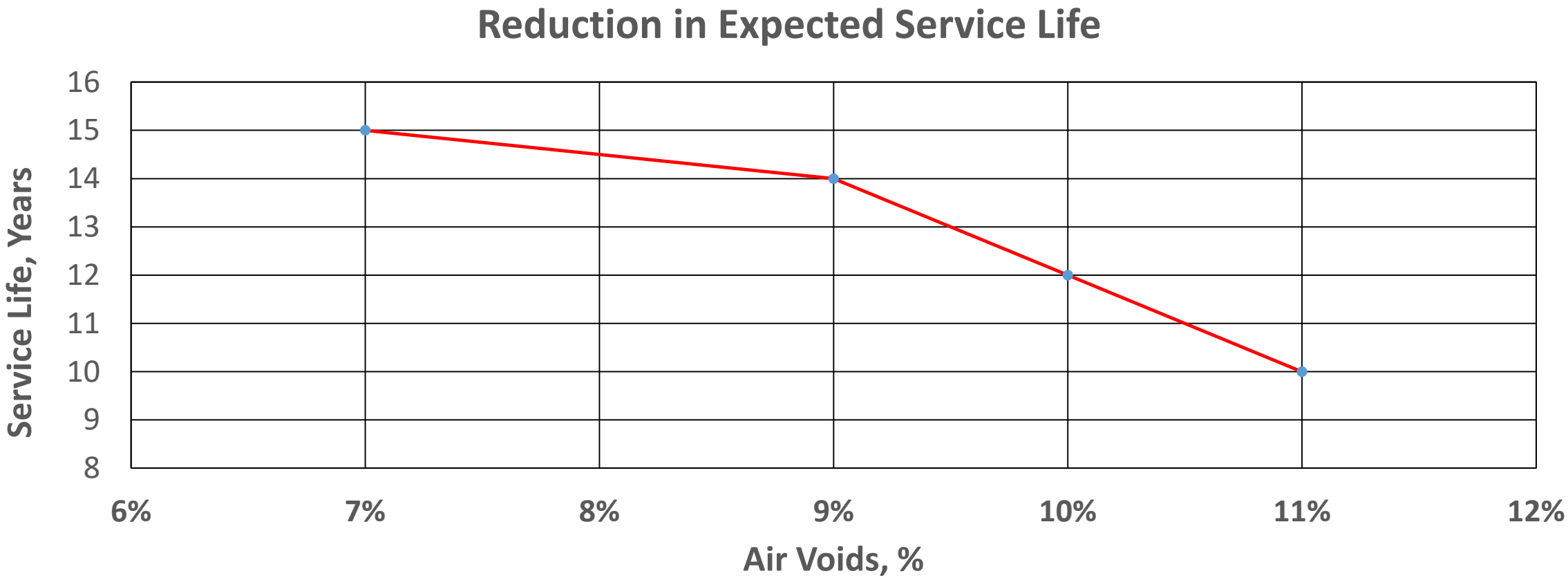
Why do joints fail early?



*Washington State DOT Study

"Effect of In-Place Voids on Service Life*

Effect of Air Voids on Pavement Service Life



If the center of the mat is at 7% voids or less, but if the joint is at 11% voids, the joint fails 5 years earlier than the rest of the pavement.

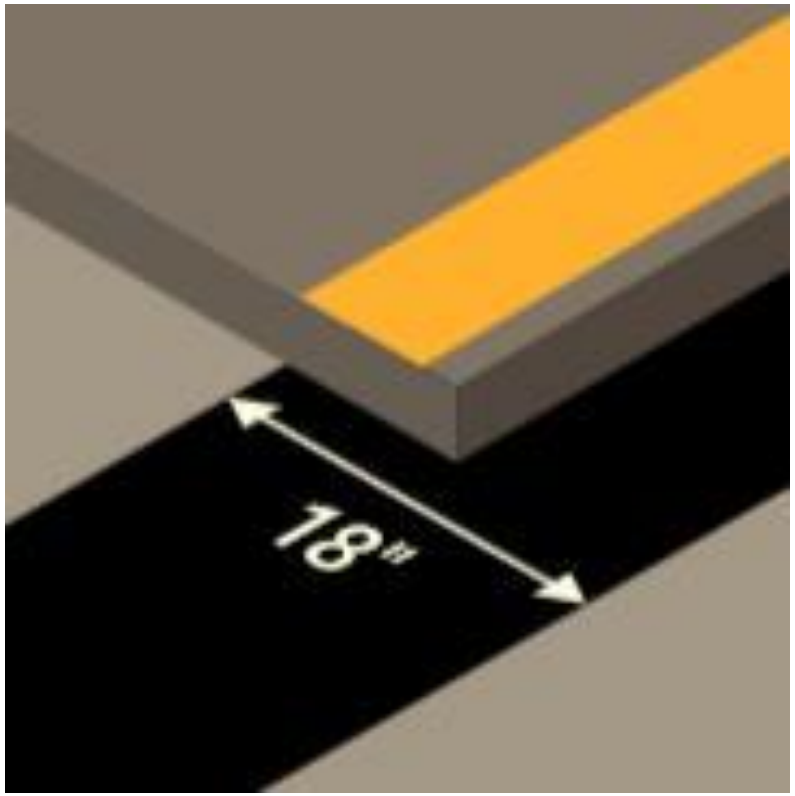
Longitudinal Joint Improvement Plan

- Early 2000 timeframe
- Illinois DOT recognized need for better joint performance
- Failure mechanism – permeability
- **Concept** – fill a portion of the voids with an asphalt product from bottom up, a Void Reducing Asphalt Membrane (VRAM)

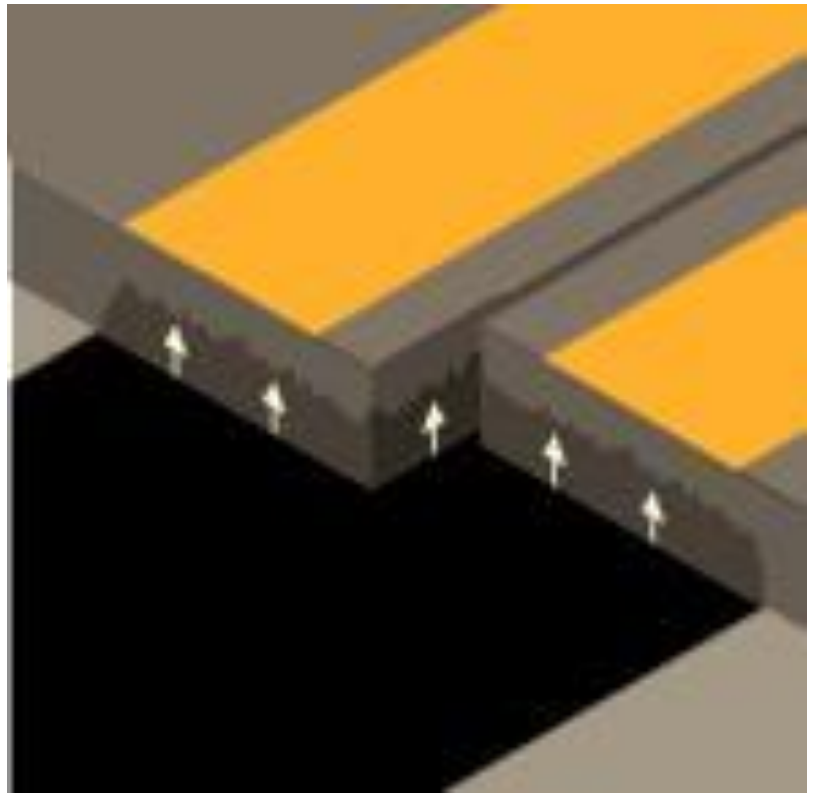
Falling head permeameter

A Materials Approach to Improve Joint Performance

Apply a heavy band of polymer modified binder in the area where the new paving joint will be placed



Place the first paving pass over half the width of the band of polymer modified binder



Polymer modified binder migrates into the HMA at the joint

VRAM Performance History

9 IDOT VRAM Experimental Test Sections Placed in 2002 – 2003

Illinois DOT took cores for testing these in 2017

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

VRAM Field Performance
IDOT D7 Elwin US-51 after 15 Years

VRAM Joint transition to control

VRAM section

VRAM Field Performance
IDOT D1 IL-50 Richton Park after 14 years

VRAM Test Section

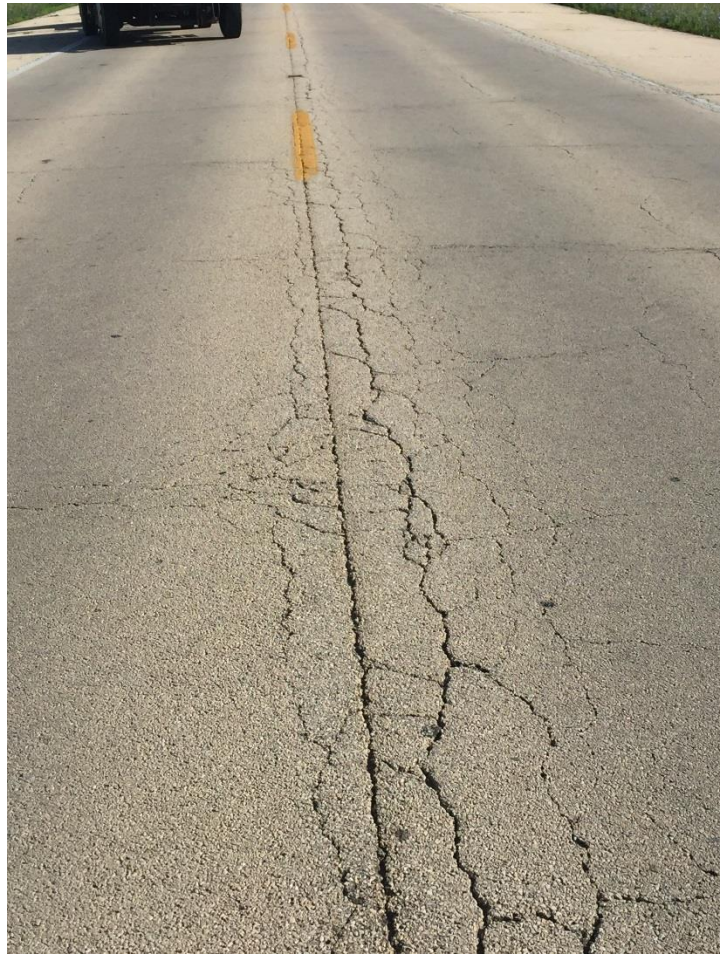
Control Section

VRAM Field Performance
IDOT D2 Cedarville IL-26 after 14 years

VRAM Test Section

All pictures were taken in 2017

Transition from Control Section to VRAM Section



Control Section

Void Reducing Asphalt Membrane (VRAM)

- Thick application of hot-applied, polymer-modified asphalt (~ 1 gal/sq yd for 1 ½” overlay)
- Application of an 18” band applied before paving in the location of the new longitudinal joint

VRAM Material Features

- Migration upward from heat of mix and compaction to reduce permeability at the joint
  - Voids filled to 50% or more of overlay height filled over the width of the application
- Bonds to the underlying pavement and bonds at the joint
- Crack resistance at the joint

Placed <u>under</u> the intended area for an overlay longitudinal construction joint

VRAM Construction Features

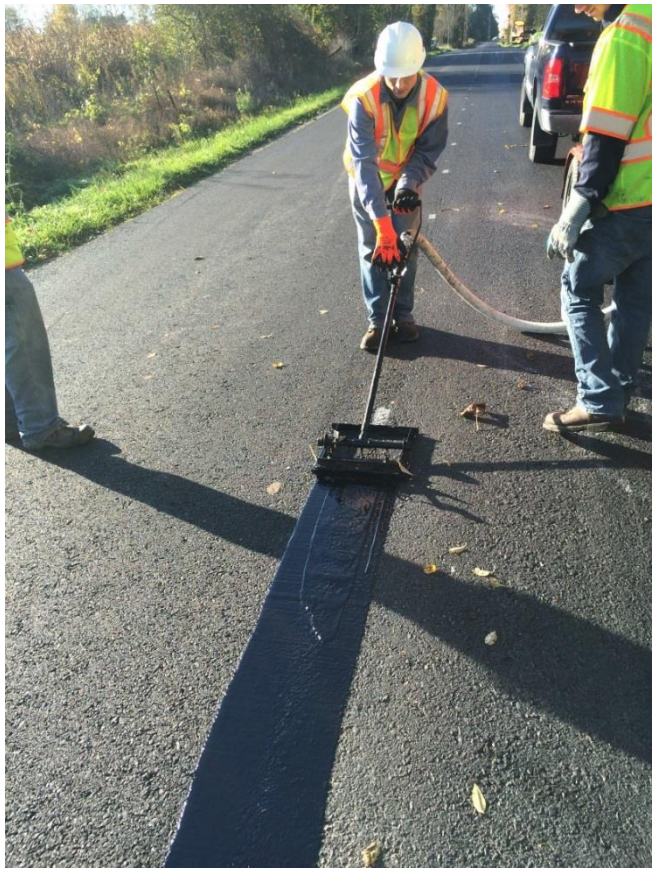
- Non-lateral flow at placement
- Minimal time from placement to start of paving
- Fast release to traffic for moving construction zone
- Non-tracking, no pick up from construction operation or traffic

Placed under the intended area for an overlay longitudinal construction joint

VRAM Application

Placed by pressure distributor with mechanical agitation in tank

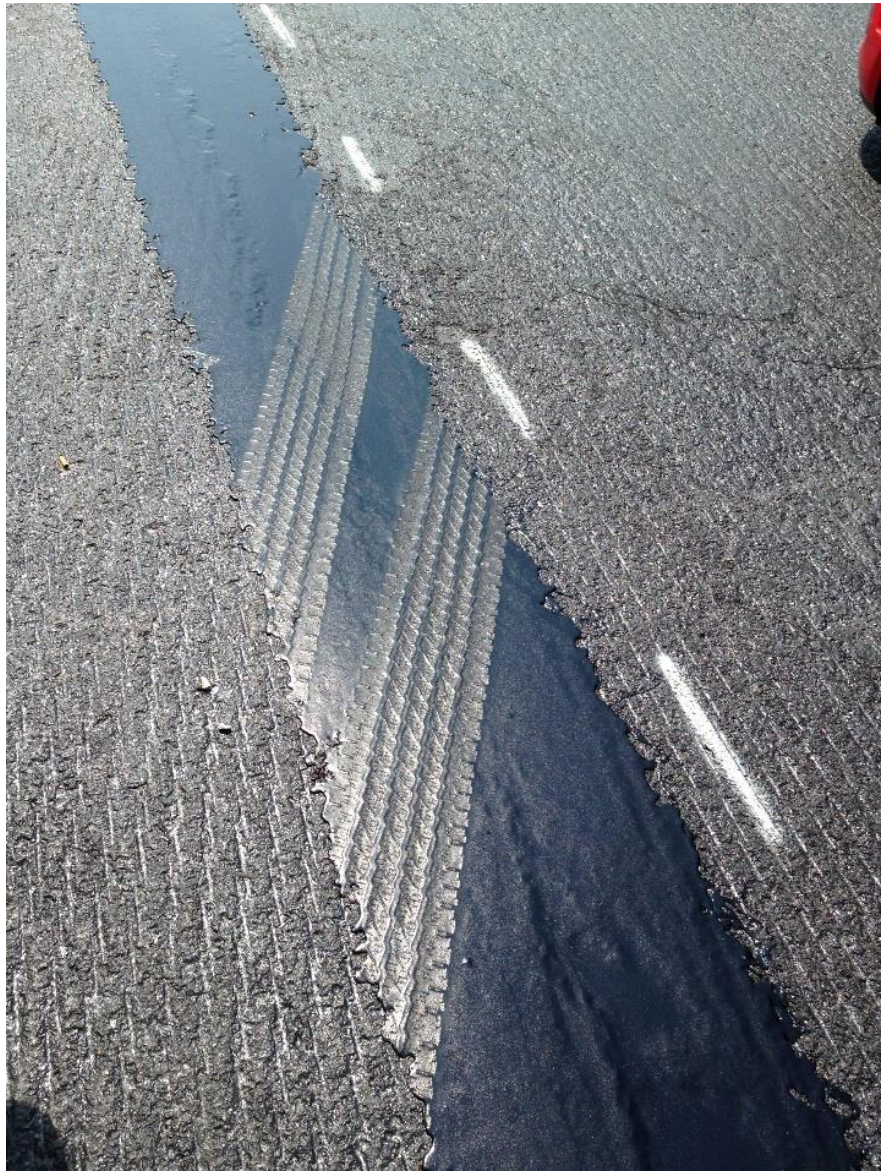
OR



Manual strike off box fed from melting kettle

Application of VRAM

- A guideline is placed for the applicator to follow.
- Vehicles may cross over the VRAM once cooled to 130F or less. **Do not permit** vehicles to stop on or drive longitudinally on top of the VRAM.



VRAM Special Provision

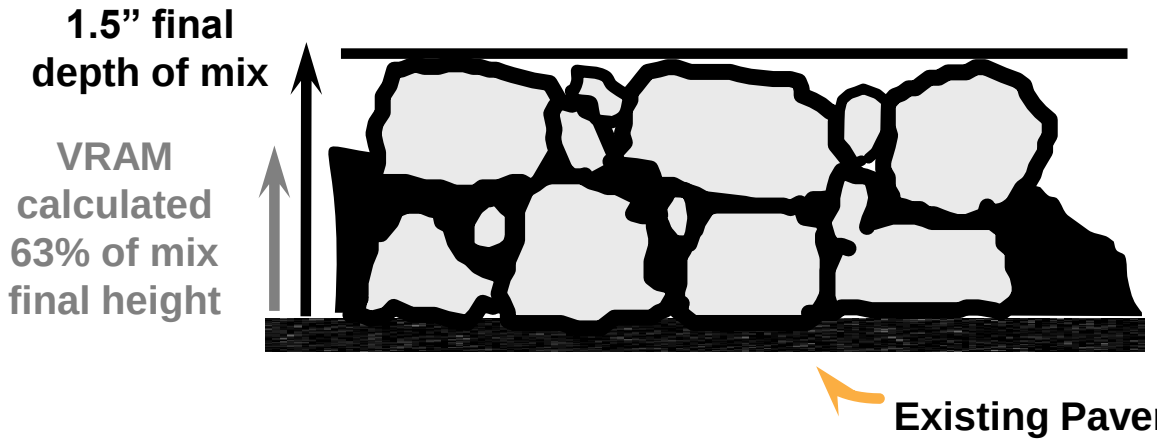
Test	Test Requirement	Test Method
Dynamic shear @ 88°C (unaged), G*/sin δ, kPa	1.00 min.	AASHTO T 315
Creep stiffness @ -18°C (unaged), Stiffness (S), MPa m-value	300 max. 0.300 min.	AASHTO T 313
Ash, %	1.0 – 4.0	AASHTO T 111
Elastic Recovery, 100 mm elongation, cut immediately, 25°C, %	70 min.	AASHTO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

VRAM Application Table		
Coarse-Graded HMA Mixtures		
Overlay Thickness, in	**VRAM Width, in.**	**Application Rate, lb/ft**
1	18	1.15
1 ¼	18	1.31
1 ½	18	1.47
1 ¾	18	1.63
≥ 2	18	1.80
Fine-Graded HMA Mixtures		
Overlay Thickness, in	**VRAM Width, in.**	**Application Rate, lb/ft**
1	18	0.80
1 ¼	18	0.88
≥ 1 ½	18	0.95
SMA Mixtures		
Overlay Thickness, in	**VRAM Width, in.**	**Application Rate, lb/ft**
1 ½	18	1.26
1 ¾	18	1.39
≥ 2	18	1.51

Effect of VRAM on Voids at Joint

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**

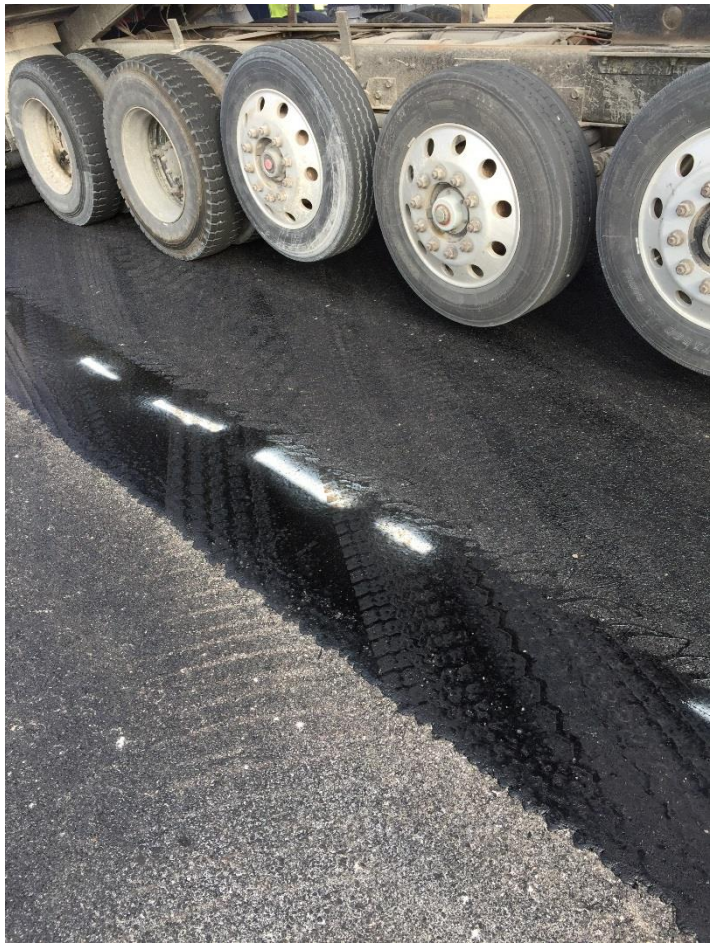


Cross Sectional View at Longitudinal Joint

VRAM Special Provision

VRAM shall be

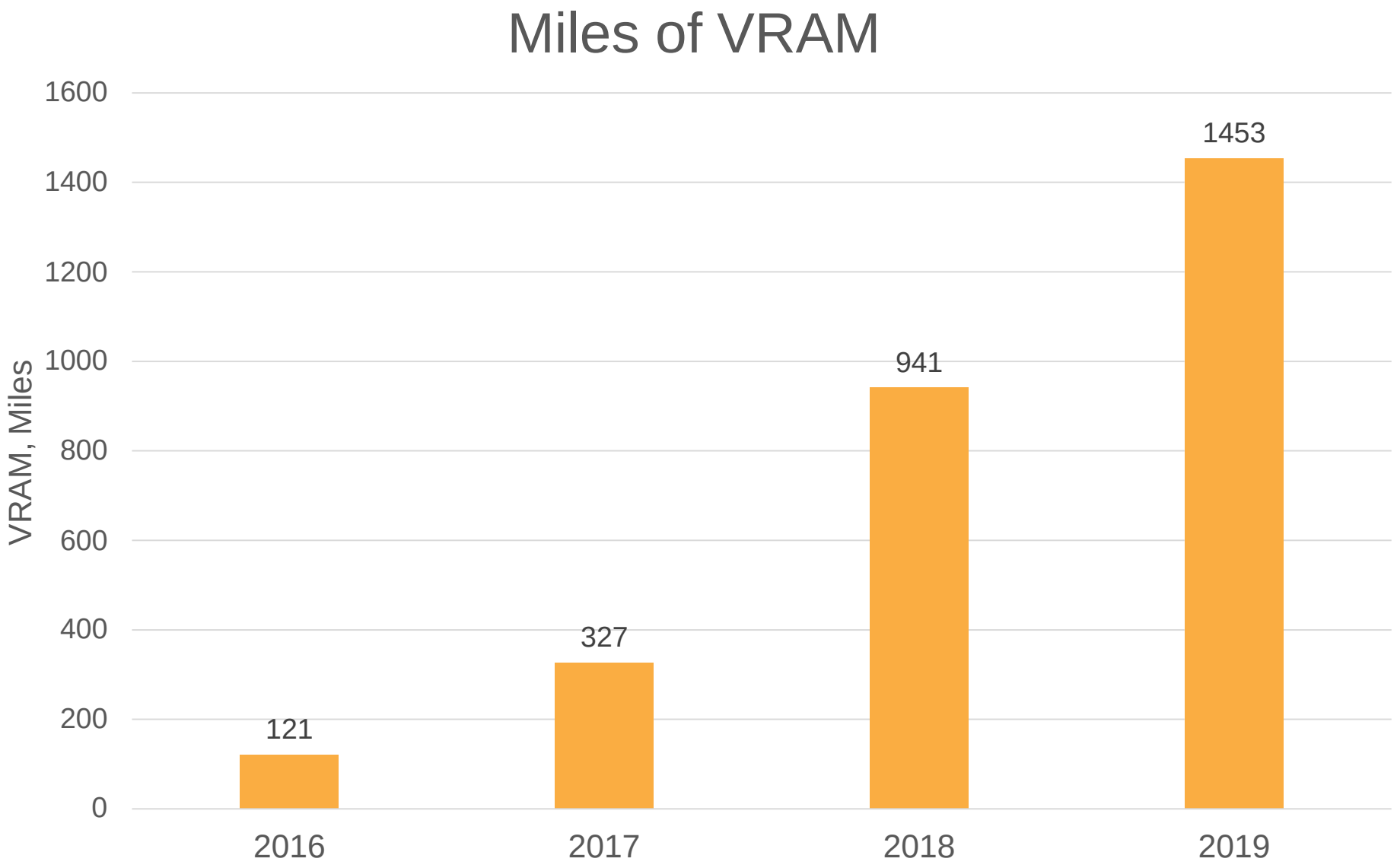
- … suitable for construction traffic to drive on without pick up or tracking within 30 minutes of placement.
- … be applied not less or greater than 1.5” of the width specified in the plans. The VRAM shall not flow more than 2” from the initial placement width.
- Density testing, one foot on either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



Field Observations and Performance

Current States with VRAM Experience

- Illinois
- Indiana
- Ohio
- Iowa
- Michigan
- Missouri
- Wisconsin
- Wyoming
- Minnesota
- Pennsylvania
- Massachusetts
- Delaware


Miles of VRAM
VRAM, Miles
1600
1400
1200
1000
800
600
400
200
0
121
327
941
1453
2016
2017
2018
2019

Types of Roads using VRAM

Interstate: ODOT I-77

State: Indiana SR-26

Urban: Indianapolis DPW 56th St

County: Champaign Co, IL Dewey-Fisher Road

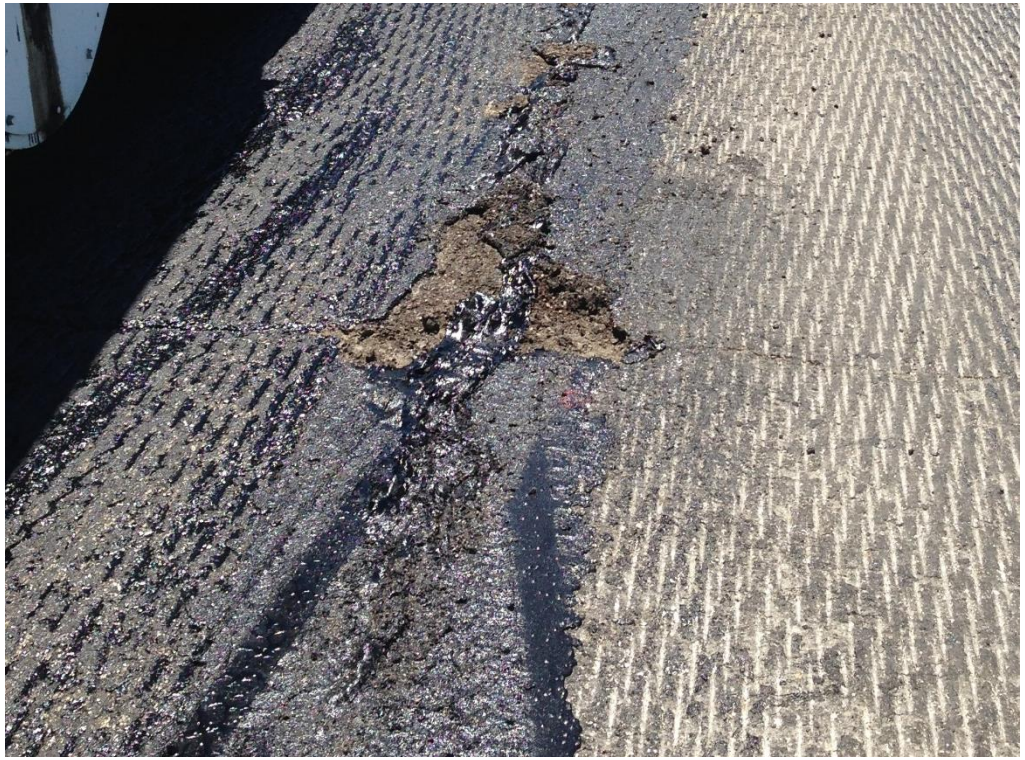
VRAM Application Temperature Limitations

- Paving temperatures and conditions will dictate

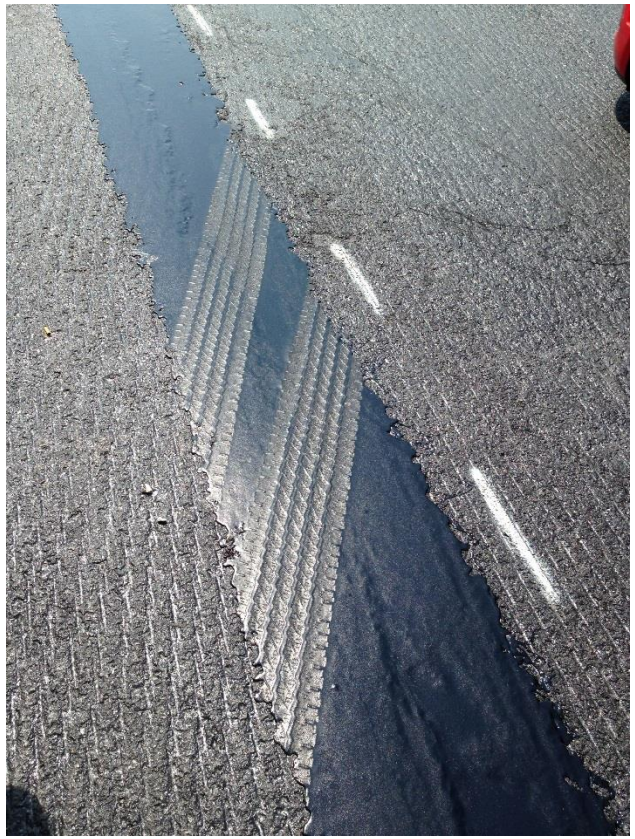
November 7th , 2018, Collinsville, Illinois

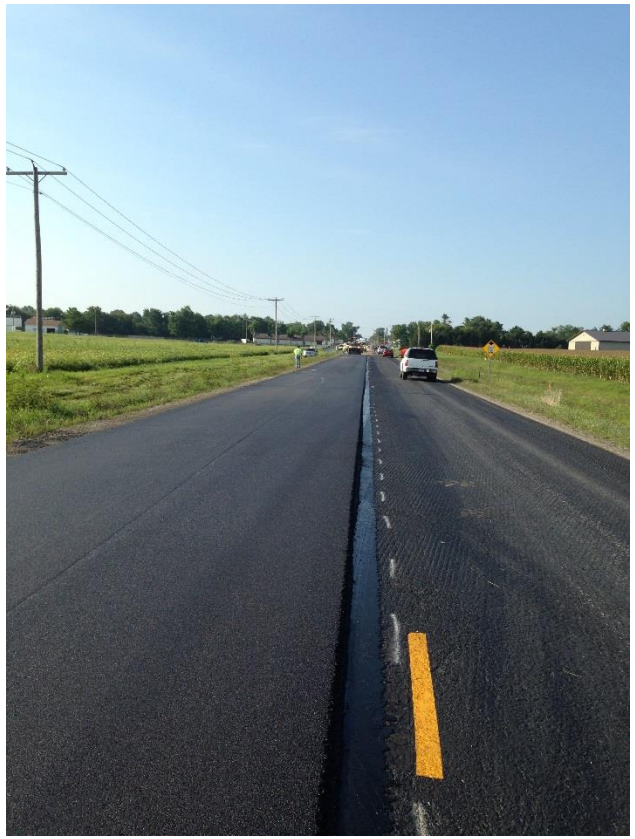
Milled Surface Preparation for VRAM Application

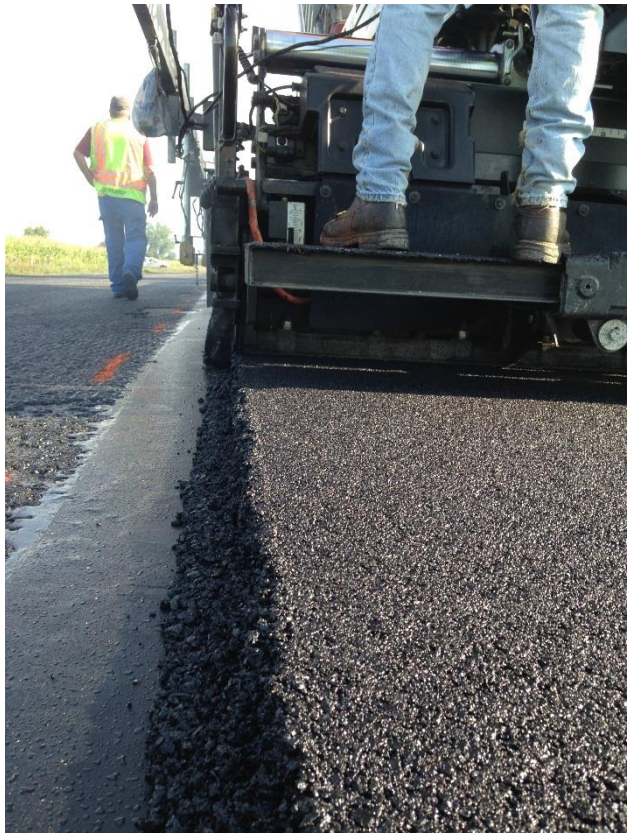
- Compressed air may be used to remove dust and fine materials from the area where VRAM will be applied.
- Roads posted < 45 miles/hour, should use compressed air to clean the surface where VRAM will be placed.
- Final cleaning within 24 hours of the placement of VRAM



VRAM Over Milled Surface







- Milled surface with 1 ½” 9.5mm surface (IL 1/US 150)
- 18” width application, 1.47 lb/ft VRAM

Mill and Fill VRAM Applications

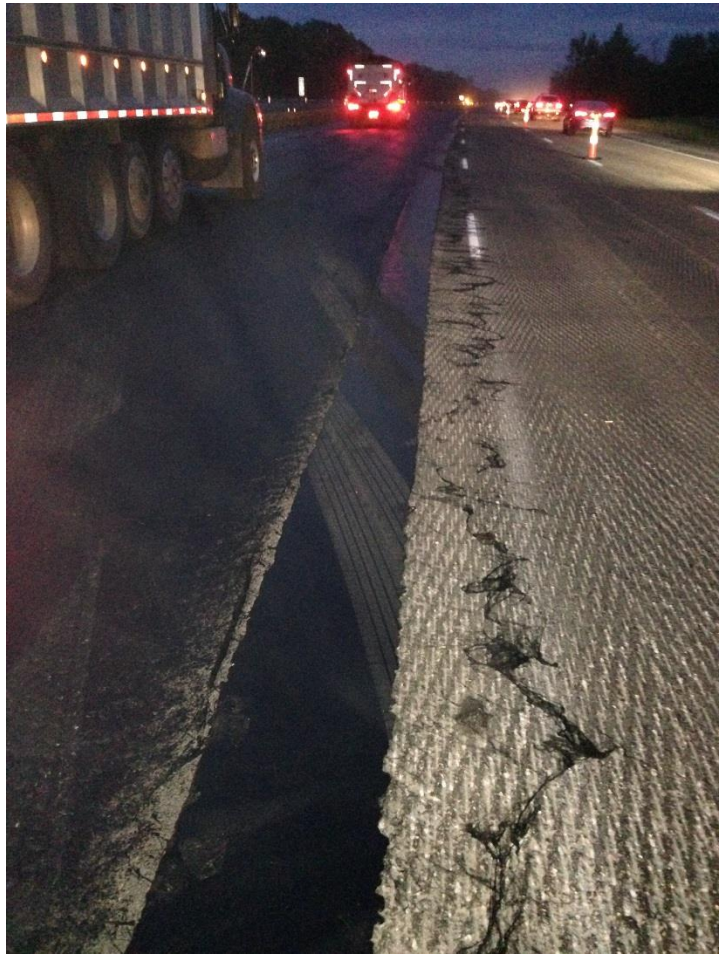
- When only one-half of the joint is exposed, VRAM is applied at one-half the prescribed width and rate and adjacent to the center of the joint

I-74 west of Crawfordsville, Indiana

Existing Pavement Not Well Bonded

VRAM will locate the weakest tensile bond. Usually the weakest bond is with the tires of the construction equipment.

VRAM on Interstate Night Paving



I-71 Near Strongsville, OH

- Night paving on milled surface
- 1 ½” 9.5mm HMA, 1.47 lb/ft target rate of VRAM at 18” width

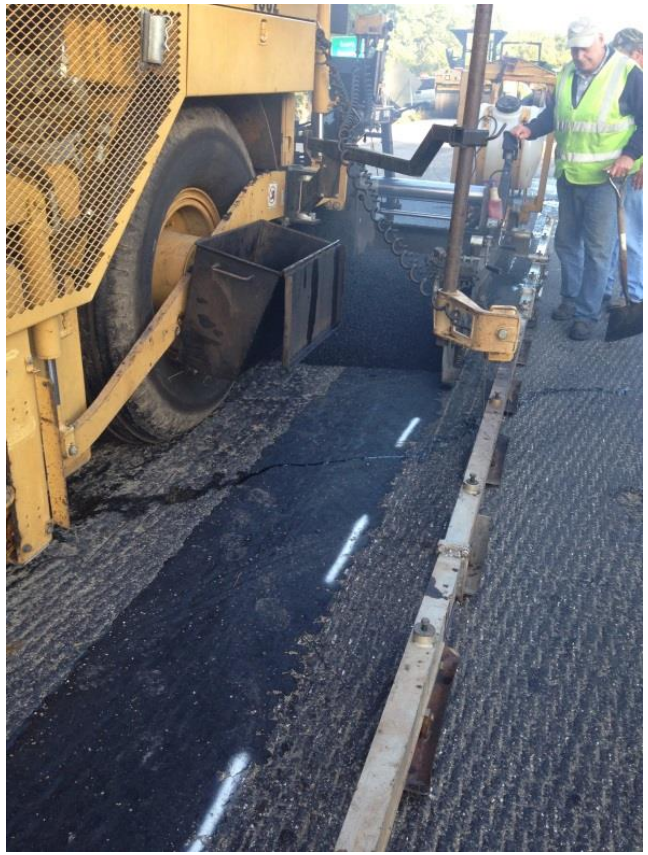
VRAM with SMA

- 2” SMA overlay (IL I-80 Henry County)
- 12” width application, 1 lb/ft VRAM

Double VRAM Application

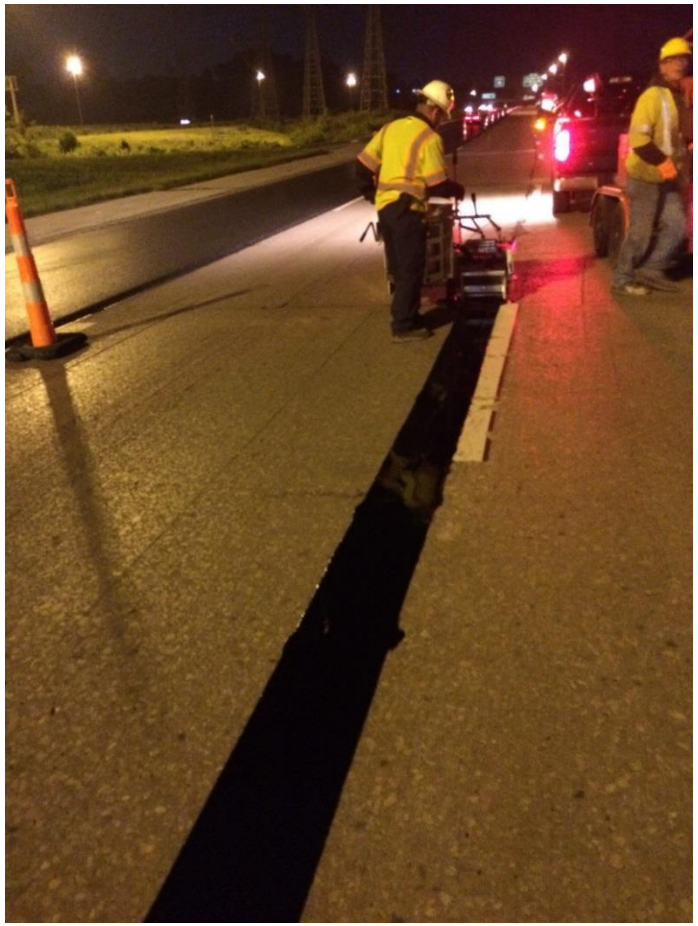
- Two VRAM applications (IL 160 Madison Co.)
  - On milled surface, under 4.75mm level, 0.88 lb/ft target
  - On level binder with 1 ½” surface, 1.47 lb/ft VRAM

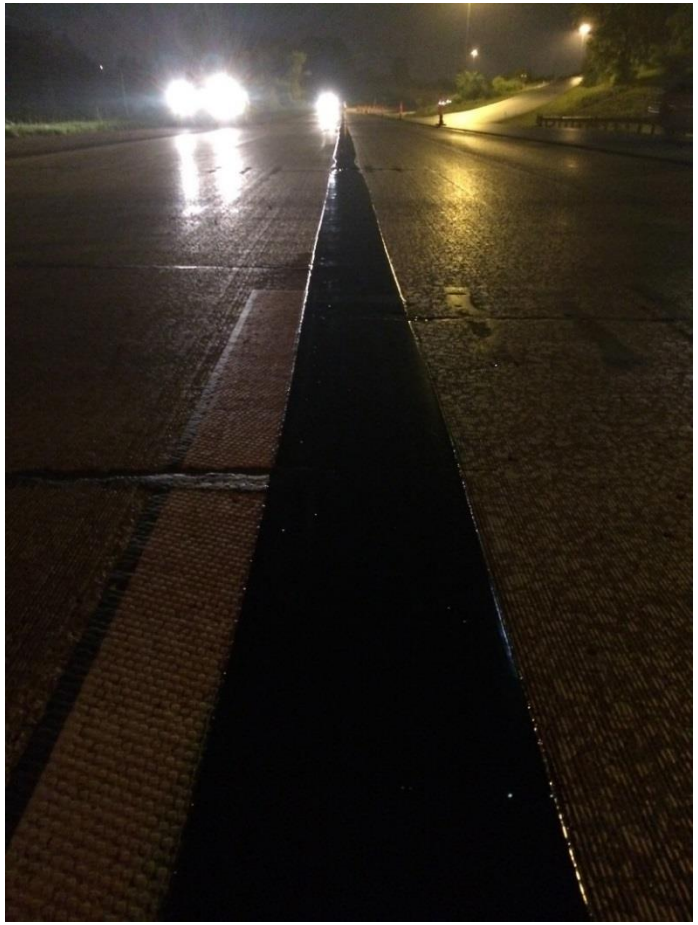
VRAM with Notched Wedge Joint



- VRAM under notched wedge joint (IL 106 Greene Co.)
- 2 ¼” surface with 1.80 lb/ft VRAM target placed on milled surface

VRAM over Diamond Ground PCC





- PCC with 1 ½” SMA overlay, MoDOT I-170
- 12” VRAM width at 1 lb/ft

VRAM at Outside Edge of Paving

- Historical weak edge of paving
- 2 lane, 22’ wide, milled surface
- VRAM placed 18” on <u>outside edges of paving</u> under two paving lifts
  - 2 ½” 19mm Intermediate mix, 1 ½” 9.5mm Surface mix

SR-119 Elkhart Co, Indiana

VRAM under Rumble Strips

- Rumble strips/corrugations
  - being used on an increasing basis for safety
  - placed in the weakest area of the pavement, centerline joint or outside edge of paving creating early failure
- VRAM under centerline or edge rumble strips to reduce air/water permeability
- Fog sealed after cuts to further help waterproof from the top

VRAM as applied to Safety

Dangers of Distracted Drivers

- VRAM can extend the life of the construction joint
- Avoids lane closures for maintenance and repair
- Improves public safety and worker safety

Cost Comparison*

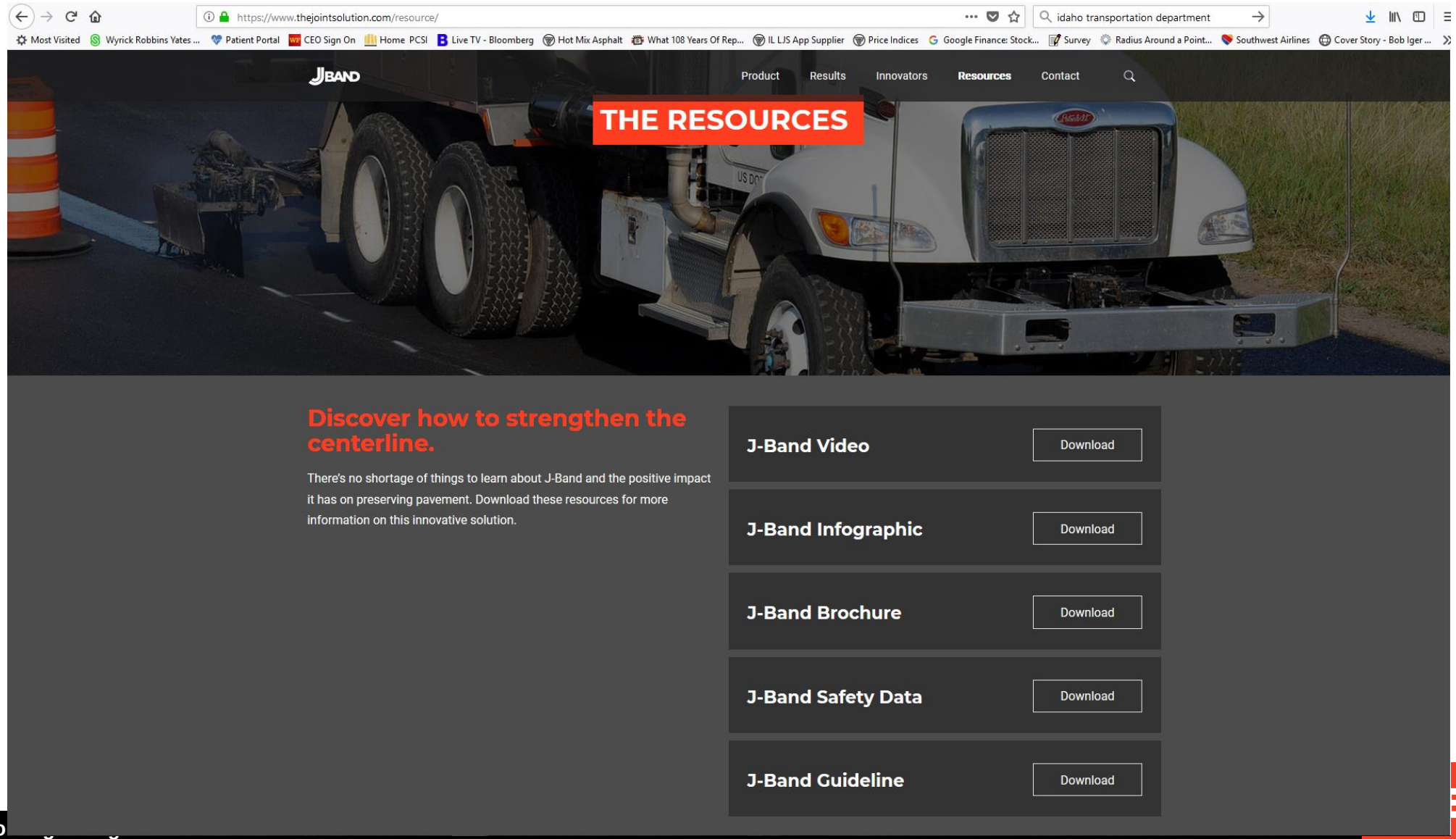
- Inlay: $8.00/linear ft
  - Includes: traffic control, mobilization, milling, priming, paving, pavement marking
- Microsurfacing: $4.81/linear ft
  - Includes: crack seal, traffic control, pavement marking/removal
- Route and Seal: $2.00/linear ft
  - Includes: prime, crack seal, traffic control
- VRAM (material including placement): $2.00/linear ft

*(Illinois DOT HMA Update, 57th Annual Bituminous Conference)

VRAM Summary

- First experimental applications in 2002 has performed over 15 years
- Application rate based on volumetrics (tailored to specific mix types)
- A material solution to reducing air voids and permeability
- Multiple field projects indicate improved long term field performance
- Provides improved cracking resistance
- Reduces need for joint maintenance and increases pavement life
- Increasing joint life reduces need for maintenance, improving safety for construction workers and motoring public

RESOURCE: www.thejointsolution.com




Questions?
For more information go to
https://www.thejointsolution.com