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OVERVIEW OF VDOT REFLECTIVE CRACKING MITIGATION RESEARCH

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Outline

- Introduction
- Reflective Cracking Mitigation Techniques
- VTRC/VDOT Research
  - Field Trials and Performance
- Summary

Introduction

Reflective cracking over jointed concrete is a major problem in Virginia.

Result of horizontal and vertical movements at the joints and cracks in the underlying PCC

-Thermal and moisture changes

Reflective cracks allow water into the pavement

-Contributes to premature deterioration

-Reduce ride quality

Introduction

The key to delaying reflective cracking is to reduce the stresses and strains produced in the asphalt overlays.

State DOT's are using several treatment strategies to mitigate reflective cracking

Most of the reflective cracking mitigation methods only delay or reduce the severity of the cracks

Reflective Cracking Mitigation Techniques

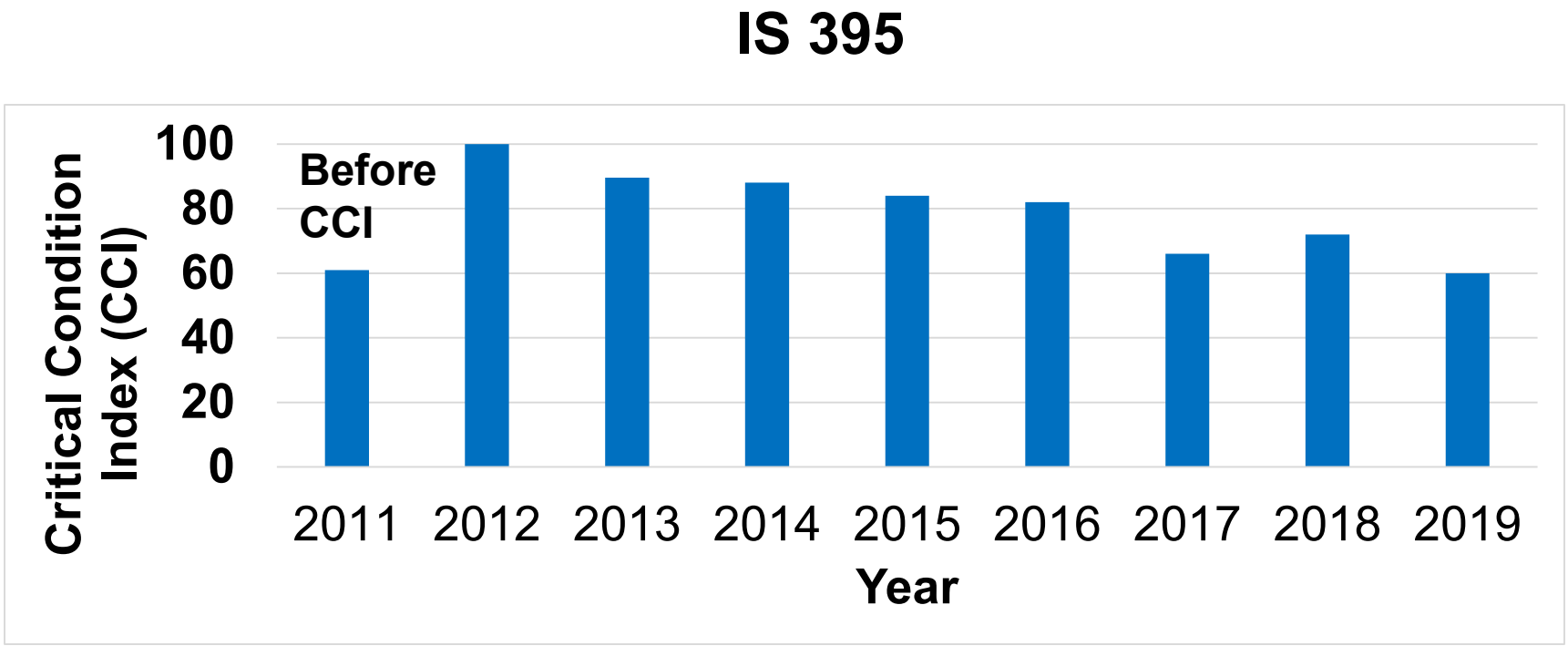
1. Saw and Seal
2. In Place Recycling (e.g.: CIR+ AC Overlay)
3. Crack-relief Mechanism (e.g.: Fabric Interlayers, Chip Seal etc..)
4. Asphalt mixes with higher cracking resistance
5. Fractured Slab Processes (e.g.: Rubblization + AC overlay)
6. Thicker Overlays

Saw and Seal

- Involves making saw cuts in the overlaying asphalt, (above the concrete joints) and sealing them with a compressible rubberized low modulus material

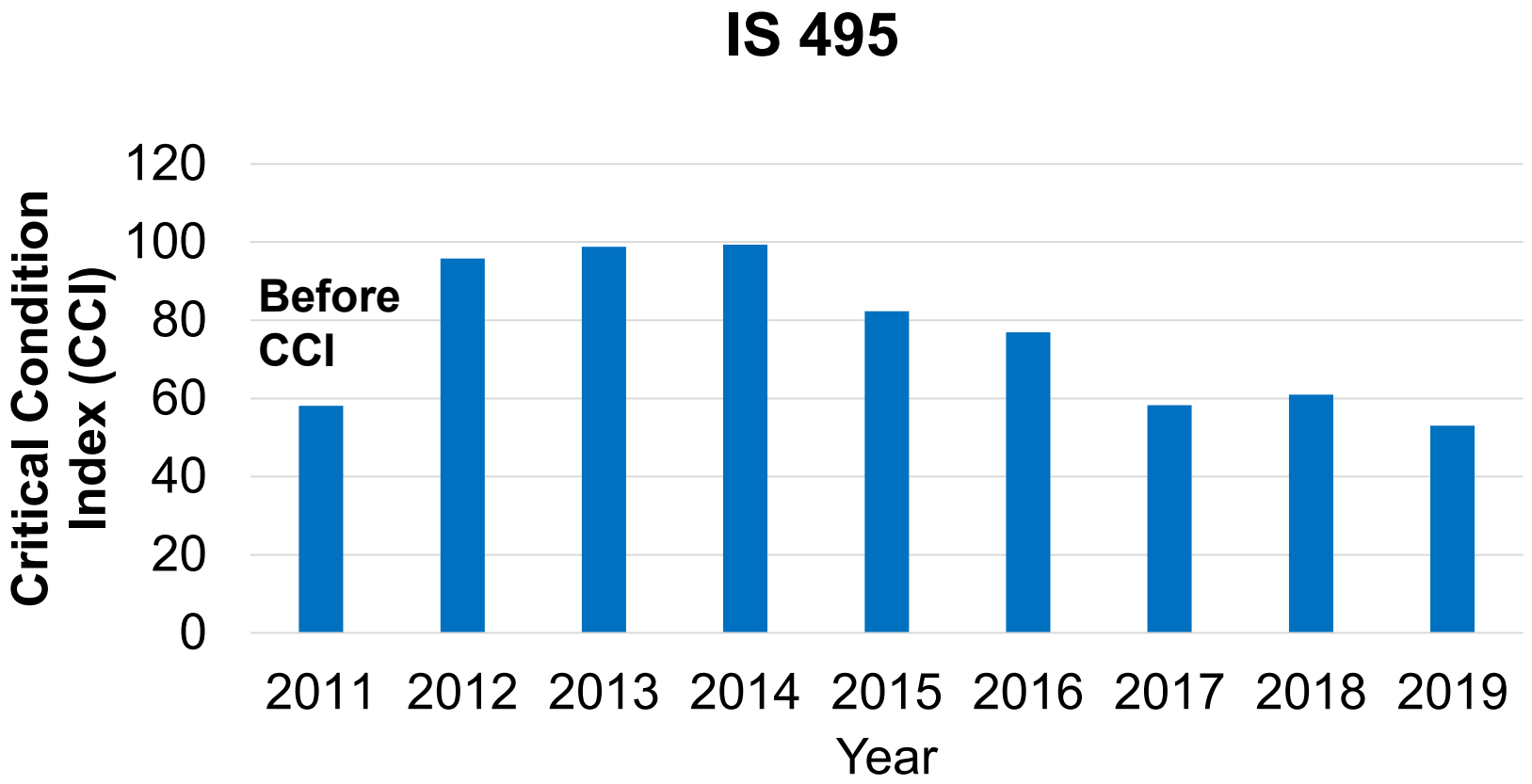
Economical option for controlling reflective cracking

VDOT Field Project: Saw and Seal



Pavement Condition	Index Value (CCI)
Excellent	90 and above
Good	70-89
Fair	60-69
Poor	50-59

VDOT Field Project: Saw and Seal



Data Credit: Bipad Saha, P.E, CO Materials Division

In Place Recycling

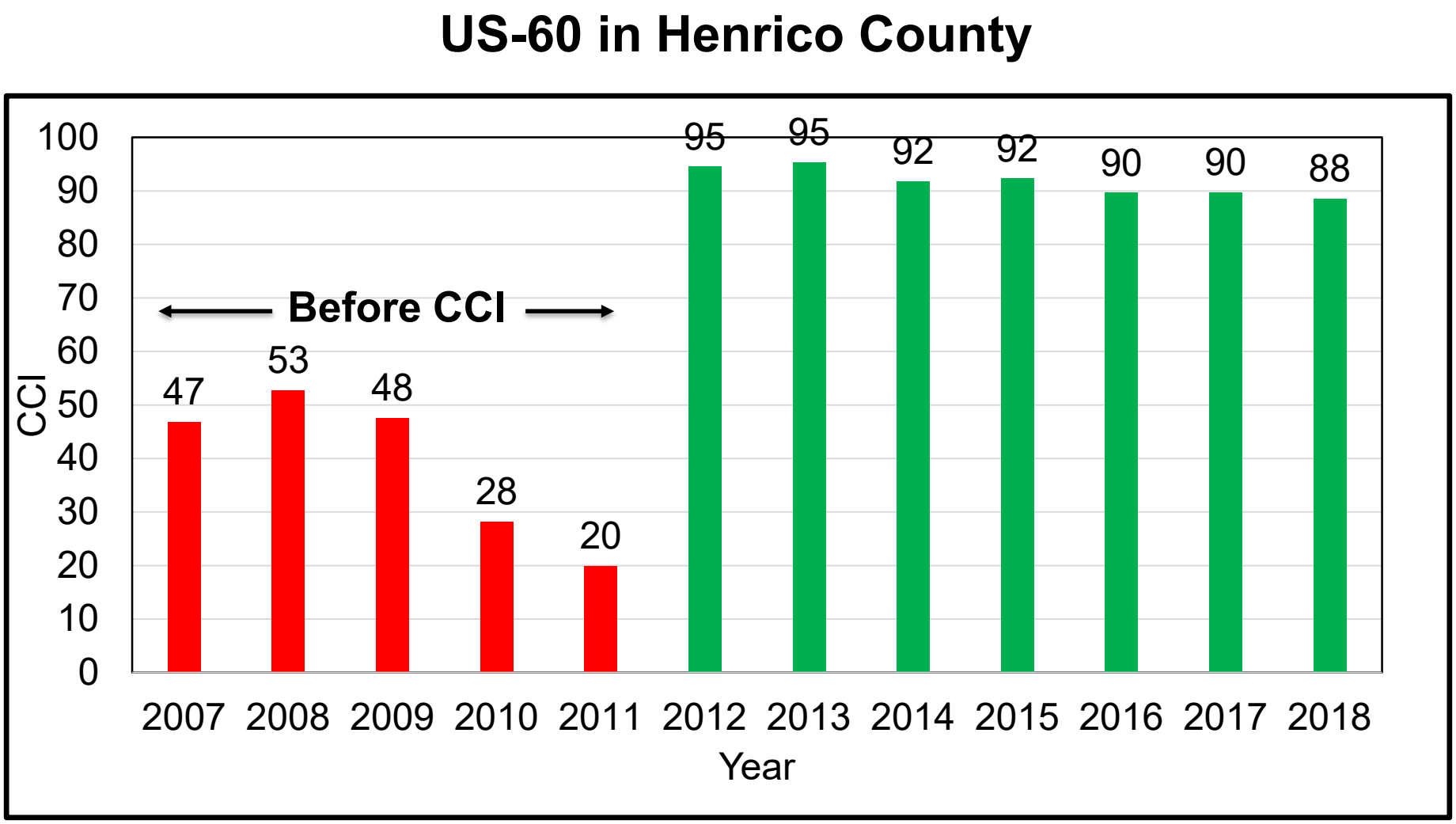
Cold In-Place Recycling (CIR)+ AC overlay

- Suitable if the composite pavement has a substantial HMA thickness built up over the years with overlays

VDOT Projects

1. **US-60 in Henrico County**
   - -Originally constructed in 1967 with 8 inches of JRCP
   - -Average of 7” of existing asphalt
   - -**The last rehabilitation prior to the CIR was done in 2000**
   - -CIR to a depth of 5 inches (after 2” mill)
   - -HMA overlay (2” SMA-12.5 and 2” SMA- 19.0)

Cold In-Place Recycling (CIR)+ AC overlay



Data Credit: Bipad Saha, P.E, CO Materials Division

Cold In-Place Recycling (CIR)+ AC overlay

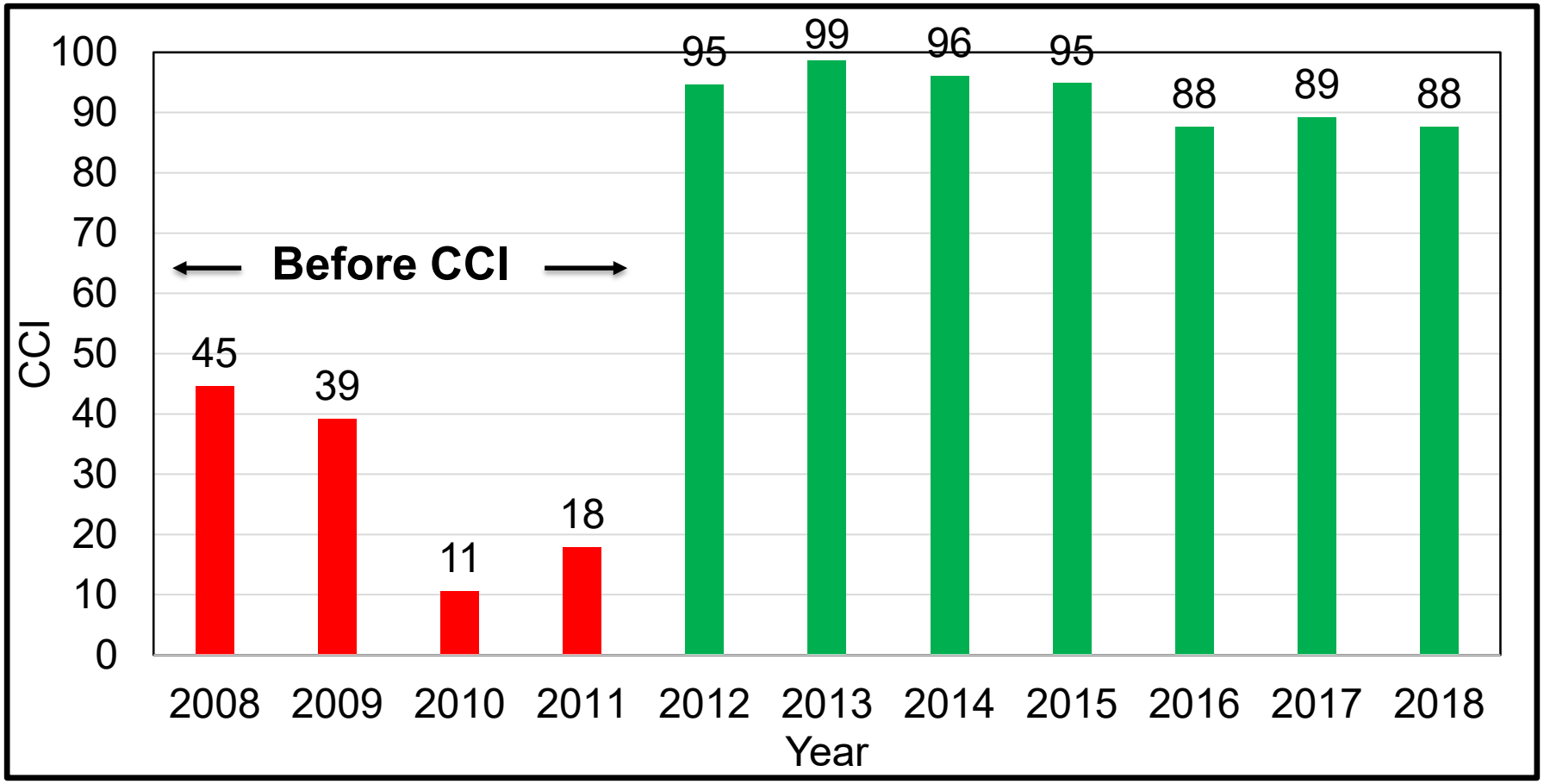
VDOT Projects

2. SR-35 in Prince George County

-Originally constructed in 1969 with 8” of JRCP
-Average of 7” of existing asphalt
-**The last rehabilitation prior to the CIR was done in 2001**
-CIR to a depth of 5 inches (after 2” mill)
-HMA overlay (2” SM-12.5E and 2” IM- 19.0A)

Cold In-Place Recycling (CIR)+ AC overlay

SR-35 in Prince George County



Data Credit: Bipad Saha, P.E, CO Materials Division

Crack-relief Mechanism

Paving Fabric Interlayers

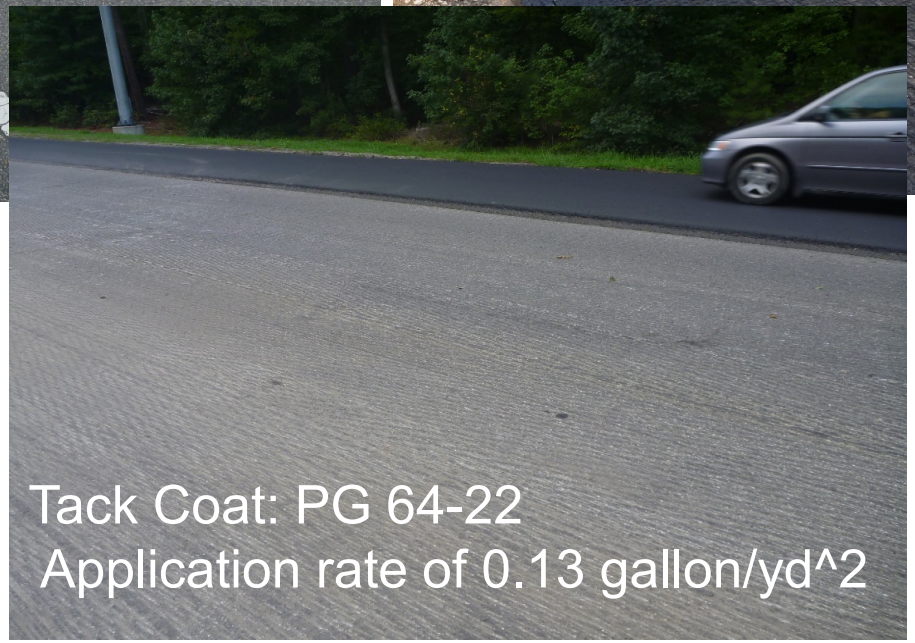
Interlayers can be used for stress absorption, reinforcement, and to provide a waterproof barrier

Performance was reported to depend on many factors including the installation procedures and condition of the existing pavement

The technologies continue to advance with more interlayer choices than in the past

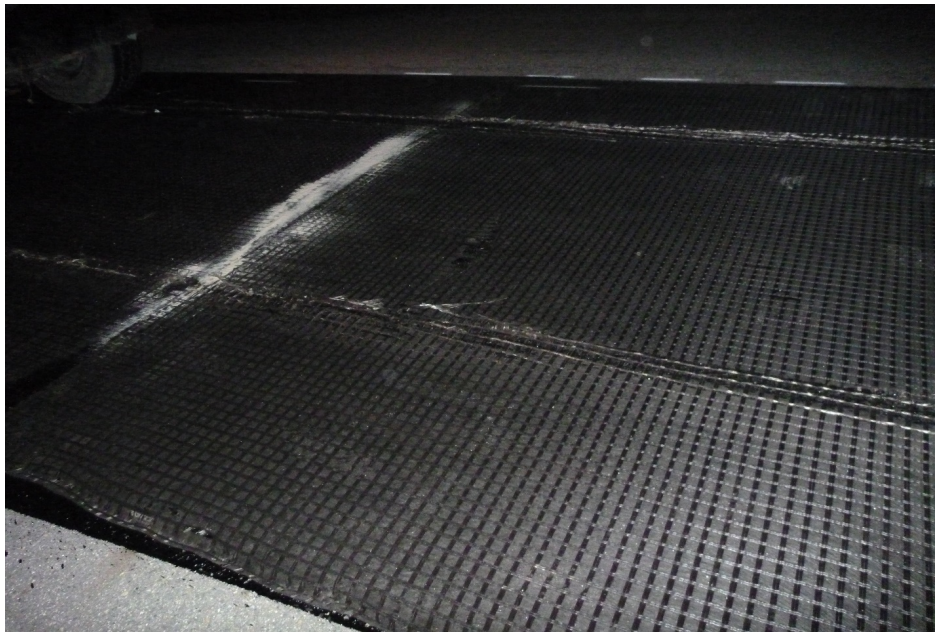
Route 143 NB & SB, York County

Paving Grid Type III on milled asphalt pavement over jointed concrete, with 1.5” overlay of SM-9.5D.



US Route 17 SB, York county

Paving Grid Type III directly on existing asphalt pavement over jointed concrete, with 2” overlay of SM-12.5D.



Tack Coat: PG 64-22 -application rate of 0.11 gallon/yd^2

US 460 Wakefield

1.12 mile long, 2” overlay

Fabric Length: 328 ft.

Width: 5 ft.

Rte. 30, York County

-Concrete patching
-Joint seal
-SM 4.75 (1”)
-Fabric placement
-Overlay (1.5”)

Crack-relief Mechanism

Fiber reinforced chip seal (Fibermat) interlayer + AC overlay

US13, Hampton Roads

Jointed concrete pavement

Fibermat + SM 9.5D overlay in year 2017

Asphalt mixes with higher cracking resistance

1. Use of highly modified (HP) binders (~7.5% SBS)

Site #	District	Route	Direction	CCI (2017)	CCI (2018)
1	Richmond	I-95	SB	99	97
2	Nova	I-95	NB	97	89
3	Nova	I-95	SB	93	90
4	Nova	I-95	SB	98	97
5	Nova	I-495	NB	97	92

Ongoing VTRC project. Contact: Jhony Habbouche, Ph.D., EIT, jhony.habbouche@vdot.virginia.gov

Asphalt mixes with higher cracking resistance

2. Asphalt Rubber Gap Graded Mixture (AR-GGM12.5)

Wet Process

I-85, Richmond district

Total Asphalt content: 8.1%, RAP content: 10%
Rubber Content:17.5%

Asphalt mixes with higher cracking resistance

3. GTR Modified Asphalt Surface Mixture, GTR-SM 12.5E

Dry Process

Total Asphalt Content: 6.5%
GTR: 10%

US 60, Richmond district

Asphalt mixes with higher cracking resistance

4. Fiber reinforced asphalt mixtures

Upcoming project in Hampton Roads District

5. SMA mixtures

Over jointed concrete pavement: Service life of 12+ years
More data analysis needed

Slab-fracturing technologies

Rubblization and other slab-fracturing technologies have proven to be cost effective.

They may not be feasible in all situations.

Terminal Boulevard (SR 406) Concrete Rubblization

Mainline
2.0” SM-12.5E
4.0” IM-19.0E (two lifts of 2”)
8” Rubblized Existing Concrete (CRCP)
12.0” Existing Cement Treated Sub-Base

Terminal Boulevard (SR 406)

Terminal Boulevard (SR 406)

	Year	Mile points	IRI (in/mile) Average	Rut depth (inch), Average	CCI Average
EB	2018	0-1.33	97	0.13	97
	2017	0-1.33	95	0.09	99
WB	2018	1.33-0.052	107	0.17	-
	2017	1.33-0.048	99	0.09	-

US 460 Appomattox By-Pass
Concrete Rubblization

SM 12.5D-1.5”
IM 19.0D- 2”
BM 25.0D+0.8 - 4” HMHB
Rubblized Existing Concrete (9-inch JPCP)

Summary

Reflection cracking is a serious challenge associated with pavement rehabilitation.

Saw and Seal and Recycling Techniques were found to be effective.

- Project selection is important

Choosing the right fabric, proper installation and dust free surface are very important for a successful Interlayer project.

-Performing well to date (1~2 Year)

More field performance data is needed to assess highly modified (HP) binder mixtures, GTR modified mixtures and rubblized pavements.

-Performing well to date (1~2 Year)

Future steps

Develop reflective cracking mitigation options to VDOT based on:

- Field performance of different techniques
- Initial Cost
- Benefit-cost
- Existing pavement distress/thickness
- Traffic conditions
- Construction feasibility

ACKNOWLEDGEMENT

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VDOT Districts

FHWA

VAA / Industry

Thank you!

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