

# VTRC: Reflective Crack Mitigation: Current and Future Research

Benjamin F. Bowers, Ph.D., P.E.  
Research Scientist  
Virginia Pavement Research and Innovation Symposium  
June 27, 2018

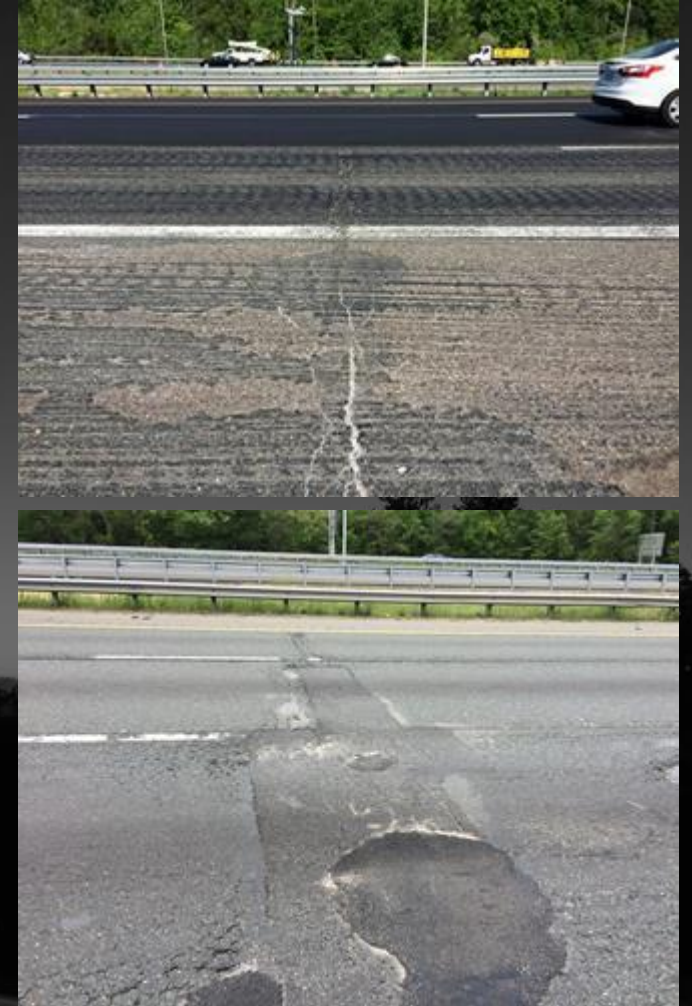
# Outline

- The problem
- Past research
- Current research
- Future research



# The Problem

- Reflective cracking over jointed concrete is a major problem in Virginia
- Many major thoroughfares = no reconstruction
- Overlays are often 1.5-4 inches thick
- In some cases cracks propagate in only one year
- *Are there tools we can use to mitigate reflective cracking?*



# There are many solutions:

- Binder modifiers
- Mixture additives such as fibers
- Interlayers (fabric, fiber, modified gradations, etc.)
- Ideal solution will:
  - Be applicable in many situations
  - Easily specified
  - Limit changes to construction practice
  - Fall within normal QA/QC practices



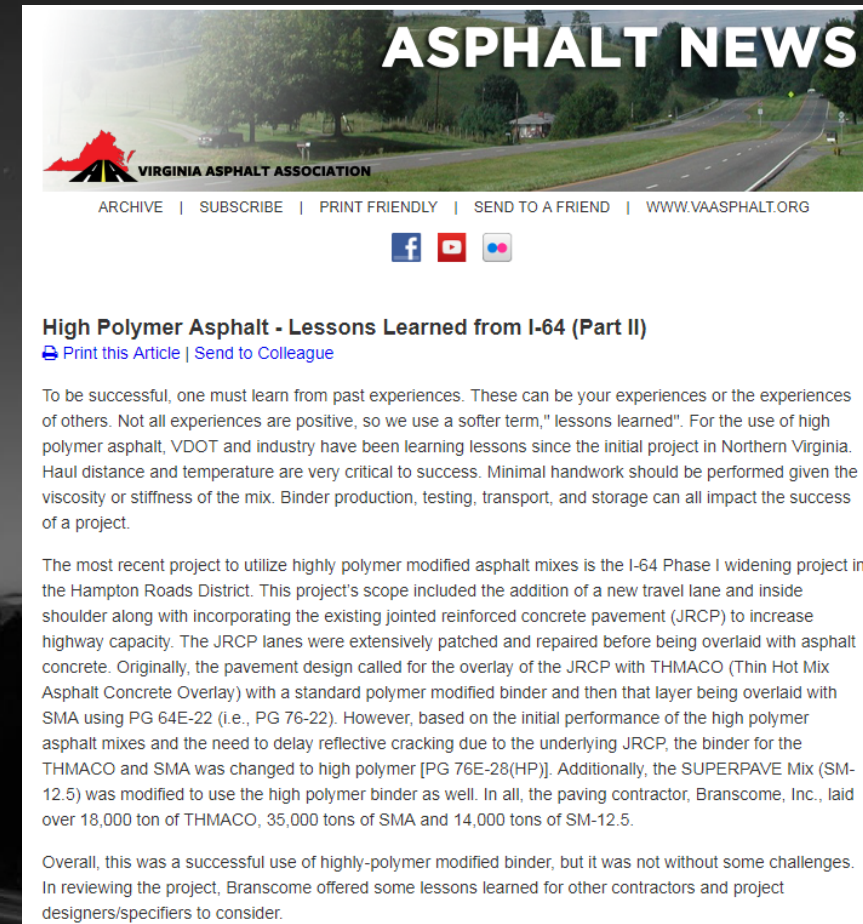
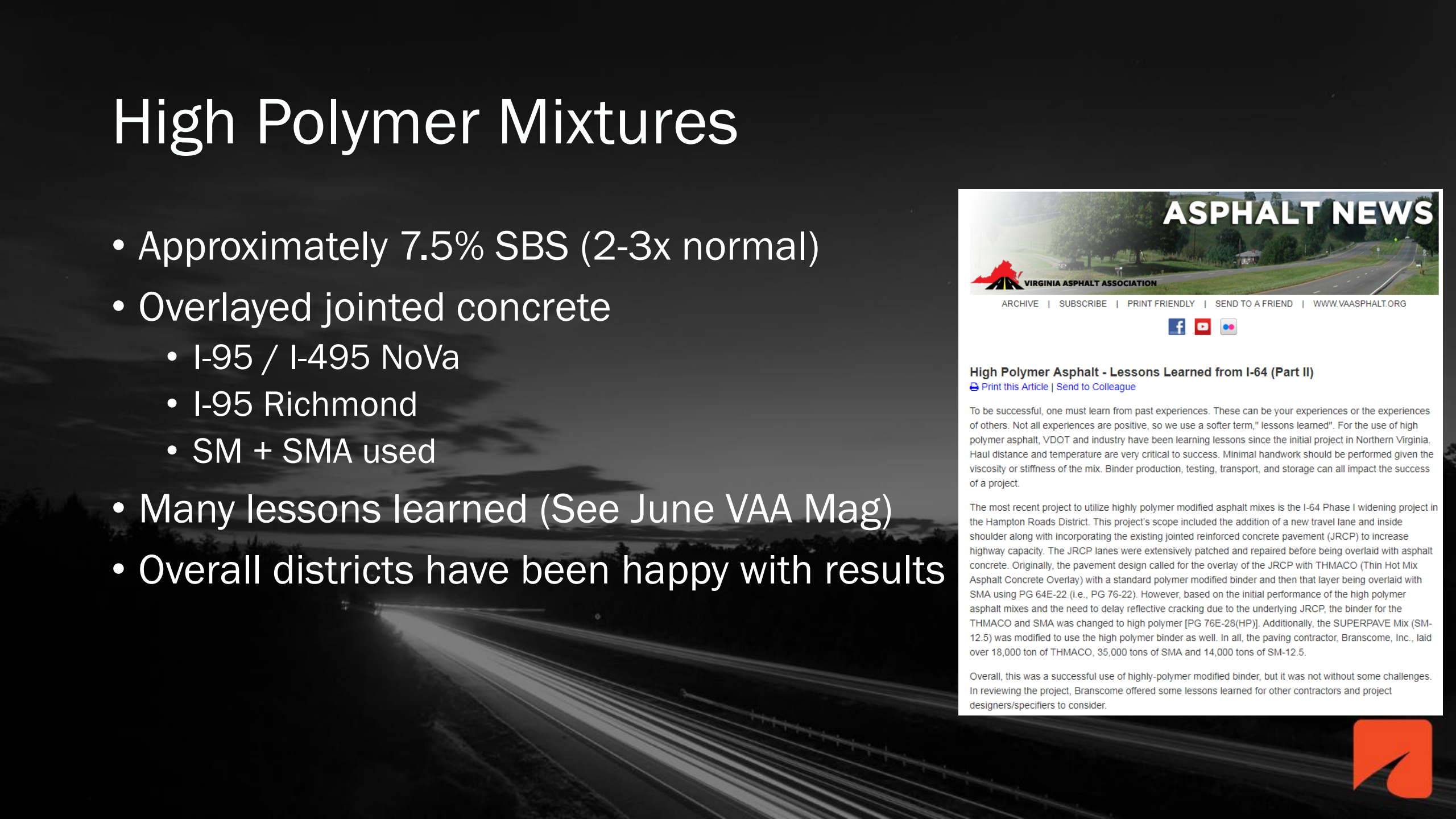
*Past research experience (Last 5-years)*






# High Polymer Mixtures

- Approximately 7.5% SBS (2-3x normal)
- Overlayed jointed concrete
  - I-95 / I-495 NoVa
  - I-95 Richmond
  - SM + SMA used
- Many lessons learned (See June VAA Mag)
- Overall districts have been happy with results



**ASPHALT NEWS**

 **VIRGINIA ASPHALT ASSOCIATION**

[ARCHIVE](#) | [SUBSCRIBE](#) | [PRINT FRIENDLY](#) | [SEND TO A FRIEND](#) | [WWW.VAASPHALT.ORG](http://WWW.VAASPHALT.ORG)

[f](#) [y](#) [in](#)

### High Polymer Asphalt - Lessons Learned from I-64 (Part II)

[Print this Article](#) | [Send to Colleague](#)

To be successful, one must learn from past experiences. These can be your experiences or the experiences of others. Not all experiences are positive, so we use a softer term, "lessons learned". For the use of high polymer asphalt, VDOT and industry have been learning lessons since the initial project in Northern Virginia. Haul distance and temperature are very critical to success. Minimal handwork should be performed given the viscosity or stiffness of the mix. Binder production, testing, transport, and storage can all impact the success of a project.

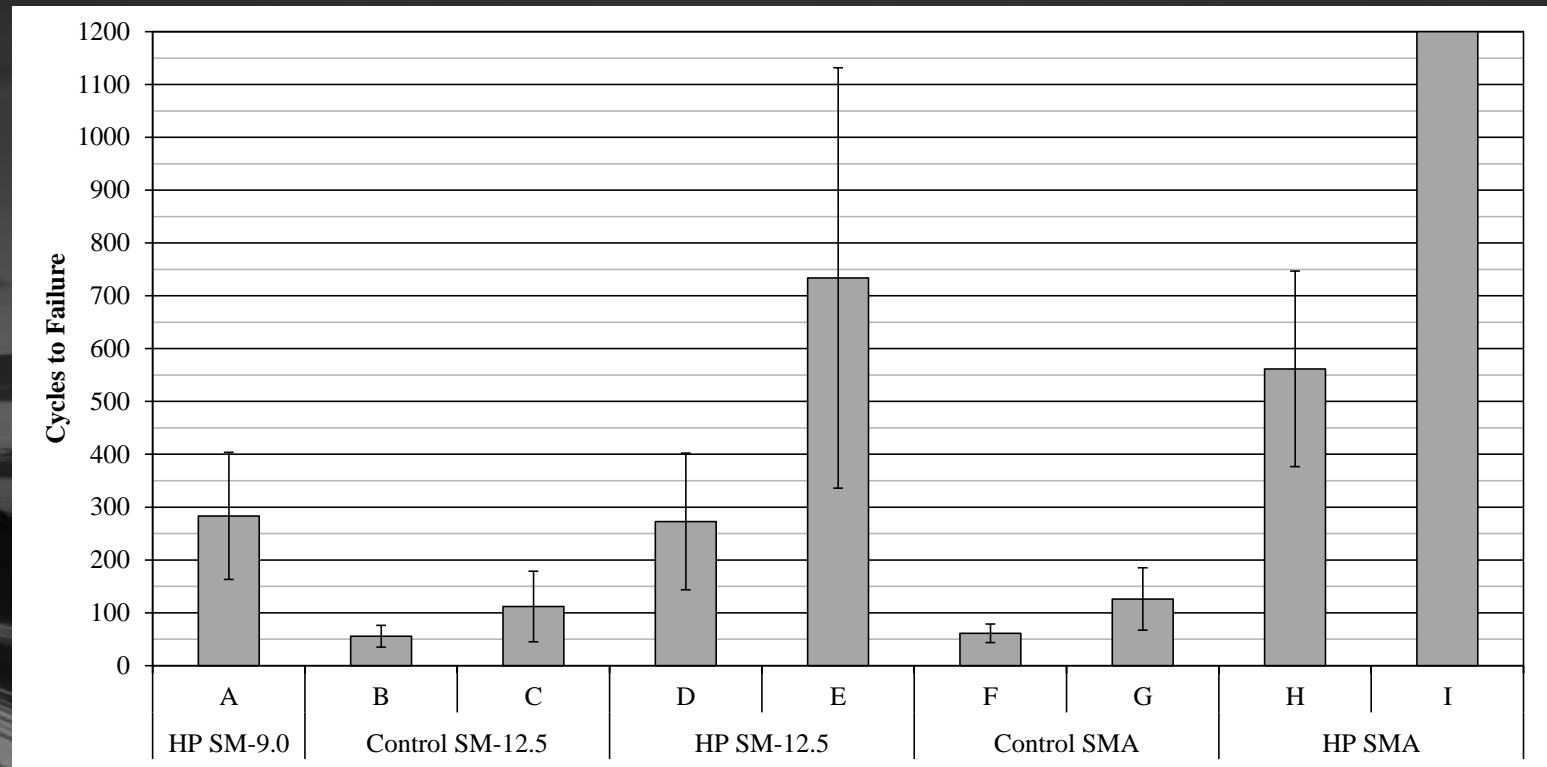
The most recent project to utilize highly polymer modified asphalt mixes is the I-64 Phase I widening project in the Hampton Roads District. This project's scope included the addition of a new travel lane and inside shoulder along with incorporating the existing jointed reinforced concrete pavement (JRCP) to increase highway capacity. The JRCP lanes were extensively patched and repaired before being overlaid with asphalt concrete. Originally, the pavement design called for the overlay of the JRCP with THMACO (Thin Hot Mix Asphalt Concrete Overlay) with a standard polymer modified binder and then that layer being overlaid with SMA using PG 64E-22 (i.e., PG 76-22). However, based on the initial performance of the high polymer asphalt mixes and the need to delay reflective cracking due to the underlying JRCP, the binder for the THMACO and SMA was changed to high polymer [PG 76E-28(HP)]. Additionally, the SUPERPAVE Mix (SM-12.5) was modified to use the high polymer binder as well. In all, the paving contractor, Branscome, Inc., laid over 18,000 ton of THMACO, 35,000 tons of SMA and 14,000 tons of SM-12.5.

Overall, this was a successful use of highly-polymer modified binder, but it was not without some challenges. In reviewing the project, Branscome offered some lessons learned for other contractors and project designers/specifiers to consider.



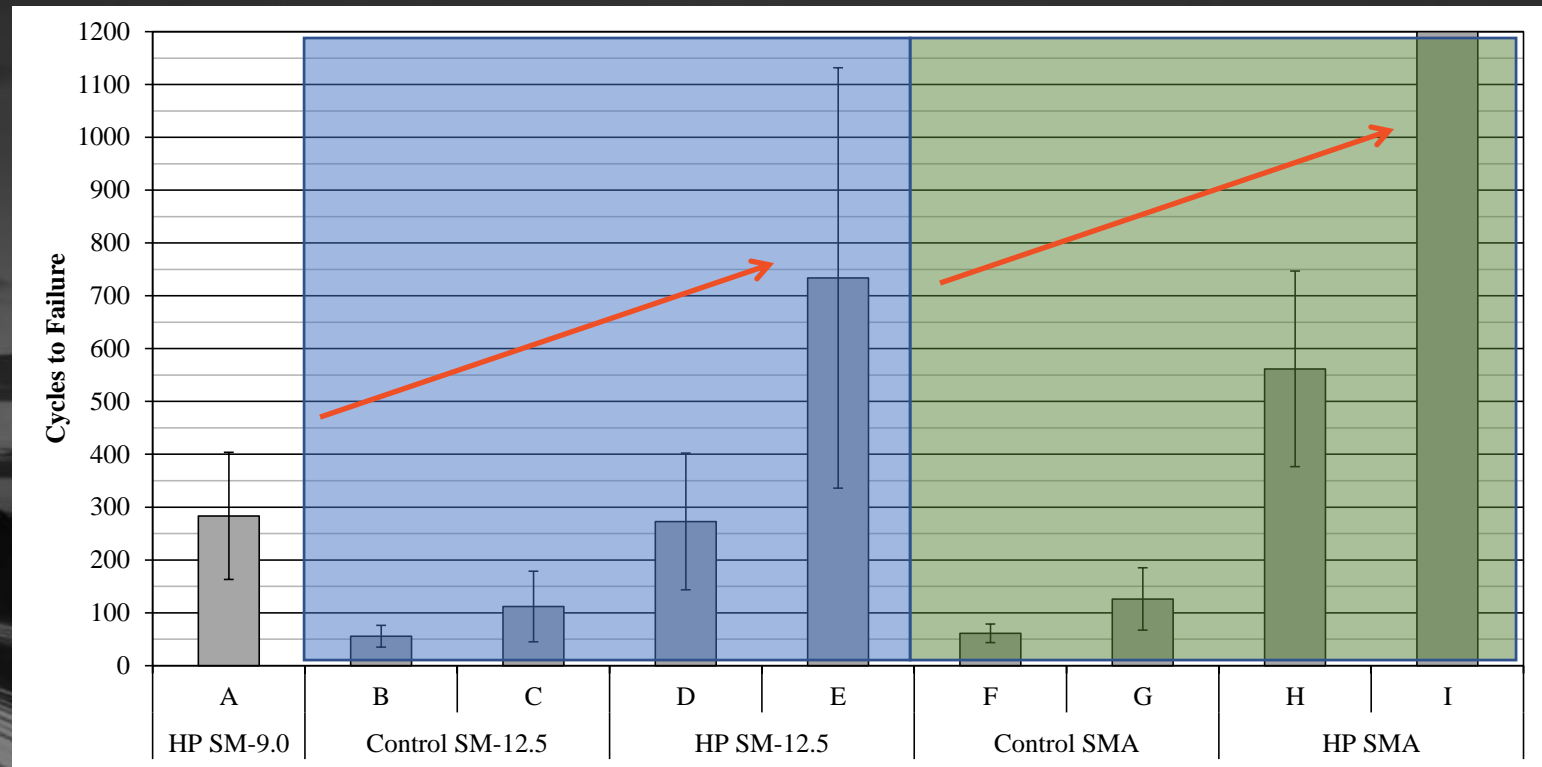
# Overlay Test

- Simulates JCP
- Higher value = better perf



# Overlay Test

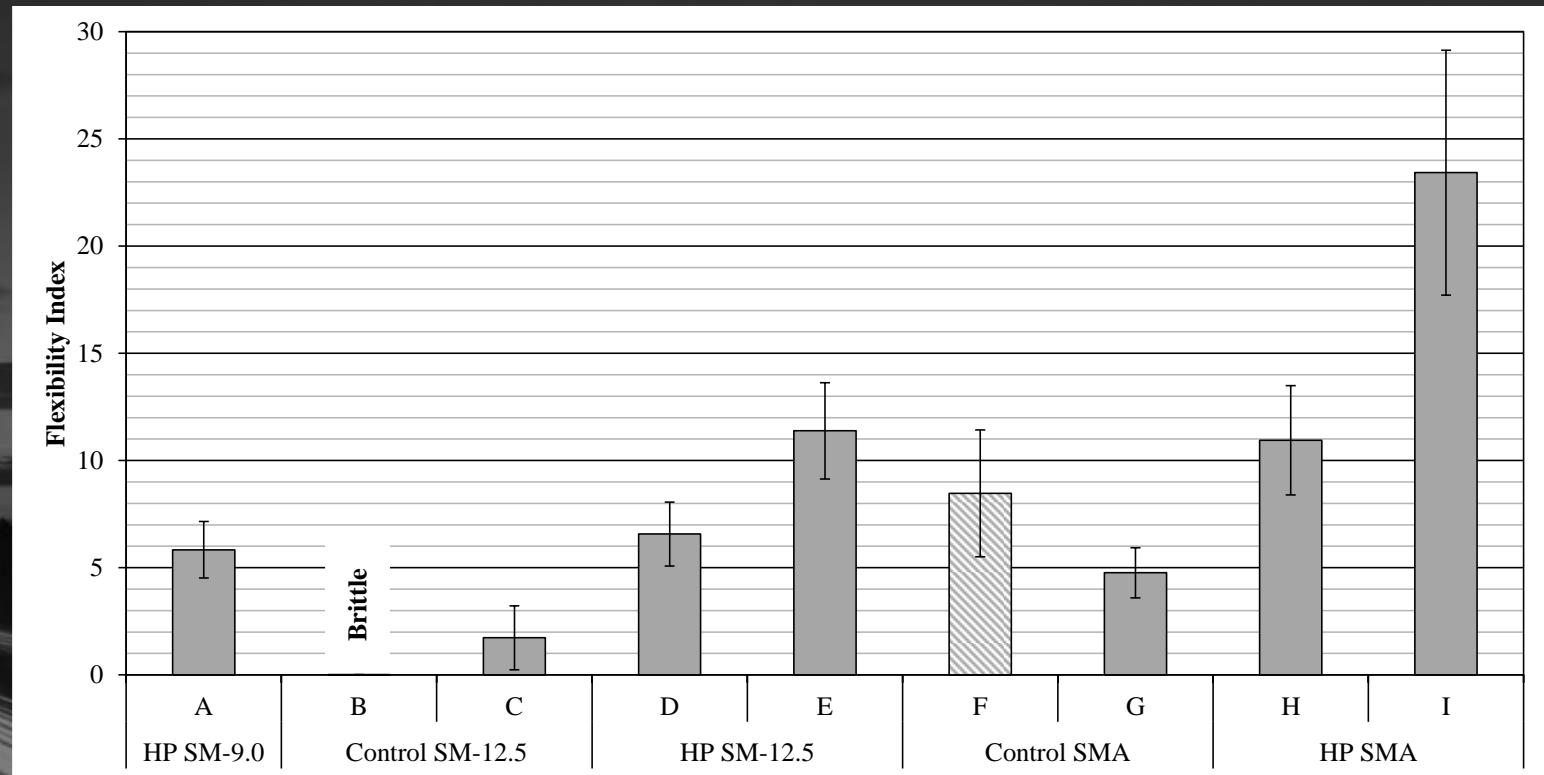
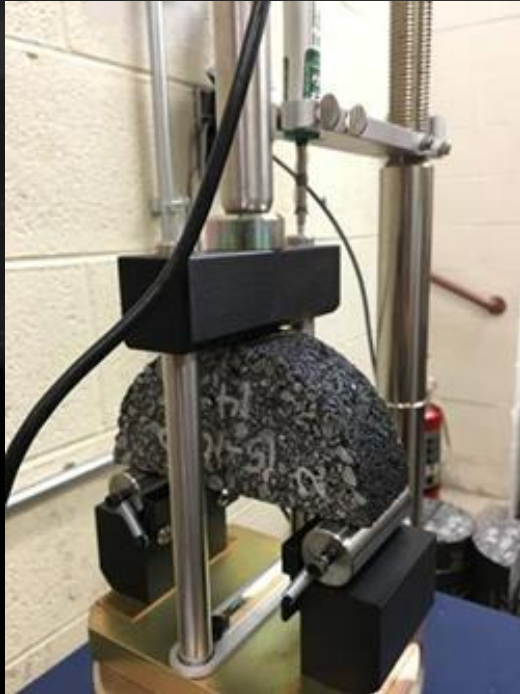
- Simulates JCP
- Higher value = better perf





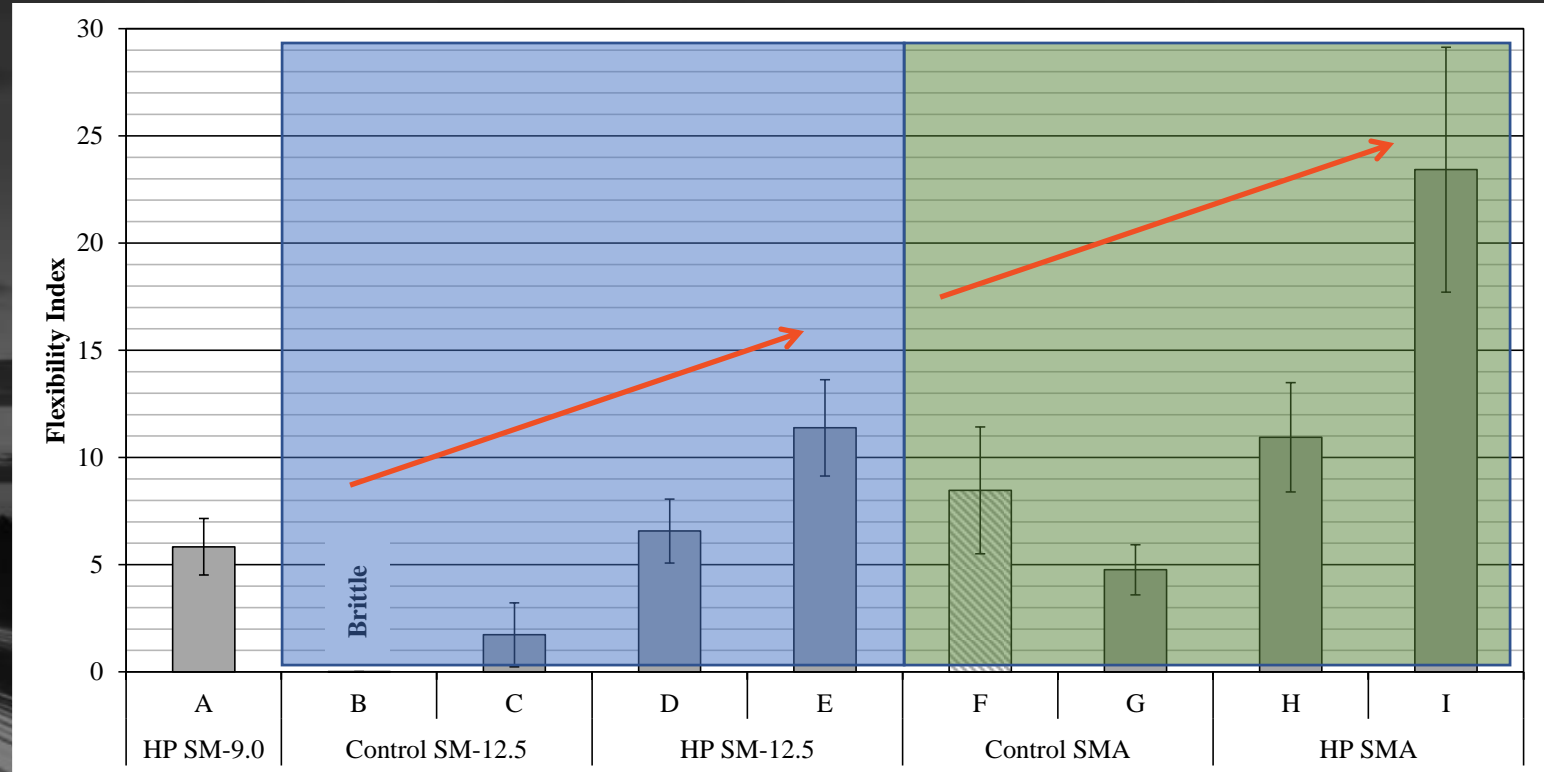
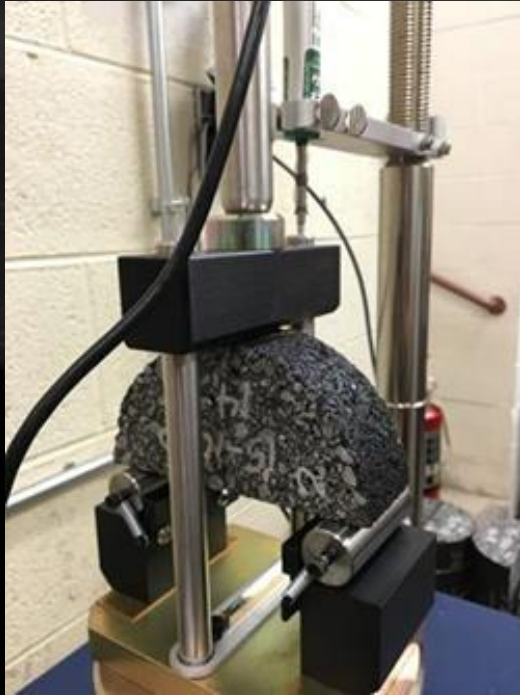
# Semi-Circular Bend (I-FIT)

- Intermediate temp crack test
- Higher FI = better perf



# Semi-Circular Bend (I-FIT)

- Intermediate temp crack test
- Higher FI = better perf



# Field Performance / Recent applications

- To date all sections have been performing very well
  - The SMA sections in NoVa and Richmond have no reported cracking
  - The SM-12.5 sections in NoVa have exhibited cracking
    - This cracking was approximately 1-year later than control (E) mixes
    - Cracks have remained “tight” – will continue to monitor
- HP was used in THMACO and SMA on the I-64 widening project outside of Williamsburg
  - There were difficulties with storage time
  - Reference Va Asphalt Mag “Best Practices” article (June 2018) for insight



*Current/ongoing research experience*





# Interlayer projects (2017)

- Route 143 NB & SB, Hampton Roads
  - Paving Grid Type III
  - On milled asphalt pavement over JCP
  - 1.5" overlay of SM-9.5D
  - Passed bond strength test
  - Performing well to date (1-year)
- US-17 SB, Hampton Roads
  - Un-milled asphalt pavement over JCP
- US-13BUS – Fibermat as interlayer
  - Summer 2017
  - Visual survey only



# Heavy Vehicle Simulator Project

- Test length (constant wheel speed)
  - 45 feet
- Loads applied
  - Up to 22.5 kips
  - 4, 6.5, 9, 12.5, 15 kips
- Passes per day
  - Up to 12,000 bi-directional passes
- Instruments
  - Strain gauges in pavement and LVDT's measuring slab movement





# Heavy Vehicle Simulator Project





# Heavy Vehicle Simulator Project

- Testing over jointed concrete
  - 8 inch thick
  - 10 feet wide
  - 300 feet long
  - 10 foot saw cut joints
  - On top of 1" SM-9.5





# Heavy Vehicle Simulator Project

- Current test
  - SMA-12.5 (PG64E) Control mix
  - SMA-12.5 (PG64E) + Fiber
- Future tests
  - SMA-12.5 + HP
  - SMA-12.5 + Arizona Style Rubber
  - Others?
- Tests are ongoing – no results to date



# *Future research*



# Binder/Mix Modifications

- Arizona Style Asphalt Rubber
  - Gap-graded asphalt mix that looks much like an SMA
  - ~18-20% rubber, wet blend
  - I-81 Salem District (mid-summer)
- Also looking at Fiber modified asphalt alternatives
  - Working to solicit project for 2019 paving season





# Interlayer

- US-460 – Hampton Roads District
  - Different fabric interlayer system
- Interest in interlayer project performance?  
Contact Dr. Hari Nair (VTRC)  
[Hari.Nair@vdot.virginia.gov](mailto:Hari.Nair@vdot.virginia.gov)







**VTRC**

Virginia Transportation  
**Research Council**

# *Questions?*

Benjamin F. Bowers, Ph.D., P.E.  
Research Scientist  
[Ben.Bowers@vdot.virginia.gov](mailto:Ben.Bowers@vdot.virginia.gov)

