Effective Strategies to Address REFLECTIVE CRACKING

Virginia Case Studies

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Background

- Virginia’s highway network over 100 years old
- VDOT maintains asphalt, concrete, composite and gravel roads
- Vast majority of concrete and composite roads are on interstate and primary routes
Initial interstate pavements built as Jointed Reinforced Concrete Pavement and Asphalt

In 1980’s, switch to Continuously Reinforced Concrete Pavement for I-295, I-664, and I-195

By early 1990’s, VDOT started overlaying exposed concrete interstates
WHAT WAS THE RESULT?
Strategies Tried

- Extensive Joint/Crack Patching
- Undersealing Slabs
- Joint Tape and Fabrics
- Saw and Seal
- Straight Asphalt Overlays
- SMA Overlays
Were They “Effective”? 

**Effective** – Adequate to accomplish a purpose, producing the intended or expected result

**Expectations** – Something expected; a thing looked forward to. (Dictionary.com)

For years, individual expectations ruled

15 years service life | Good Ride
Little or no maintenance | Etc.
Were They “Effective”? 

- Results have been mixed
  - Some lasted 8 years, some almost 20 years
- Depends on amount of concrete deterioration
  - Were punch outs repaired?
  - Were joints replaced?
- Are the joints/cracks moving vertically or horizontally?
Commonality of “Effective” Projects

- Repair prior to overlay is critical
- Ensure adequate bonding between asphalt overlay and concrete
- Polymer modified binders matter
- SMA has outperformed dense graded mixes
Two Case Studies

I-64 Richmond District

I-66 NOVA District
I-64 Project History

- Laburnum Ave. to Bottoms Bridge
- By mid-2000’s, existing jointed concrete pavement very deteriorated
- Deteriorated joints with poor ride quality
Define “Effective” After 10 Years

Asphalt Solution

- Average IRI less than 110 inch/lane-mile
- No 0.1-mile with an IRI greater than 170 inch/mile
- Average rut depth less than 0.5 inches per wheel path per mile
- No. 0.1 mile section with a rut depth greater than 1 inch per wheel path
- No more than 15 Severity 3 reflective cracks per lane mile.

Concrete Solution

- Average IRI less than 110 in/lane-mi
- No 0.1 mi. with an IRI greater than 170 in/mi
- No more than 15 deteriorated transverse joints or asphalt patches located at a joint per lane mile requiring Type I or II PCC Patches
- No more than 15 deteriorated concrete patches per lane mile with a condition of Severity 3
Asphalt Solutions – Henrico

Laburnum Avenue to I-295

- Remove and replace distressed PCC with AC
- Overlay with SM-12.5E (1.5”) as Leveling Course
- Overlay with SMA-19.0 (76-22) (2”)
- Overlay with SMA-12.5 (76-22) (1.5”)
Asphalt Solutions – New Kent

I-295 to Bottoms Bridge

- Remove and replace distressed PCC with PCC
- Overlay with SMA-19.0 (76-22) (2”)
- Overlay with SMA-12.5 (76-22) (1.5”)

Important to note: VAA proposal was only used in Henrico County; deemed as experimental due to AC patches. New Kent approach was standard VDOT rehab
Were the Fixes “Effective”?

- Project awarded to Mega Contractors (later acquired by Branscome)
- Construction from late 2004 to 2007
- Ride Quality Prior to Rehab
  - Travel Lane Measurements
  - Average 162 – 175 inches per mile
- By 2011, Ride Quality
  - Average 62 inches per mile in EB
  - Average 77 inches per mile WB
  - No segments with IRI greater than 170 in per mile

Sources – VTRC 10-R3 and VDOT Pavement Management Data
Ride Data for 2016

Source – VDOT Pavement Management Data for 2016
How About Today?

- Average IRI both directions is 80 inches per mile
- Seven 0.1 mile segments exceed 170 inches per mile
- All but one segment is between truck weigh station and I-295 (Henrico Section)
- EB average IRI is 69; WB average IRI is 91
- In 2004 – IRI of 169; In 2016 – IRI of 80

Source – VDOT Pavement Management Data for 2016
CCI Data for 2016

- Above 90 (Excellent): 83%
- 70 - 89 (Good): 2%
- 60 - 69 (Fair): 4%
- 50 - 59 (Poor): 8%
- < 50 (Very Poor): 3%
I-64 Conclusions

Both asphalt fixes were effective (7 segments failed the 170 inches per mile criteria)

Total of 195 segments analyzed (3.5% failure in 10 years)

More failures in standard VDOT repair approach (but traffic is heavier)

Polymer modified binders in all layers

With right depth, AC patches & Concrete patches equivalent (Consider costs & project details)
I-66 Project History

- Approximately from US 50 to Beltway
- By mid-1990’s, existing jointed concrete pavement very deteriorated
- Deteriorated joints with poor ride quality
How Was “Effective” Defined?

Goal

▪ Provide a cost effective pavement rehabilitation that will last for 20 years with minimum disruption to the traveling public

Challenges

▪ Limited space for Maintenance of Traffic (MOT)
▪ Limited times for dual lane closures
▪ Limited overhead clearance for existing bridges
▪ Drainage
▪ Concrete barriers
▪ Lane shifts across longitudinal joints in concrete
▪ Coordination with adjacent Mega Projects

Source – I-66 Pavement Rehab Presentation, 2012 Fall Asphalt Conference
I-66 Prior to Rehab

- Old Pavement in Poor Condition
- Approx. 20% of all pavement in poor shape
- Distresses generally at transverse joints
- Isolated slabs have distress (spalling) throughout

Source – I-66 Pavement Rehab Presentation, 2012 Fall Conference
“Effective” Solutions

- Extensive Concrete Patching with PCC
- 5/8” THMACO bonding layer
- Scratch/Leveling Course of Superpave
- 2” SMA-12.5 (76-22)
- 1.5” SMA-9.5 (76-22)
Project Approach

- Met with industry associations (concrete and asphalt) on May 20, 2008
- Received industry suggestions/proposals on June 18, 2008
- Provided follow-up comments to industry
- Follow-up details received from industry on June 23 and June 24, 2008
- Performed comparison of alternatives
- Project was funded and advertised in September, 2010
- Delivery mechanism was design-build (pavement repairs specifically identified on RFP plans)
- Awarded to Fort Myer Construction Company on December 20, 2010
- Paving performed by Superior Paving and APAC-Southeast (THMACO)
- Total Contract Amount - $37.9 million
### Final Ride in 2012

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**Note:** project design-build specification required average IRI < 70 ins./mi. with no individual 0.01 mile section >80 ins./mi.
How About Today? – CCI

- 63% Above 90 (Excellent)
- 35% 70 - 89 (Good)
- 1% 60 - 69 (Fair)
- 1% 50 - 59 (Poor)
- 0% < 50 (Very Poor)
How About Today? – Ride

- 55% < 60 (Excellent)
- 35% 60 - 99 (Good)
- 2% 100 - 139 (Fair)
- 8% 140 - 199 (Poor)
- 0% > 199 (Very Poor)
I-66 Conclusions

Patching “all” failed
PCC needed

THMACO beneficial for bonding AC to PCC in thin sections

SMA and Polymer modified binders work
Commonality of “Effective” Projects

- Repair prior to overlay is critical
- Ensure adequate bonding between asphalt overlay and concrete
- Polymer modified binders matter
- SMA has outperformed dense graded mixes
I-66 Today – THANK YOU