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VDOT Pavement Recycling Research Overview

Virginia Pavement Recycling Conference

November 26, 2012

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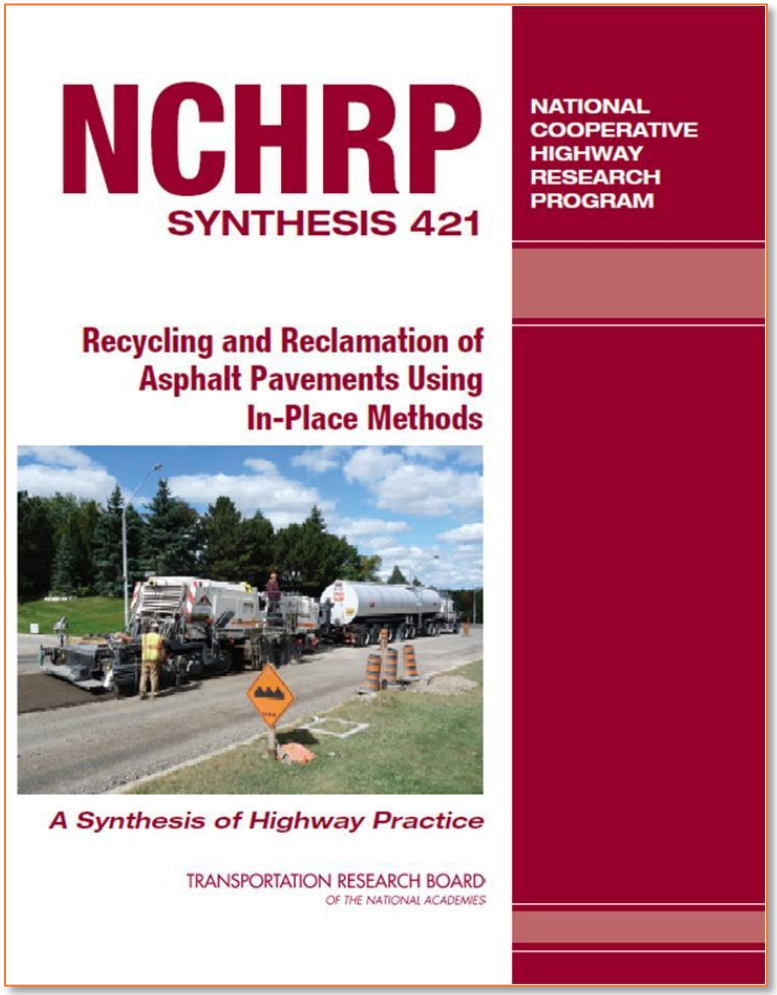
Why VDOT Wants to Recycle

- **Economic**
  - **Nevada DOT saved $600 million over 20 years**
  - **Other studies show 30-50 percent cost savings**
- **Environment**
  - **MTO (Ontario) estimated CIR process emits 50 percent less greenhouse gases**
- **Construction**
  - **Fix deterioration causes rather than symptoms**
- **FHWA recycled materials policy***

*http://www.fhwa.dot.gov/legsregs/directives/policy/recmatpolicy.htm

National Experiences

- 45 agencies responded to questionnaire on usage
  - 75% reported some recycling
  - Mostly low-volume routes
- Barriers include a lack of:
  - Specifications and project selection criteria
  - Standardized mix-design procedures
  - Engineering design inputs

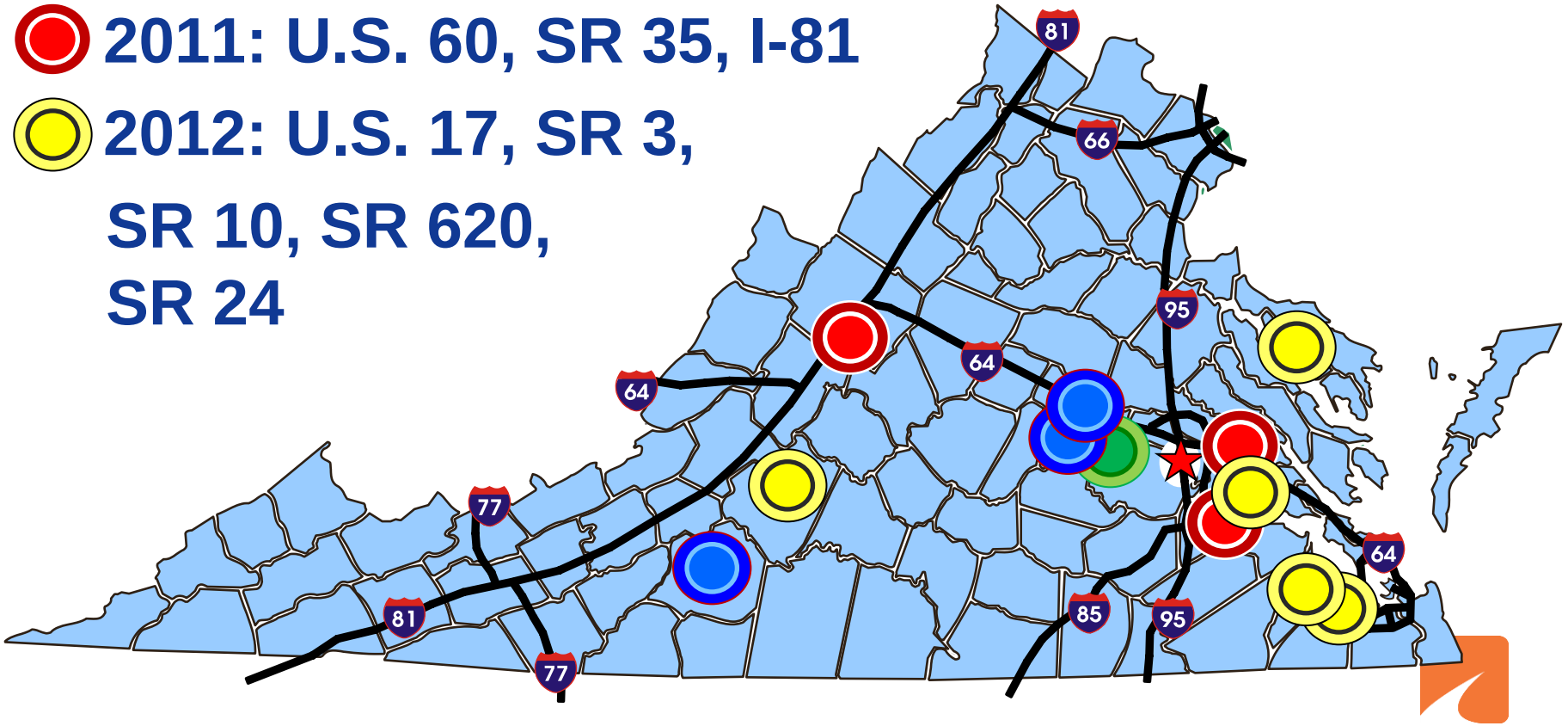


VDOT Recycling Program

- **12 projects to date, approx. 75 lane miles**
- **Specifications and usage guidelines**
  - **Nearing completion**
  - **Iterative process = room for future improvements**
- **Research**
  - **Field and lab tests to assess performance**
    - Field: Rut depth, ride quality, FWD
    - Lab: Dynamic modulus, flow number, resilient modulus, indirect tensile strength
  - **Documenting agency experiences**

VDOT Recycling Projects

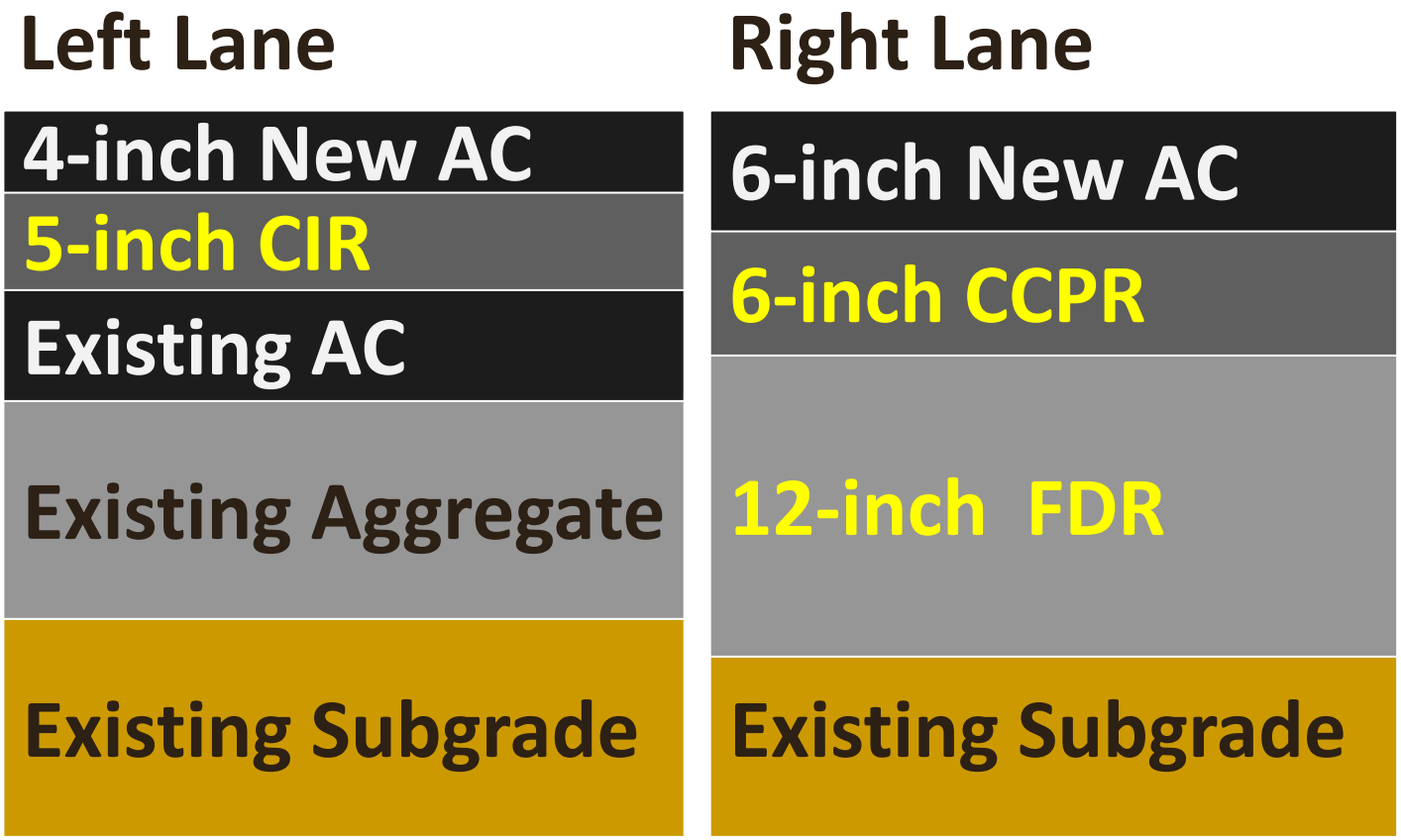
- 2008: SR 6, 13, 40
- 2010: U.S. 60
- 2011: U.S. 60, SR 35, I-81
- 2012: U.S. 17, SR 3, SR 10, SR 620, SR 24



I-81 Pavement Recycling Project

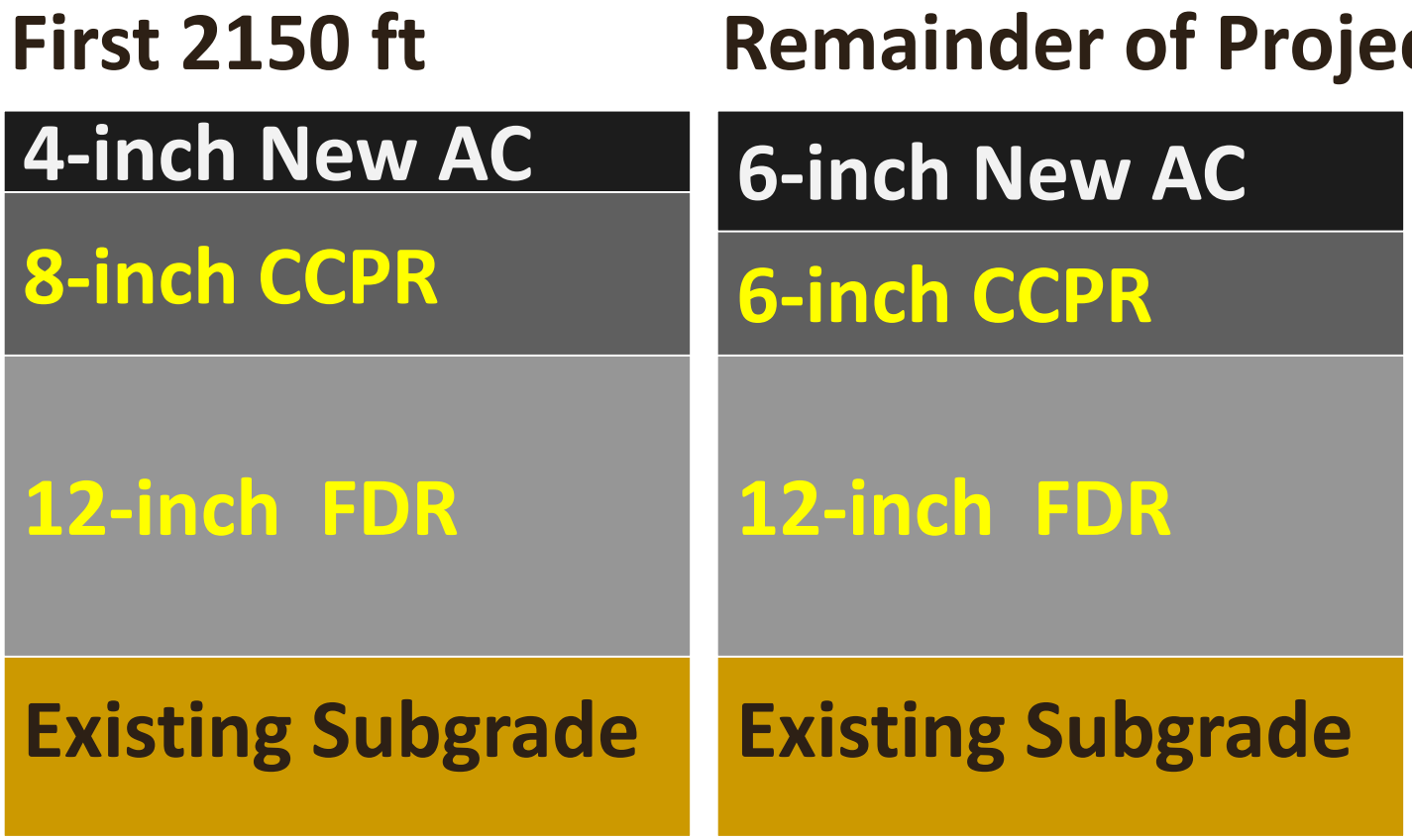
- AADT = 23,000 (28 percent trucks)
- 7.2 lane miles
- $7.6 million

I-81 Pavement Design



More than 70 percent was derived from recycled materials

I-81 Pavement Design, Right Lane

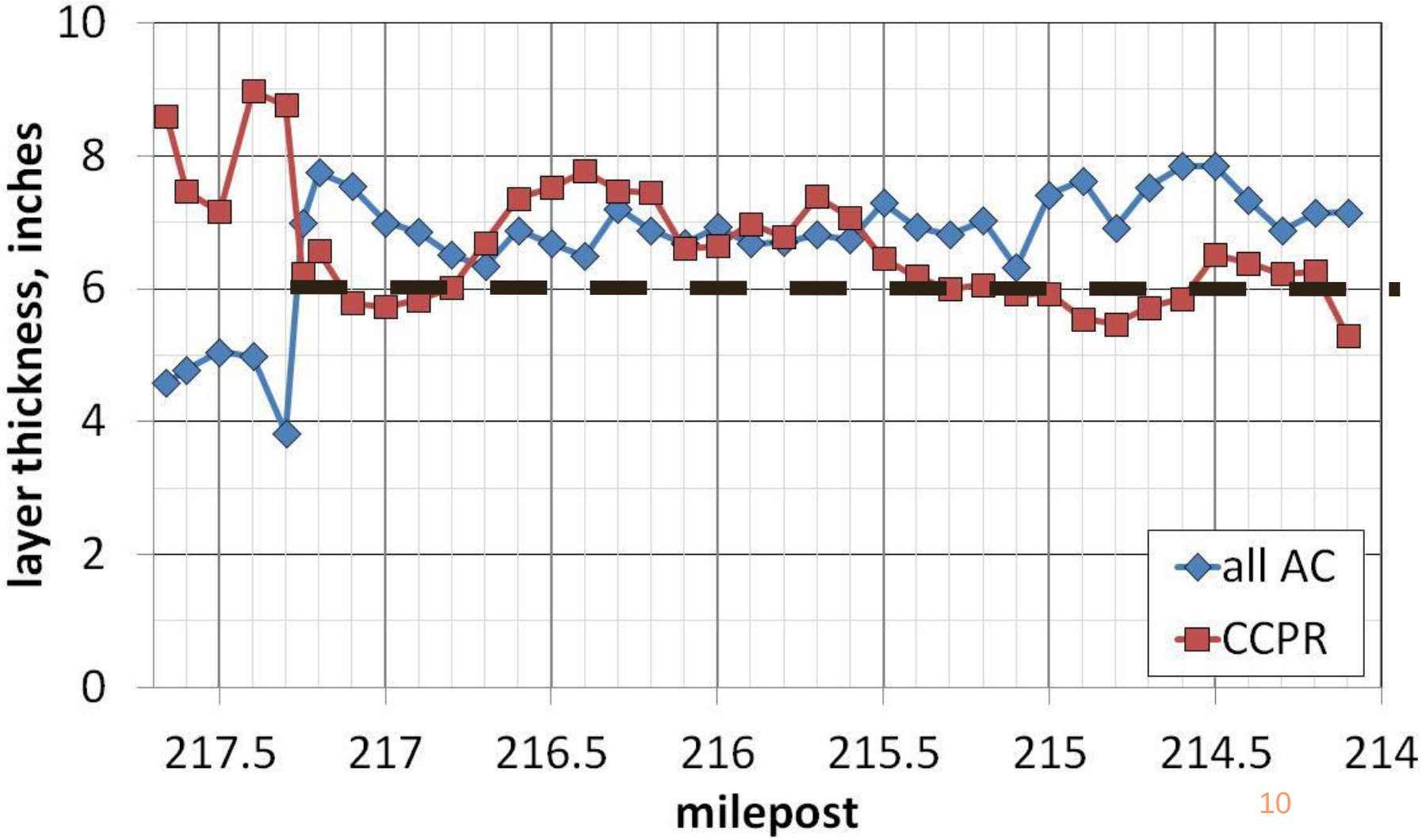


Compare 1st 2150 ft (4 over 8) with 2nd 2150 ft (6 over 6)

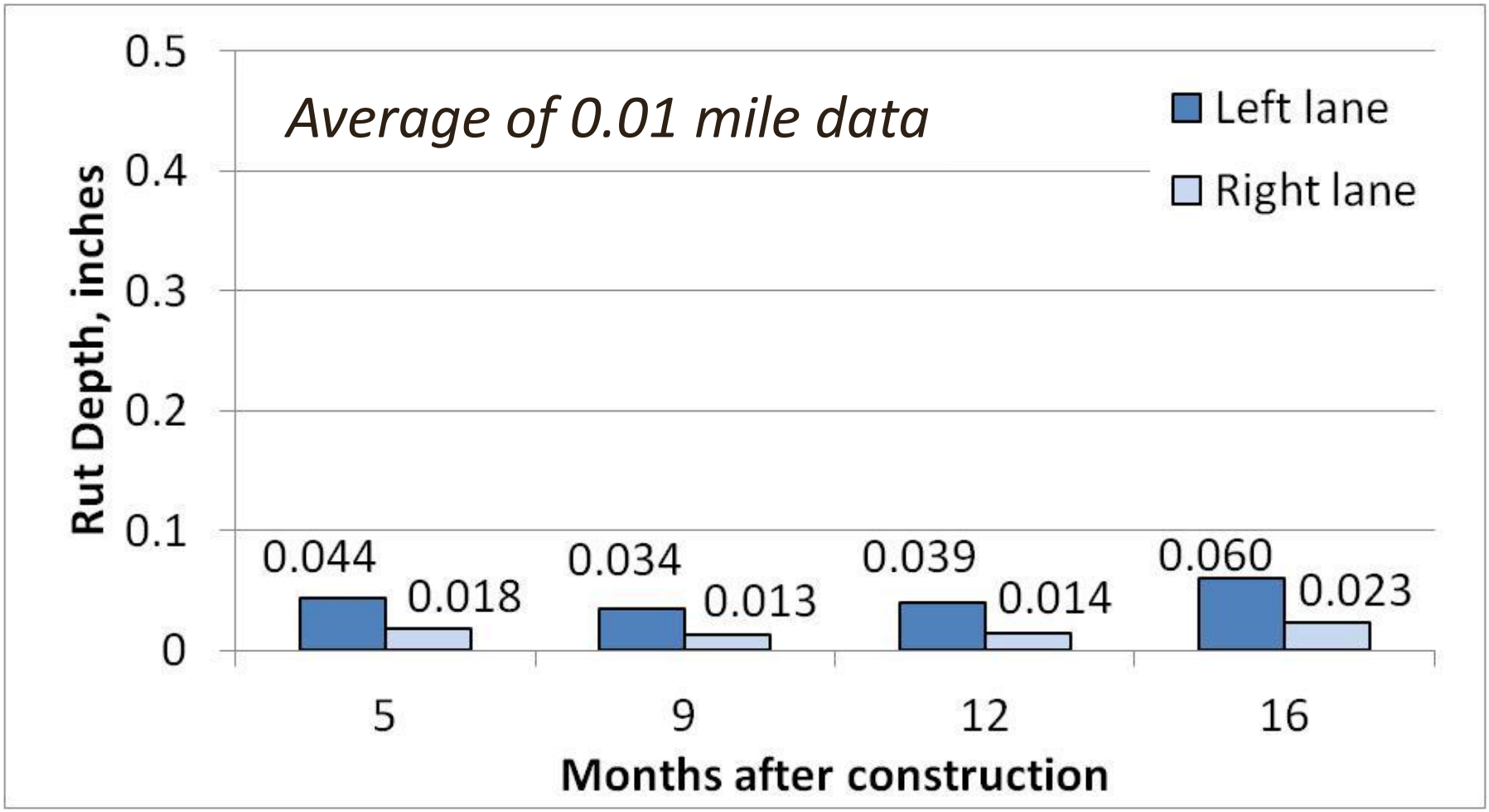
Falling Weight Deflectometer

- **Structural number (SN), December 2011**
  - **Right lane = 8.8, Left lane = 5.5**
- **Right lane SN**
  - **4-inch AC / 8-inch CCPR = 9.0**
  - **6-inch AC / 6-inch CCPR = 8.7**
  - **Standard deviation ~ 0.5**
- **No backcalculated layer moduli**
- **2nd test was November 15th, not yet analyzed**

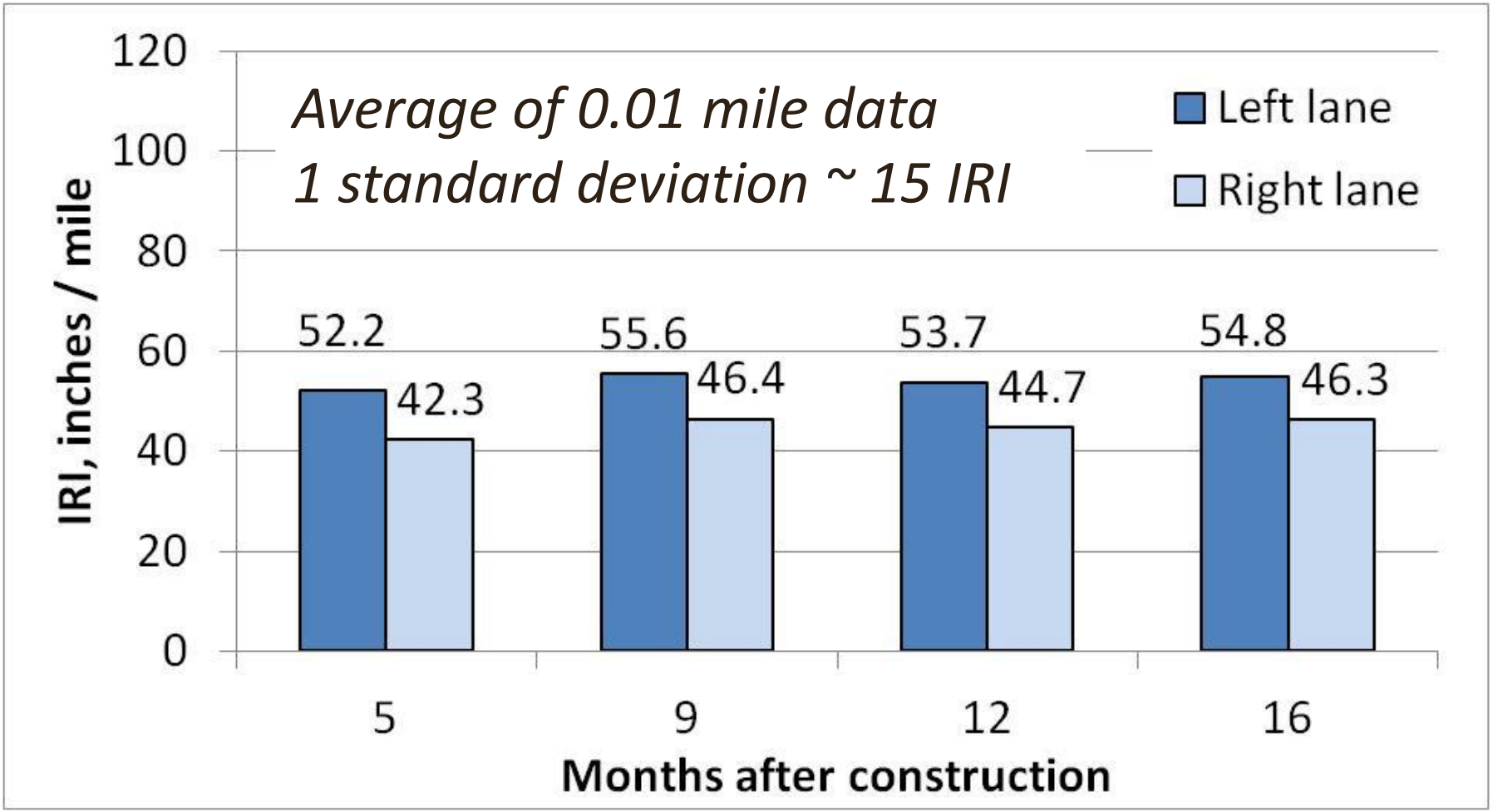
Ground Penetrating Radar
(Right Lane)



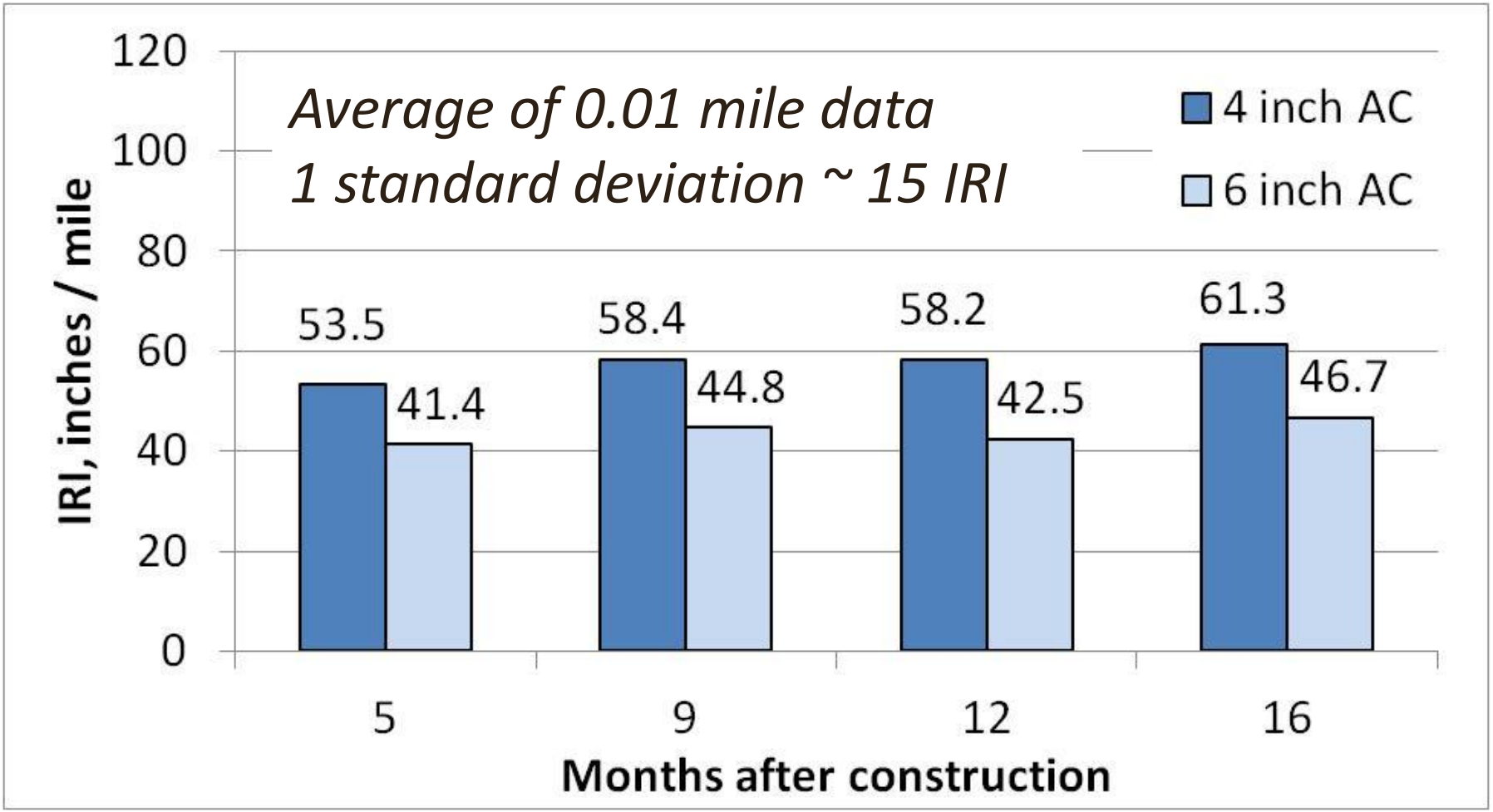
Rut Depth


Average of 0.01 mile data
Left lane
Right lane
Rut Depth, inches
0.5
0.4
0.3
0.2
0.1
0
0.044
0.018
0.034
0.013
0.039
0.014
0.060
0.023
5
9
12
16
Months after construction

Ride Quality



Ride Quality, Right Lane

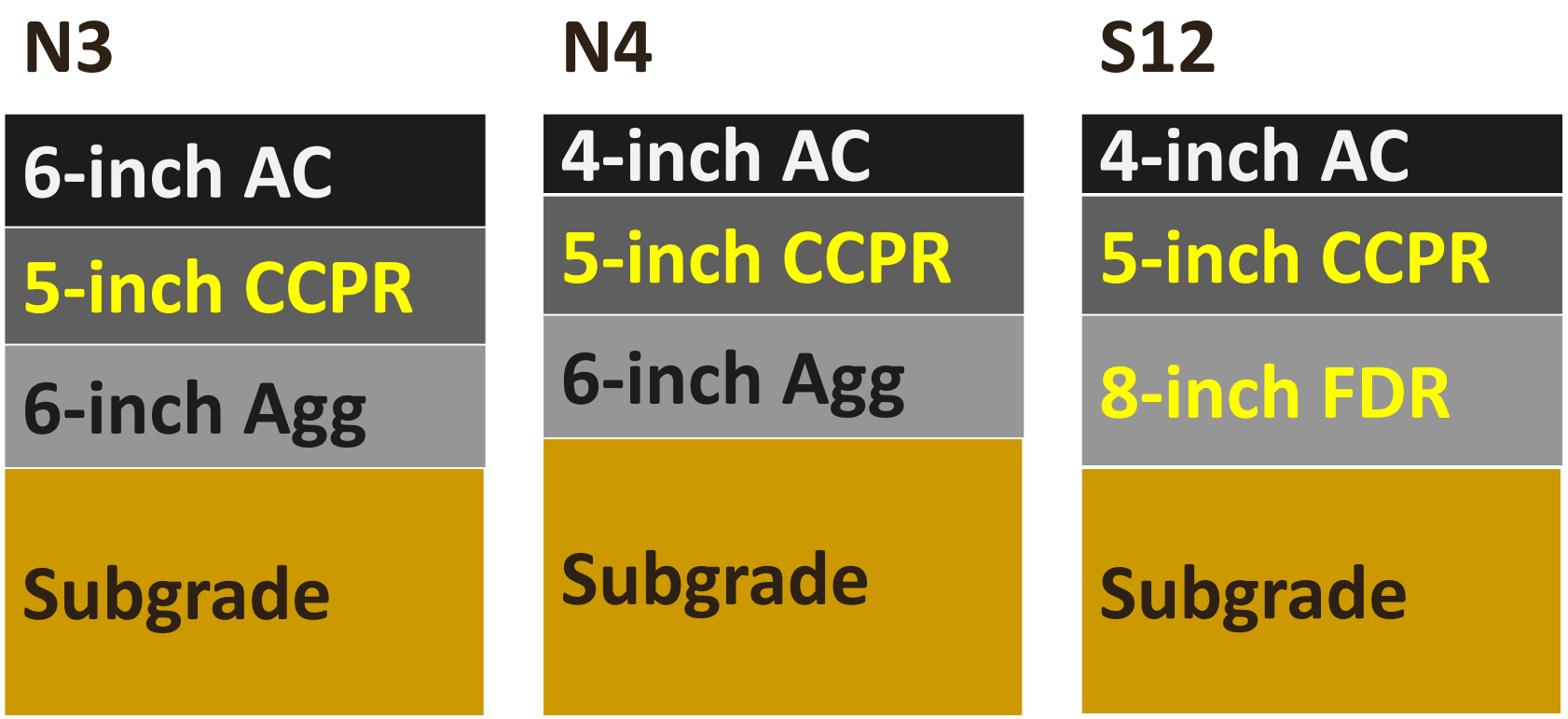


Comparing 1st 2150 ft (4 over 8) with 2nd 2150 ft (6 over 6)

I-81 Field Testing Summary

- **FWD testing**
  - **Assumptions of structural layer coefficients for recycled layers are conservative (for this project)**
- **Rut and Ride quality**
  - **Statistical difference between lanes and within right lane. Practically significant?**
- **There is still a need to assess long-term performance**
  - **More than 2.5 million ESALs in right lane to date**

NCAT Recycled Sections



N3 vs. N4, N4 vs. S12

Section length = 200 ft

NCAT Recycled Sections

- Constructed August 2012
- Trafficking began October 2012
  - 2 years, 10million ESALs
- Constructed with CCPR rather than CIR
  - Used millings from 2011 I-81 project
  - Foamed asphalt
- FDR placed in Section S12
  - Stabilized existing aggregate base and subgrade
  - Cement


KENWORTH
C 37
EAST ALABAMA PAVING
MC-769410-C
RP-190B
DTEC

Anticipated Results

- **Performance Comparisons**
  - **Performance of 4-inch vs. 6-inch AC over CCPR**
  - **Performance of 4-inch AC over FDR vs. aggregate base**
  - **Performance of previous full-depth asphalt sections vs. recycled sections**
- **Instrumentation**
  - **Stiffness / performance of CCPR with respect to accumulated traffic**

NCHRP 9-51

- ***Material Properties of Cold In-Place Recycled and Full-Depth Reclamation Asphalt Concrete for Pavement Design***

- **Focus areas**
  - **Laboratory testing for structural properties of field cured materials**
  - **Material property inputs for MEPDG/DarWin-ME**
  - **Distress models for MEPDG/DarWin-ME**

NCHRP 9-51 Project Team

- **Charles Schwartz**
  - University of Maryland (PI)
- **Brian Diefenderfer**
  - VCTIR (Co-PI)
- **Todd Thomas**
  - Colas Solutions
- **Mike Marshall**
  - Wirtgen America

NCHRP 9-51

- **Work underway**
  - **Literature review and summary of proposed tests**

- **Next steps**
  - **Sample from (approx. 12) completed projects and conduct lab testing to develop material inputs for design**
    - Led by VCTIR
  - **Determine adequacy of existing distress-prediction models for asphalt-based recycled materials**
    - Led by University of MD

Summary

- **Recycling can be advantageous to VDOT**
  - **Cost**
  - **Environment**
  - **Construction solutions**
- **Research is adding to our knowledge-base**
  - **Summarizing and documenting the experiences of others**
  - **Developing engineering design input parameters**
  - **Assessing long-term performance**

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Thank you!

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