Virginia Center *for* Transportation
INNOVATION
& RESEARCH

We bring innovation to transportation.

Virginia Pavement Recycling 2012 Update

VAA – 25th Fall Asphalt Conference

October 2, 2012

Brian K. Diefenderfer, Ph.D., P.E.

Pavement Recycling

- **A method to reuse existing paving materials when constructing a new pavement layer**

- **Performed by:**
  - **Pulverizing**
  - **Stabilizing**
    - Cement, lime, fly ash, foamed asphalt, asphalt emulsion
  - **Repaving**

Pavement Recycling Processes

- Hot in-place recycling (HIR)
- Cold recycling
  - Cold in-place recycling (CIR)
  - Cold central/mobile plant (CCPR)
- Full-depth reclamation (FDR)

Increasing depth and level of deterioration

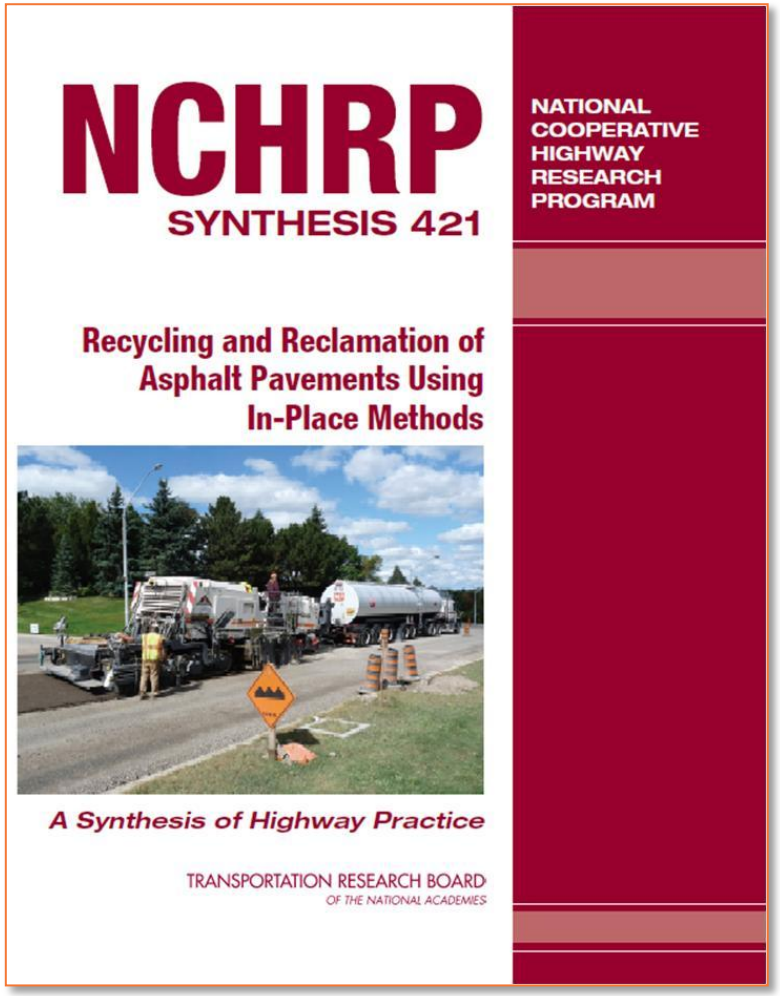
Why VDOT Wants to Recycle

- **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 percent reported some recycling
  - 60 percent >10 years experience
  - Mostly low-volume routes

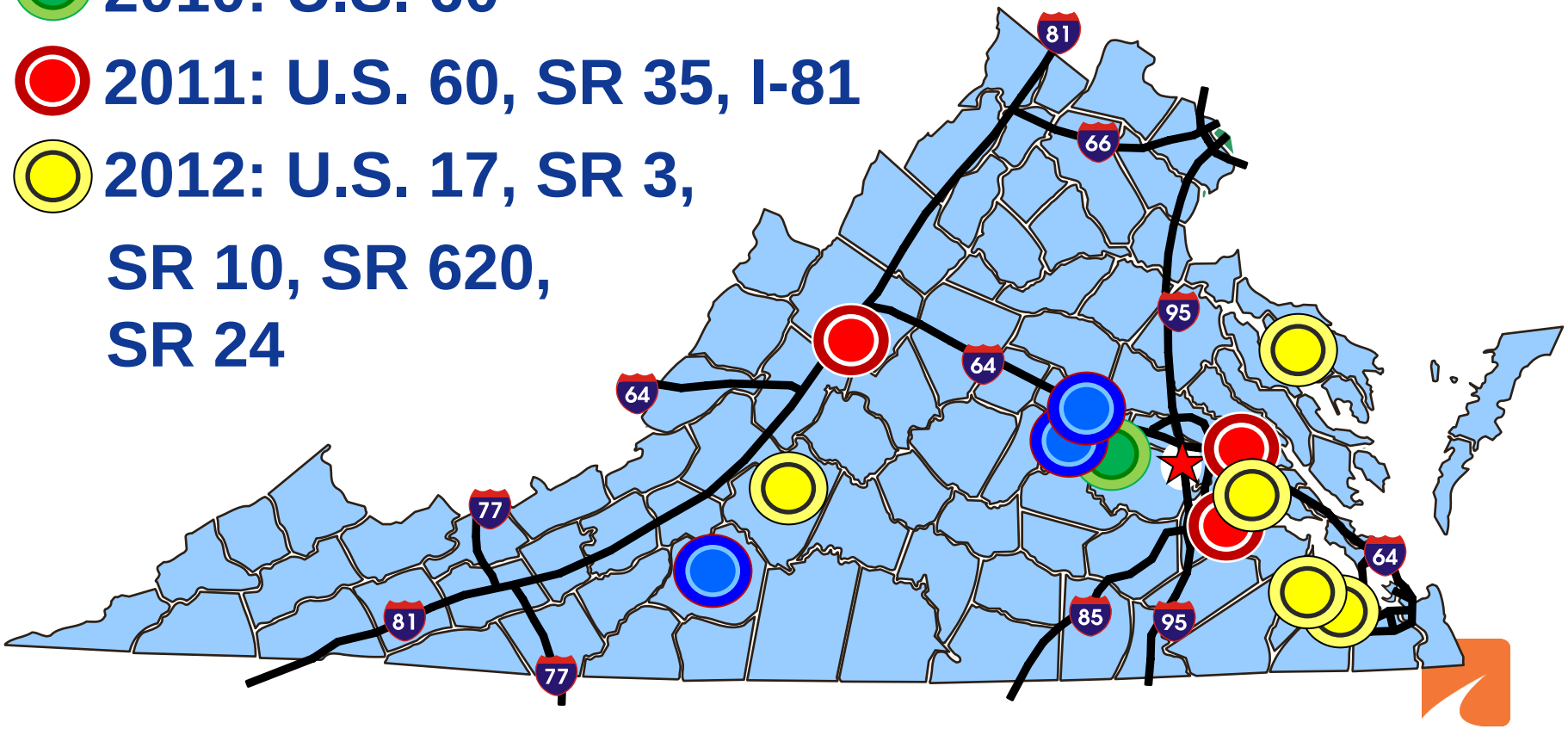


National Experiences

- **Benefits**
  - Saves new materials
  - Shortens lane closure times
  - Reduces fuel consumption
  - Reduces emissions
  - Cost benefits
- **Barriers**
  - Limited experience
  - Unsuccessful experiences
  - Lack of:
    - Standardized mix-design procedures
    - Specifications
    - Standardized project selection criteria
    - Engineering design

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

Left Lane	Right Lane
4-in New AC	6-in New AC
5-in CIR	6-in CCPR
Existing AC	
Existing Aggregate	12-in FDR
Existing Subgrade	Existing Subgrade

More than 70 percent was derived from recycled materials

Ongoing work on I-81

- **FWD structural testing, December 2011**
  - **Right lane SN = 8.8**
  - **Left lane SN = 5.5**

- **Rut testing and ride quality**
  - **Average rut < 0.04 inch**
    - No difference with respect to time
  - **IRI = 53 in/mile, left lane; 43 in/mile, right lane**
  - **Localized roughness in both right and left lanes**
    - Underlying condition, construction joint, other?
  - **No differences in 4-inch and 6-inch sections**

After I-81 Recycling Project

- **Long-term performance?**
  - **Research project formally wraps up early 2013**
    - Second round of FWD testing, October 2012
    - Fourth round of rut/ride testing, October 2012

- **Opportunity at NCAT to construct quiet-pavement sections**
  - **Also identified three available sections for a structural study on recycled pavements**

NCAT Recycled Sections

- **Goal**
  - **Gain a better understanding of long-term performance under heavy truck loading**

- **Contract with NCAT**
  - **Construct, instrument, monitor three sections**
    - 200 feet each
  - **Two years of traffic = 10 million ESALs**
  - **Instrumentation to measure temperature and pavement response from truck loading**

NCAT Recycled Sections

N3	N4	S12
6-in AC	4-in AC	4-in AC
5-in CCPR	5-in CCPR	5-in CCPR
6-in Agg	6-in Agg	8-in FDR
Subgrade	Subgrade	Subgrade

N3 vs. N4, N4 vs. S12

NCAT Recycled Sections

- **Construction, August 2012**
- **Traffic, starting October 2012**

- **CCPR rather than CIR**
  - **Millings from 2011 I-81 project**
    - Shipped from Virginia, crushed on site
    - New lab mix design, foamed asphalt
  - **Profile milled**
- **FDR**
  - **Stabilized existing aggregate base and subgrade**
    - Cement

LINFORD

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

Anticipated Results

- **Direct Comparisons**
  - **Performance of 4-inch vs. 6-inch AC over CCPR**
  - **Performance of 4-inch AC over FDR vs. aggregate base**
- **‘Indirect’ Comparisons**
  - **Performance of past sections, which consisted of full-depth asphalt vs. recycled sections**
- **Instrumentation**
  - **Stiffness / performance with respect to time**

Moving Forward

- **VDOT recycling specifications and guidelines**
- **Addressing research needs**
  - **Long-term performance (NCAT study)**
  - **Mechanistic design inputs (NCHRP 09-51)**
- **Upcoming events**
  - **Virginia Pavement Recycling Conference**
    - November 26-27, 2012
  - **TRB Pavement Recycling Workshop**
    - January 13, 2013

Virginia Center *for* Transportation
INNOVATION
& RESEARCH

We bring innovation to transportation.

Thank you!

brian.diefenderfer@vdot.virginia.gov
434-293-1944