VDOT Pavement Recycling Initiative

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Andy Babish, P.E.
State Materials Engineer

VDOT Pavement Recycling Initiative

- **Pavement Recycling Initiative Background**
- **Goal and Key Components**
- **Going Forward**

- **Initiative Background**

- **2008: 3 Full Depth Reclamation trial sections constructed and evaluated looking at constructability, costs, and engineering properties**
- **2009 to 2012: Additional pavement recycling projects built;**

  SR 60 in Powhatan (FDR)

  SR 60 in Henrico (CIR)

  I-81 Southbound in Staunton District

  I-81 first project to utilize FDR, CIR and CPR methods together

Initiative Background (cont)

Today's generation of VDOT is charged with rehabilitating a system the generation before us built. Brings many different challenges with it, primarily, maintaining the existing traffic that is now using the system.

We see the Pavement Recycling methods as a viable tool to accomplish this.

- Expeditious
- Minimizes use of natural resources
- Minimizes construction traffic in work zone when FDR or CIR employed

Goal and Key components

- **Goal - To successfully implement pavement recycling methodologies in VDOT to a steady state of practice for applicable roadways.**

- **Key Components –**

  - Establish statewide specifications and project selection guidelines
  - Education and training for staff
  - Research program

- **Project Selection Guidelines**
  - **Tool for rehabilitation of failed pavement structures where failure mechanism is deeper than surface layers. Intended for addressing significant structural problems, not functional problems with pavements.**
  - **CIR and CPR for top 5-6 inches existing pavement structure in need of rehabilitation**
  - **FDR typically for existing failed aggregate base material interfacing with subgrade (8-10 inches in thickness typ.)**

Guidelines (cont)

- Structural design coefficients;
  - CIR and CPR = 0.30
  - FDR = 0.20

- Interstates and Primaries
  - Minimum of 2 lifts of Asphalt Concrete totaling a minimum thickness of 3.5 inches
- All other routes
  - ESAL's > 3 Million, minimum of 2 lifts of Asphalt Concrete totaling a minimum thickness of 3.5 inches
  - ESAL's < 3 Million, per designer recommendations

Guidelines (cont)

- Pavement Design and Evaluation Report with recommendations to be completed by responsible charge engineer in the District and submitted to State Materials Engineer for review prior moving to forward with advertisement.

- CIR and FDR processes have potential for volume change as with any process where disturbing material from an "in-situ" state to a remixed and re-compacted state.

Specifications

- Quality Control Plan requirements
- Mix Design requirements and Job Mix Formula
- Equipment requirements
- Density
- Gradation
- Stabilizer dosage rates

Quality Control Plan Requirements

For each project, a project specific Quality Control Plan is required, and shall include the following (minimum) information:

- Contractor’s Quality Control organization,
- Quality Control Sampling, Testing and Analysis Plan
- Laboratory Accredidation for lab testing activities;
- Specify documentation for QC activities;
- Corrective action procedures when QC requirements are not met

The Contractor is required to have technical representatives at the project site during mixing and placement operations. Qualifications:

- 2 years minimum experience with the CIR/CPR process,
- Supervised a minimum of 5 successful CIR/CPR projects,
- CIR/CPR mix design experience,
- Field process control testing experience,
- References

Mix Design Requirements and Job Mix Formula

CIR/CPR/FDR

- Mix Design is conducted on materials obtained from the project site.
- Maybe obtained either by coring or test pits
- Contractor option for CPR (Previously stockpiled RAP may be used for mix design purposes)

Mix Design requirements and Job Mix Formula

Mix Design Requirements are identical for CIR/CPR

Emulsion Based Designs

- Minimum Marshal Stability of 2500 lb
- Minimum Retained Stability of 70% to account for moisture induced damage
- Raveling Stability
- Emulsion Selected to prevent Thermal Cracking through AASHTO T322 Indirect Tensile Test

Foamed Bitumen Based Designs

- Minimum Indirect Tensile Strength (ITS) of 45psi
- Minimum Retained ITS of 70% to account for moisture induced damage

Emulsion and Foamed

- Minimum Resilient Modulus of 150,000 psi
- Field Density Target established by Modified Proctor
- Target: Gradation(s), Stabilizing Agent and Optimum Moisture Content

Mix Design requirements and Job Mix Formula

Mix Design Requirements for FDR

Cement

- Compressive Strength of Soil Cement Cylinders (Min 250 and Max 450 psi at 7 days)

Emulsion Based Designs

- Minimum Marshal Stability of 2500 lb

Foamed Bitumen Based Designs

- Minimum Indirect Tensile Strength (ITS) of 45psi

Emulsion, Foam and Cement

- Field Density Target established by proctor (method dependent on stabilizer)
- Target: Gradation(s), Stabilizing Agent and Optimum Moisture Content

Equipment requirements

CIR

- A self-propelled machine with a down cutting milling head
- Full lane width capability within two passes
- Electronic grade controls

CPR

- A plant shall be capable of homogeneously incorporating all stabilizing agent(s) and materials to size requirements
- The plant shall be capable of delivering additives to within +/- 0.2% of the JMF
- Plant capability of adding up to 5% water by weight of the pulverized bituminous material
- The plant shall have inspection nozzle on spray bar end for representative sample collection.
- Produce print outs of stabilizing agent(s) and water quantities used during production

Equipment requirements

CIR and CPR Pavers

- Meet the requirements of Section 315.03(b) of the Specifications.

CIR and CPR Rollers –

- All rollers shall be self-propelled.
- At least one Pneumatic Tire Roller shall have a minimum gross operating weight of not less than 50,000 lbs. (22,600 kg).
- At least one double steel-wheeled vibratory roller shall have a gross operating weight of not less than 24,000 lbs. (10,800 kg) and a width of 78 inches (2.0 M).

FDR Equipment

- Pulverize, Stabilize, Grade and Compact

  The equipment used to reclaim existing pavements shall be capable of pulverizing, stabilizing, grading and compacting the existing pavement, as well as any additional materials, to meet the requirements of the approved plans and specifications.

CIR and CPR Field Density

Minimum Field Density Targets are established by Modified Proctor AASHTO T180 during mix design and verified during production

Field Acceptance is preformed via Roller Pattern, Control Strip and Test Sections

- Density is measured using a nuclear density gauge by Direct Transmission (VTM-110)
- Both the established nuclear target and field proctor shall meet 98% of the JMF Proctor
- Acceptance is based on 5000’ Lots using 1000’ Sub-lots (Test Sections)

FDR Field Density

Minimum Field Density Targets from the JMF

- AASHTO T 134 Moisture-Density Relations of Soil-Cement Mixtures
  - For use with Hydraulic Cement, Lime or Fly Ash stabilized designs

- AASHTO T 180 Moisture Density Relations for Bituminous Stabilizing Agents
  - For use with Asphalt Emulsion or Foamed Asphalt stabilized designs

Field Acceptance is performed via Test Sections

- Density is measured using a nuclear density gauge by Direct Transmission (VTM-10)
- Acceptance is based on 5000’ Lots using 1000’ Sub-lots
- Lot Averages shall meet 97% of the JMF Proctor

Gradation and Stabilizer Dosage Rates

Gradation – For CIR

- Verify un-stabilized gradation conforms to the JMF at the beginning of each production day and wherever there are changes in the pavement structure being recycled.
- Gradation bands established for the day based on 2 distinct machine speeds

Gradation – For CPR

- The contractor shall verify that the un-stabilized gradation conforms to the JMF once per day of production

Stabilizing Agent Dosage Rate – For CIR, CPR and FDR

- The Contractor shall verify the stabilizing agent dosage rate using calibrated meter within 0.20 percentage points of the approved JMF.

- **Research Program**

  - Mechanistic engineering properties for cold recycled materials need to be established; will be used in DarWin ME design protocol

  - Performance characteristics need to be established (durability), NCAT 2012 sites

  - Future sites in Virginia will be evaluated in partnership with VCTIR to evaluate performance and mechanical properties…Need to build adequate data set to confirm relationship between:

  Design – Construction - Performance

Going Forward

Publish specifications and guidelines for use (November 2012)

Conduct evaluations of projects to capture necessary refinements and modifications to guidelines and specifications

Training-

- **Virginia Pavement Recycling Conference in late November**
- **Conduct project specific "just in time" training in districts for project staff**

Research-

- **NCAT study beginning this year**
- **Continued monitoring of I-81 for performance traits**
- **Future projects…**

Going Forward

Vision of usage –

FDR : Effective method to rehabilitate secondary routes and lower volume primary routes…where conventional asphalt concrete layers are 4 inches or less

CIR/CPR – could be applicable for higher volume routes where asphalt concrete layers within the pavement structure 5 inches and greater.

Should route classification govern where methods are used?? NOT REALLY

Decision should be driven by existing pavement structure, failure mechanism, project scope and needs

Thank You