FULL DEPTH RECLAMATION SYMPOSIUM
Lab Testing/JMF
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VDOT Special Provision for Full-Depth Reclamation (FDR) (April 1, 2016)

- Materials
- QC Plan
- Job Mix Formula (JMF)
- Equipment
- Trial Section
- Construction Methods
- Acceptance Testing
- Weather Limitations
- Measurement and Payment

I. DESCRIPTION

Full-depth reclamation (FDR) is defined as those processes in which all of the asphalt pavement layers and some portion of the underlying bound and unbound layers are pulverized, stabilized, and compacted in place. This is most commonly performed using hydraulic cement, lime, foamed asphalt emulsion as the primary stabilizing additives.

The Contractor shall furnish all labor, materials, and equipment required for completing the work. The Contractor shall select the final mix design (job mix formula - JMF) and construction methods to meet the performance requirements specified herein.

II. MATERIALS

- Stabilizing Agent(s) — The amount of stabilizing agents to be used shall be determined by the Contractor by means of a mixture design process. Hydraulic cement shall conform to the requirements of Section 244 of the Specifications. Lime shall conform to the requirements of Section 245 of the Specifications. Fly ash shall conform to the requirements of Section 244 of the Specifications. All liquid asphaltics used for stabilizing agents shall be emulsions and PG binders in the VDOT Approved List for emulsions and PG binders, Approved List 30 and 501. Liquid asphaltics not currently on the Approved List shall be submitted to VDOT for approval. Asphalt emulsions shall conform to the requirements of Section 210 of the Specifications; liquid asphaltics shall meet the requirements of Section 211 of the Specifications.

1. Water — Any water used for mixing shall meet the requirements of Section 215 of the Specifications.
2. FDR — The FDR material shall have 100% of all particles passing the 2.0 inch (50mm) sieve size and 85% of all particles passing the 3/4 inch (19mm) sieve size prior to the addition of any stabilizing agents.
3. Other Additives — If necessary, additional additives may be used by the Contractor to meet the requirements in TABLE 4, in the case where an additional additive is used, the type and dosage must be described in the JMF’s submitted to the Engineer. For FDR using asphalt emulsion, hydrated lime shall be added according to the requirements in Section 211.02(2) of the Specifications.
4. Addition of Crushed Reclaimed Asphalt Pavement (RAP) Material — RAP material may be added by the Contractor and shall meet the requirements of Section 211.02(2) of the Specifications.

TABLE 1 — ADDITIONAL CRUSHED RAP
Job Mix Formula

- Laboratory testing to determine optimum percentage of stabilizing agent
  - Based on strength
- Materials/Stabilizing Agent(s)
  - Cement
  - FDR
  - Addition of other materials – RAP, rock dust, soil, aggregate,…
Job Mix Formula

- Pavement evaluation
  - Design depth

- Field Sampling
  - Collect blended samples of pavement structure

- Design Range
  - FDR material – lower range (100% passing 2 inch sieve and 55% of all particles passing 3/8 inch sieve) – Upper range (100% passing 2 inch sieve)
Field Sampling

- FDR Thickness
- Pre-cut / Fill
- Elevation Changes
- Shoulders
- 2,500 linear feet between samples (within each lane)
Field Sampling

Full Depth Pavement Reclamation
Field Sampling

Full Depth Pavement Reclamation
Field Sampling

Full Depth Pavement Reclamation
Field Sampling

FULL DEPTH PAVEMENT RECLAMATION
Field Sampling
Laboratory Mix Design

- Atterberg Limits (VTM-7)
- Gradation (VTM-25)
- Moisture Density Relations of Soil Cement Mixtures (AASHTO-T134)
- Compressive Strength of Soil Cement Cylinders (ASTM D1633).
- 7 day compressive strength requirement typically 250 to 450 psi (max)
Laboratory Mix Design

- Moisture Density Relations of Soil Cement Mixtures (AASHTO-T134)
  - Uses materials passing the #3/4 sieve

- Addition of cement
  - time of preparation
Compressive Strength of Molded Soil-Cement Cylinders - ASTM D 1633

- Method A (4” Split Proctor Molds)
- Uses materials passing the #3/4 sieve.
- Compacted at Optimum Moisture.
- Scarify the tops of layer 1 and 2 to remove shear planes.
- Cured per ASTM D 1632 in moist room and protected from free water.
- Samples immersed in water for 4 hours prior to testing.
- Samples capped in accordance with ASTM D 1632
Compressive Strength of Molded Soil-Cement Cylinders - ASTM D 1633 - Continued

- Compressive load rate
  - Screw or Hydraulic
- Typical applied load is 3,000 to 4,000 lbs. The 500,000 lb load cell of a standard concrete break machine is not calibrated in this range.
- A 10,000 lb load cell should be used.
Compressive Strength of Molded Soil-Cement Cylinders - ASTM D 1633 - Continued
Challenges

- Pre-cutting/sample depth
- Roadway shoulders
- Changes in grade/Fill
- Too Gravelly / Too Sandy
- Old cement
QA/QC Plan
(from JMF Perspective)

- Critical for ensuring compliance with JMF
- Application rate within 0.20 % of design range from JMF
- Moisture content within 2% +/-
- Minimum Compaction of 97%
Laboratory Mix Design

Lessons Learned

- The Project Manager and Principal Engineer must be actively involved in the mix design.
- A kick off meeting must be held with the lab personnel to review the test procedures, specifications and outline how the process will flow.
- Need to understand the standards/specifications
- A mix design for a large project can quickly overwhelm a small lab. Be prepared to ask for assistance.
- **Recognize mix gradation problems early in the design process**
- Keep the lab clean and organized.
- Make sure you have adequate supply of equipment
  - Mixing Pans/Shelving
  - Split Molds
Questions