PCA
America's Cement Manufacturers™

Portland Cement Association
Southeast Region
www.secement.org

Virginia DOT Tackles Deteriorating Truck Route on SR 30 Using Full-Depth Reclamation with Portland Cement

1 Initial pulverization.

2 Motor grader performs rough grading on pulverized pavement.

3 Calibrated spreader places portland cement at the appropriate rate.

When a 4.4 mile section of Virginia State Route 30 near Mechanicsville became worn out due to high volumes of heavy truck loading and stripping of lower layers, the Virginia Department of Transportation (VDOT) turned to full-depth reclamation (FDR) with portland cement to create a new durable base. Route 30 is a two-lane undivided primary route that carries approximately 4400 vehicles per day, of which 21 percent are large commercial trucks.

VDOT rates their pavements on a zero to 100 scale, with 100 being excellent. In 2013, the pavement ratings for the project ranged from 24 to 46. VDOT's assessment of the pavement found that the existing pavement was made up of numerous asphalt overlays with depths of up to 14 inches in some areas, with extensive stripping in the lower layers. The deep stripping was the factor that necessitated either the full replacement of the asphalt pavement or recycling of the existing pavement with FDR.

VDOT chose to mill 2 inches of asphalt from the existing pavement and reclaim the remaining structure to a depth of 12 inches, with the addition of 4 percent portland cement, to achieve a 7-day compressive strength of 300 to 400 psi. The milled material was placed in a trench in the shoulders and reclaimed along with the rest of the road to widen the pavement from 25 to 32 ft. This allowed VDOT to enhance safety through the addition of 4 ft paved shoulders.

The project was awarded to Lee Hy Paving Corporation of Richmond. Slurry Pavers, also of Richmond, was selected as the full-depth reclamation subcontractor. Milling began on August 21, 2014 and FDR commenced on August 25. FDR was completed on October 8.

Amazingly, during reclamation traffic was maintained throughout the project through the use of daytime lane closures and a pilot car. Each day's work was covered with a single bituminous chip seal and reopened to traffic the same day. Once a week, a two-inch course of intermediate asphalt was placed over the base reclaimed the previous week. The project was completed by placing an additional two-inch surface asphalt course as the final riding surface. The base and chip seal carried the heavy truck loadings for up to a week without damage while awaiting the first asphalt lift.

David Stowell of Slurry Pavers said "FDR with portland cement was ideal for this project. The large amount of ordinary repair needed to prepare this project for a conventional mill-and-fill overlay would have been impractical. Full-depth reclamation using cement not only can be done for less than the cost of patching, but provides a uniform, strong new base. It also allows us the ability to maintain traffic while completely renewing the pavement structure. We see this process as applicable to many, many miles of roadway in Virginia and elsewhere."

VDOT District Construction Engineer Mike Coffey for the Fredericksburg District is sold on the value of FDR with portland cement. Coffey says, "Portland cement full-depth reclamation is a proven method of rehabilitating our aging road network. The speed of construction and cost savings over new construction are just a few of the reasons that we consider FDR."

4 Testing technicians check cement spreader rate using a square yard tarp.

5 Mixing cement and water into pulverized pavement as traffic runs in the adjacent lane.

6 Reclaimed base has been mixed, compacted, graded, and is receiving bituminous surfacing as traffic runs on adjacent lane that was reclaimed the previous day. Traffic may use the bituminous surfacing as a riding course for up to a week.

Typical Construction Sequence of Full-Depth Reclamation with Portland Cement

1. **Investigate existing pavement**: To ensure that the final results are optimized, always investigate the existing pavement structure and subgrade prior to reclamation. Typically, samples of the pavement and subgrade are collected to the desired depth of reclamation and tested by a qualified testing laboratory to determine the appropriate rate of portland cement addition. Either too much or too little cement may reduce the quality of the final product.

2. **Plan operation to ensure a well-coordinated job**: Mixing, curing, and paving operations should be sequenced to minimize traffic disruptions and cover the FDR in a timely manner. Although FDR base can carry traffic for a week or more with only a chip-seal treatment, extended exposure without further paving is not recommended.

3. **Begin FDR by pulverizing existing pavement**: As a first step, it is recommended that the existing pavement be pulverized to the desired depth using the pavement reclaimer. The maximum particle size after pulverization varies with different specifications, but is generally required to be 2 inches or less. (Photo 1) The contractor may elect to add some water at this stage to reduce dust and ease initial shaping, as was done on this project.

4. **Roughly reshape the pulverized pavement**: A motor grader and sheepsfoot roller are used to roughly regrade the base and prepare it to receive portland cement. (Photo 2)

5. **Spread portland cement**: Cement is spread with a spreader that is calibrated to deliver the specified amount of cement within tight tolerances. (Typically +/- 5 percent.) (Photo 3) Actual spread rate should be measured in the field by testing technicians periodically during construction. (Photo 4)

6. **Mix cement, water, and pulverized pavement**: The reclaimer will make a second pass to mix the cement and pulverized pavement. The reclaimer will also use an attached water tanker to simultaneously bring the final mixture to the appropriate moisture content as determined in Step 1. (Photo 5)

7. **Compaction and fine grading**: The sheepsfoot roller is used to compact the reclaimed mixture. The motor grader works in tandem to achieve deep compaction while maintaining the desired elevation. Once initial compaction is achieved, the motor grader and vibratory steel wheel roller will complete the fine grading operation and provide a smooth surface ready for overlay. This step is critical in achieving a smooth base that is ready to receive further overlay.

8. **Curing**: A variety of methods are available to properly cure the FDR. Due to the heavy truck traffic, VA Route 30 received a single treatment bituminous chip seal almost immediately. (Photo 6) At this point, the FDR base is complete and ready to receive its final surface, whether hot-mix asphalt, concrete, or bituminous surfacing.

By: Stan Bland, PE
Pavement Applications Director, Carolinas/Virginia

and Andrew Johnson, PhD, PE
Pavement Design Engineer
Portland Cement Association, Southeast Region