CENTRAL PLANT RECYCLES IT COLD

BY TOM KUENNEN

VDOT can rely on a decade of experience using cold central plant recycling to rebuild its interstates. In 2011 the commonwealth completed an in-place pavement recycling project on I-81 near Staunton in the foothills of the Blue Ridge Mountains. That project consisted of a 3.66-mile section of southbound I-81 in Augusta County. And most recently, in 2021, CCPR was used on the reconstruction of I-64 in the Hampton Roads region.

On I-81, VDOT employed three in-place pavement recycling techniques—full-depth reclamation (FDR) and cold in-place recycling (CIR) using Wirtgen mobile equipment, and CCPR using the Wirtgen KMA 220i mobile cold recycling mixing plant. That project marked the first time in the United States that these three recycling techniques were combined in one project on the interstate system.

FDR is an engineered rehabilitation technique in which the full thickness of the asphalt pavement and a portion of the underlying materials are uniformly pulverized and blended to provide an upgraded, homogeneous material in one pass. The reclaimed materials may be improved and strengthened by using mechanical, chemical or bituminous stabilization, the latter via foamed asphalt or asphalt emulsion.

CIR is a surface process in which specialized equipment cuts the top 3 to 5 inches or more of an existing poor quality pavement surface, grinds and resizes the reclaimed asphalt pavement (RAP), mixes it with foamed asphalt or asphalt emulsion binder, and replaces it in the right-of-way, ready for compaction and surface treatment or overlay. With CIR, Virginia calls for a typical depth of 3 to 5 in. and stabilizes the material with either foamed asphalt or asphalt emulsion.

CCRP involves RAP that has been crushed and screened and brought to a cold recycling plant like the KMA 220i to create a foamed-, asphalt emulsion-, or cement or

lime slurry-stabilized base material, which is trucked out to a reconstruction site.

VDOT uses CCPR to create structural base material placed to a depth of 3-6 inches, specifies foamed or emulsified asphalt as a stabilizer, and uses it as an alternate to deeper mill-and-fill/partial depth patching.

"The I-81 in-place pavement recycling project was completed quickly and cost-effectively," said the Virginia Transportation Research Council (VRTC) in 2014. "Because of its engineering excellence and innovation, the project earned several prestigious national awards. Nearly three years of good performance proved the success of the pavement produced with these in-place recycling processes. The surface and deep structure of the rehabilitated section are expected to remain sound for years to come."

CCPR FOR VIRGINIA'S I-64

Its success in using all three asphalt recycling techniques in reconstructing I-81, and its performance for years thereafter, led to VDOT's use of the three techniques in an ongoing three-segment rebuild of I-64. There, in Segment III, the Wirtgen KMA 220i is producing more than 220 tons per hour of foamed asphalt structural base for the I-64 rebuild, and the entire process spotlights the manner in which VDOT reconstructs its high-volume highways in an environmentally sustainable manner.

In 2021 the I-64 Capacity Improvements Project work was in Segment III of a three-segment project to improve traffic flow in Virginia's Tidewater peninsula. Improvements include replacement of existing lanes, the addition of 12-foot-wide travel lanes in the median, and new 12-foot-wide shoulders in each direction.

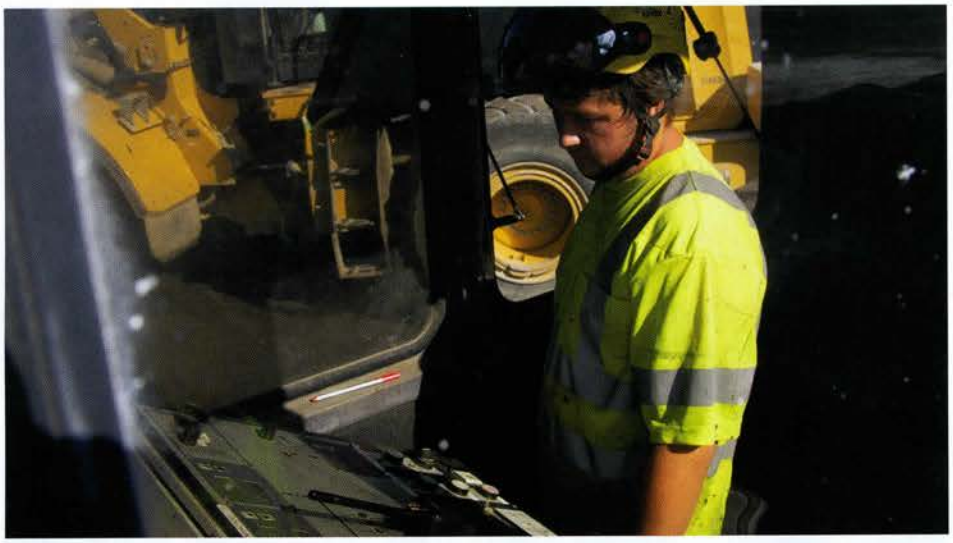
The $178 million Segment III is 8.2 miles long and, according to VTRC, with the earlier two segments, constitutes one of the largest pavement recycling initiatives in North America and second largest in the world. Recycling will result in an estimated $15 million cost savings total for Segments II and III. Over the course of the I-64 widening projects, it's estimated that nearly 1.2 million tons of recycled materials will be used.

From the bottom, the Segment III section design is 12 inches of FDR, a 2-inch asphalt open graded drainage layer, 5-in. of CCPR from the KMA 220i, and 4-in. surface course of stone matrix asphalt (SMA).

Allan Myers Inc. was prime contractor for Segment II, and was the CCPR and asphalt placement subcontractor for Segment III. While state specs say Allan Myers

LEFT: At Allan Myers' HMA facility, the Wirtgen KMA 220i portable plant will operate in stationary mode for some time to come. Raw, processed RAP is fed into plant for foamed asphalt. ABOVE: Plant mechanic Steven Morris, operator Gage Browning and quality control manager Craig Rayfield tend the KMA 220i portable cold recycling plant at Allan Myers' New Kent, Virginia, HMA facility.

They start making foamed asphalt base mix early in the morning, prepping it to ship out to I-64.



Gage Browning, plant operator, at the controls of KMA 220i.

"The KMA 220i is ... great for the environment, because we have a mountain of unprocessed RAP that we now have something to utilize it with," Craig Rayfield said.

The cold central plant recycles RAP into foamed asphalt at full capacity for owner Allan Myers for use on the I-64 project.

could have used its KMA 220i to stabilize the CCPR using asphalt emulsion, instead it chose to use foamed asphalt for Segments I, II and III.

Foamed asphalt or bitumen incorporates liquid "foamed" asphalt as a recycled mix stabilizing agent for bases or FDR, in which hot liquid asphalt is foamed with water and air, and is then injected into RAP in a mixing chamber, in a portable plant, or a self-propelled recycler/reclaimer. This permits use of less liquid asphalt and lower mixing temperatures, which benefits the environment. Depending on the degree of presence of fines in the existing materials to be recycled, up to 1 percent cement or hydrated lime may be required to act as a carrier or "dispersing agent" for the liquid asphalt to assist its spread throughout the pulverized material.

"The KMA 220i is easy to run, so long as you keep up with the maintenance and the clean-up," said Steven Morris, KMA 220i plant mechanic for Allan Myers. "You keep on top of your cement and make sure all the feeders are feeding. You make sure all the skirt rubber is cleaned up and that the weigh bridges are clean; that way it reads correctly.

"On start-up, getting your base line is a little tricky because you have to work with your lab," Morris continued. "But after that, it's pretty much plug and play. As long as everything's running steadily, it's a smooth operation but with walking around and checking everything, keeping your water full."

The foamed asphalt mix design was prepared by Stephanie Drain P.E., Charleston, Illinois, and Wirtgen's Mike Marshall. "We have between 80 and 85 percent RAP, around 14 percent No. 10 screenings," said Craig Rayfield, quality control manager for Allan Myers, Williamsburg, Virginia. "We have 2.5 percent liquid asphalt, and 1 percent Portland cement."

The performance-graded asphalt cement for foaming is PG64-22 spec, and for the mix a moisture specification is maintained to assist compaction. Unlike the I-81 project—in which RAP was coming off the job site, foam-mixed, and returned to the site—in this project, existing stockpiled RAP from different jobs was being used.

"We have RAP from all over the area," Rayfield said. "When that RAP arrives, it's unprocessed. A contract crushing company processes the material to 1/2- to 3/8-inch size, which pretty much gives us about a hundred percent passing the half-inch sieve."

Because the RAP comes from different job sites, it varies in residual asphalt

content, which will affect the foamed mix design. To get around that, the stockpiles are blended so they will produce a RAP with a reliable, consistent average percent residual asphalt.

"The processing takes the RAP and blends it into a homogenous mix of a certain particle size range," Rayfield said. "Then our lab technicians will pull samples to run gradations and asphalt contents. That way we have an idea of what's going into the product, and we can control it."

STATIONARY MODE

While the plant is mobile—the KMA 220i is mounted on a three-axle flatbed trailer—Allan Myers' KMA 220i is in a stationary location at its New Kent, Virginia, hot-mix asphalt (HMA) plant just off I-64 and west of the three segments.

"The plant is portable, but I would say it's 'semi-stationary' right now," Rayfield said. "We've added larger asphalt tanks, up to 22,000 gallons total, for highest production capacity, and a larger cement silo for better production. And we have a 5,000-gallon water tank on the back side, eliminating the need to hook into a water line or well system. It wouldn't take much effort to get it portable again, and we can move it if we want to, but we have no need to now."

Planned VDOT reconstruction segments for I-64 may mean the KMA 220i stays where it is indefinitely. "It's in a very strategic location right now," Rayfield added.

A typical shift of 9.5 to 10.5 hours will produce 1,600 to 1,800 tons per day of foamed asphalt base mix. "These guys get here at 4:30 in the morning, and run up to 700 tons on the ground; we then start shipping and the plant keeps up with it the rest of the day," Rayfield said. "We're looking at 27,000 more tons to finish the project, with a total forecast of 170,000 tons of cold central plant recycled foam mix."

Foamed asphalt may be stockpiled for a few days, but Allan Myers found moisture loss over 24 hours impacted compaction in the field. The contractor even erected a shelter with sprinkler system that could hold the mix longer while maintaining moisture. "But we found that we're better off just coming in early and making the mix, and let it sit a couple of hours before placement, rather than try to hold it for 24 hours," Rayfield said.

Back in Segment II, Allan Myers had to get used to the plant and production of foamed base mix.

"When this product came here originally, a lot of us were skeptical," Rayfield said. "We were shy of it, but it didn't take long to figure it out."

"It's clean, it doesn't smoke, and it doesn't smell," Morris said. "It has no pollution. We can run a whole day shift on less than three-quarters of a tank of fuel, which we calculated as 10.2 gallons per hour."

"That represents a huge savings, along with the amount of RAP that's going into it," Rayfield added. "As far as being effective and efficient, it's very cost-effective. At Allan Myers, if there's a way we can do something better, or be innovative, we jump on it. We tackled the challenge, bid the job, and got the information we needed to design the mix. It's been smooth sailing ever since."

And while the 220 tons per hour that the Wirtgen plant can produce is adequate, Rayfield could use even more volume.

"We could use a bigger plant," he said. "The 220i's capability is limited as far as its tons-per-hour, but it's given use what we need to perform. But if we could run 300, 350 tons per hour we could ship even faster." AP