INSIDE

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OREGON TRIES ADVANCED PAVEMENT OVERLAY

ODOT conducts Interstate 5 demonstration using highly modified asphalt binder

By Paul Fournier

The Oregon Department of Transportation (ODOT) recently had a section of Interstate 5 paved with advanced hot mix asphalt as part of a nationwide demonstration program involving thin pavement overlay incorporating highly polymer-modified asphalt binder (HiMA).

Knife River Materials manufactured and installed the new HiMA mix for ODOT's demonstration on a two-mile segment of northbound lanes of I-5 near Medford, the seat of Jackson County located in southern Oregon near the California border.

Knife River Materials' Blaw Knox 5510 paver installs thin-lift overlay on Oregon's I-5 near Medford during night demonstration of HiMA for ODOT.

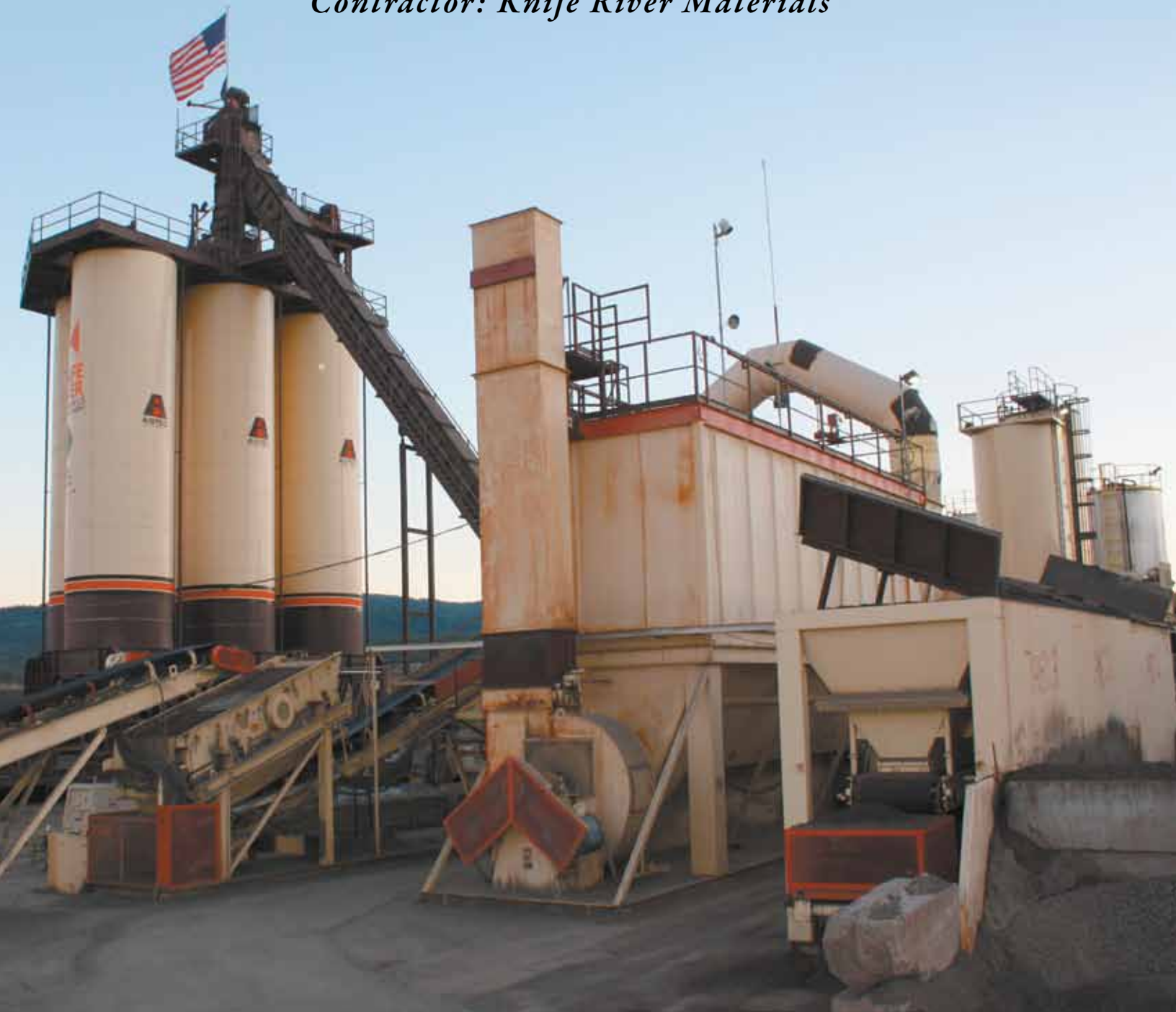
Production of the HiMA thin-lift overlay is based on specifications developed by the Northeast Pavement Preservation Partnership (NEPPP), a regional DOT group dedicated to advancing pavement preservation. Entitled "Superpave 9.5mm Highly Polymer-Modified Thin Overlay Specifications (PMTOL)," the new regional specifications were designed by NEPPP as a pavement preservation strategy to extend a pavement's service life. The new mix is intended to be placed on pavements that are structurally sound.

As a member of the Rocky Mountain West Pavement Preservation Partnership (RMWPPP), a sister regional partnership, ODOT learned about the program and decided to conduct a demonstration similar to those undertaken by state transportation agencies in New Hampshire, Vermont and Minnesota.

The test of HiMA thin overlay would serve as an adjunct to ODOT's continuing search for economical preservation methods that will boost pavement service life on high-volume roads. In addition to environmental and load-related factors, these roads experience rutting due to studded tire-abrasion and raveling where open-graded surfaces were used. Five years ago, ODOT began using hot-applied chip seals on moderate- to high-volume-traffic roads with pavements nearing the end of their service life. The goal of using hot-applied chip seal is to provide additional service life to such highways that cannot be paved due to current budget constraints. Several of the hot chip seals are still in place after five years and ODOT anticipates realizing a service life of eight years from them. Ideally, officials are looking for a preservation process that would lengthen pavement service life by up to 15 years.

Oregon Tries ADVANCED PAVEMENT OVERLAY

Owner: Oregon Department of Transportation
Contractor: Knife River Materials



AASHTO TSP • 2 Posting

The demonstration program is hosted by the National Center for Pavement Preservation (NCPP) housed at Michigan State University. The Center is under contract to develop and administer the Transportation System Preservation Technical Services Program (TSP•2), a national program funded by the American Association of State Highway and Transportation Officials (AASHTO) that provides current information on pavement and bridge preservation measures. Developed as an extension to NCPP's website, the TSP•2 website provides transportation agencies with news and technical information on preservation issues.

Samples of plant-produced mixes from the demonstrations including those from ODOT's demonstration are being analyzed by The Highway Sustainability Research Center at UMass Dartmouth under the direction of Dr. Walaa Mogawer, P.E., with results being posted on the TSP•2 website.

I-5 Pavement Fix Needed

ODOT also wanted to try HiMA thin overlay to preserve the pavement of a section of I-5 with a ¾-inch open-graded wearing surface that was nearing the end of its service life due to wear and raveling.

In the past, the agency employed a 2-inch deep, ¾-inch open-graded hot mix asphalt concrete (OGHMAC) as a wearing course on its multilane high volume highways to reduce splash and spray. Historically, paving operations involved milling off two inches of existing pavement and replacing it with open-graded mix. Due to cost increases in materials and the service life of the open-graded mixes, ODOT switched to using ½-inch dense mixtures as the standard pavement wearing course.

"Currently, the texture of that pavement needs help," said Larry Ilg, ODOT Pavement Quality and Materials Engineer.

"We have some wearing ruts and raveling in this particular section of I-5 from the high traffic volumes including heavy trucks. This is also partly because the pavement has been in place for 12 years," Ilg said. "But we just don't have the money to be able to do 2-inch mill-and-fill with our standard ½-inch dense-graded mix in all the places around the state that need it," he said.

Elastic Recovery Criterion

The I-5 demonstration is regarded as a significant change from ODOT's traditional paving protocol. Instead of milling off two inches of existing road surface, crews micro-milled just one inch, and the HiMA mix overlay for the project incorporated not a traditional asphalt binder but one modified with a high concentration of polymer.

ODOT standard specifications for asphalt materials follow Table 1 of AASHTO M320, Standard Specification for Performance Graded Asphalt Binder. For use on high-volume roads, an additional test is required to determine the Elastic Recovery (AASHTO T301) of the asphalt cement. For instance, ODOT requires a minimum ER value of 50 percent for binders that have the PG70-22ER designation.

The Elastic Recovery test indicates a polymer is present in an asphalt binder by measuring the amount of its recoverable elongation. In other words, it is a measure of the elastomeric quality of the material – the ability of a test specimen to elongate when stress is applied and to return to original shape when stress is removed. This ability is affected by properties of the base asphalt and the amount and concentration of a modifier such as polymer.

Overcoming Polymer Content Limits

A unique aspect of HiMA binder is that it contains 7.5-percent by weight of an advanced SBS (styrene-butadiene-styrene) polymer – more than twice as much used in conventional polymer-modified binders. While modification of liquid asphalt binders with polymers has been shown to improve resistance to rutting and raveling of asphalt mixes, there is a practical limit to polymer concentration. Usually, as polymer concentration exceeds three percent, the viscosity of binder increases such that hot mix becomes more difficult to produce in the plant and less workable for the paving crew.

HiMA mix at approximately 290 degrees Fahrenheit is laid out by paver, exhibiting no viscosity problems.

However, polymer used in the demonstration program is Kraton D0243, a new SBS product developed and manufactured by Houston-based Kraton Performance Polymers Inc., which meets the requirements of the new regional specifications without increasing viscosity.

Appearances Count In Scenic Oregon

For the I-5 demonstration, two travel lanes (fast and slow) in the northbound direction were paved. ODOT called for the application of HiMA mix overlay in two, 1-mile sections, with each mile section of HiMA mix followed by a mile section of ODOT's ⅜-inch dense graded polymer-modified hot mix for control. The control mix binder had approximately 3 percent traditional polymer with an ER of 64 percent, while HiMA binder was modified with 7.5-percent of Kraton D0243 polymer and had an ER value of 89 percent.

Paving was scheduled to take place at night. But before mainline paving could begin, ODOT required the contractor to pave part of the adjacent shoulder with about 250 tons of HiMA mix, to see how it handled in the field. They also wanted to check its appearance, to make sure it would be aesthetically acceptable and compatible with Oregon's scenic, rugged landscape, which attracts many thousands of tourists each year. Residents take great pride in these natural wonders, as do the ODOT personnel responsible for maintaining the safety and appearance of roads providing access to the natural attractions.

This part of the state, in particular, is noted for snow-capped (even in June) 9,500-ft.-tall Mount McLaughlin. The area is also the gateway to Crater Lake National Park. The park's centerpiece, Crater Lake, is up to six miles wide and nearly 1,950 ft. deep, making it the deepest lake in the U.S., the second deepest in the Western Hemisphere, and the seventh deepest in the world.

A Weiler E1250A materials transfer vehicle feeds HiMA mix for I-5 thin overlay into Blaw Knox paver.

One of two Ingersoll Rand Rollers consolidates the mix for the Interstate 5 demonstration.

And not far from the demonstration site another scenic attraction serves as a backdrop for Knife River Materials' Central Point manufacturing plant in Medford. Overlooking the plant are the Upper and Lower Table Rocks, hugely popular hiking locales in Jackson County's Rogue River Valley, with over 45,000 people each year visiting the 800-ft. tall, flora- and fauna-rich volcanic plateaus.

Producing The Mixes

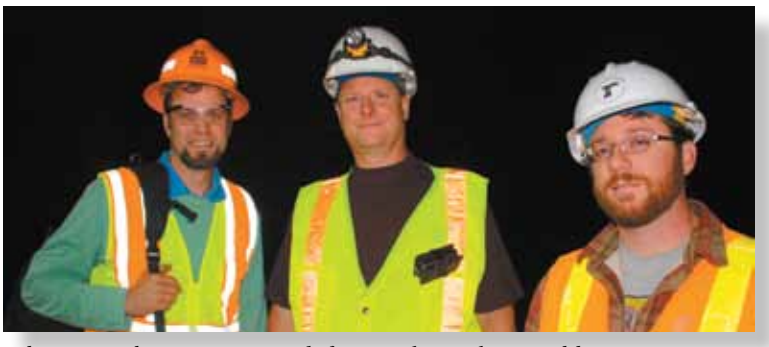
Satisfied with the trial shoulder work, ODOT gave the green light to the contractor for main line paving to begin the following evening.

Before the overlay was placed, Knife River crews micro-milled off one inch of the existing pavement, then sprayed the surface with CRS-2Ph, a latex-modified asphalt tack coat, to ensure a strong bond between the old pavement and the overlay.

HiMA binder used by Knife River to make the hot mix was supplied by the Seattle, Washington, facility of Paramount Petroleum Corp. Paramount blended neat asphalt binder with 7.5 percent Kraton D0243 polymer in pellet form. Headquartered in California, Paramount is a major manufacturer and producer of paving and roofing asphalt products, and operates a 54,000 barrel-per-day refinery in Paramount and a 35,000 barrel-per-day refinery in Long Beach, California.

HiMA binder was shipped to the Knife River plant and stored at between 335- and 340-degrees Fahrenheit until needed. The company's Sand and Gravel Division at the facility supplies aggregate to their Astec drum mix plant.

Built in 1994, the plant has undergone a number of updates and has a current production rating of 400 tons per hour. The facility has seven 20-ton cold feed aggregate bins, 3 RAP (recycled asphalt pavement) bins, 5 300-ton heated mix storage silos, and 4 liquid asphalt binder storage tanks ranging from 15,000- to 30,000-gallon capacity. The Medford plant is just one of the company's nearly 40 locations in Oregon. Over all, the Bismarck, North Dakota-based company produces aggregate, asphalt, ready-mix concrete, liquid asphalt and cement at various facilities in 14 central, southern and western U.S. states, plus Alaska and Hawaii.



Observing demonstration, left to right.: Chris Lubbers, Kraton Polymers technical sales manager., Larry Ilg, P.E., ODOT Pavement Quality and Materials Engr. and Chris Harris, P.E., asstistant pavement quality engineer.

Control and HiMA mixes were produced with identical aggregate gradation and volumetrics, and differed only in the type of asphalt binder. No special plant adjustments were made to accommodate HiMA mix production, other than switching to the HiMA binder tank when it was called for. Astec plant operators combined 9.5mm (⅜-inch) top sized aggregate with 6.4 percent binder and 20 percent RAP, producing mixes at approximately 310 degrees Fahrenheit.

Knife River Materials did not report any viscosity problems in manufacturing either HiMA mix or control mix.

Vehicles travel on I-5 northbound lanes, with HiMA paved shoulder at far left, middle lane with no overlay, and HiMA paved fast lane at right.

Main Line Paving

On the first night of main line paving, as haul trucks arrived at the job site after a 12-mile run from the plant, the temperature of the mix was about 290 degrees when it was loaded into a Weiler E1250A materials transfer vehicle. The Weiler in turn fed mix to a Blaw Knox 5510 paver equipped with a Carlson screed. Two Ingersoll Rand rollers provided compaction without incident.

There were no problems with viscosity as the control mix and HiMA mix were placed by the Blaw Knox and rolled. However, there were problems with some clumps of material being evident on the surface of the mixes.

"The clumps weren't caused by the mixes but by the latex-modified tack coat," said Chris Harris, ODOT Assistant Pavement Quality Engineer, who personally observed the three-night paving process.

"As the trucks and material transfer vehicle passed over the tack coat their tires picked up not only some tack coat but also fines from the milled surface," said Harris. "The milled area had been swept but not vacuumed so there were some fines left on the surface. There were three men from the crew ahead of the paver using shovels to remove clumps but a number got through under the screed."

Harris said that when workers removed the clumps after the screed their rakes picked up fines from the pavement surface as well. He added that fortunately, there weren't many clumps and the surface as a whole looked good.

To prevent further problems, they switched to a CSS-1h traditional tack coat and there was a significant drop in clumping on the second, and final, night of mainline paving, said Harris.

Performance Is The Deciding Factor

In the end, judgment by ODOT officials to see if they have found a new method for cost-effectively extending the service life of their hundreds of miles of roadways will be heavily influenced by the performances of both control and HiMA thin overlays after being subjected to a winter of high interstate traffic.