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PAVEMENTS PRESERVED AROUND DEEPEST U.S. LAKE

Chip sealing of roads at Oregon's Crater Lake, part of new National Park Service program, provides data for groundbreaking FHWA/Fed Lands study

By Paul Fournier

At Oregon's Crater Lake National Park, a BearCat chip spreader applies aggregate during chip sealing of road next to the deepest lake in the United States.

Several roads at Oregon's Crater Lake National Park were recently chip sealed as part of a new National Park Service (NPS) pavement preservation program, with the project providing valuable information for a study designed to help transportation officials across the country.

Contractor D. L. Santos Construction of North Bend, Washington, recently chip sealed approximately 22 miles of roads in the park that encompasses the deepest lake in the United States, an effort that not only extended the service life of the roads but allowed researchers to complete a study of polymer-modified asphalt emulsions as well. That technology study is underway by the National Center for Pavement Preservation under contract to the Federal Highway Administration (FHWA) and Federal Lands Division.

Adopting Pavement Preservation

The Division is coordinating efforts to develop the pavement preservation program to protect all roads in the National Park System, according to Charles "Chuck" Luedders, a registered professional engineer and manager for FHWA's pavement management program. Luedders is responsible for pavement preservation projects from beginning to end, i.e., from the scoping phase, through design, construction and agency acceptance.

He said that at present the new program is in place in two of the Park System's regions – Intermountain and Pacific-West – and credited David Kruse, former NPS project coordinator and current Lava Beds National Monument superintendent, for working with FHWA to promote the establishment of a standard pavement preservation program to replace a "haphazard, uneven" paving program. Under the old program, he explained, each National Park was responsible for obtaining federal funding, designing and overseeing road paving in its own park. Smaller parks lacked design and construction expertise, so large parks received the majority of federal funds while road paving programs in smaller parks languished. The new program aims to establish a rational, systematic and consistent procedure for selecting candidate roads and the corresponding correct pavement preservation treatment.

"The National Park Service pavement preservation program was launched in 2007 with a single project. In 2008 there were two major projects and this year there are four active projects. Next year, we expect to let at least four more pavement preservation jobs," said Luedders.

Filling A Knowledge Gap

In addition to being one of NPS' four 2009 pavement preservation projects, Crater Lake is the final job providing data for the polymer-modified asphalt emulsion study. This information is critical to the report since Crater Lake is the only project that utilized both SBR latex and SBS polymer-modified asphalt emulsions in the chip seal process. SBR latex, a polymer dispersion of styrene-butadiene rubber, was employed in all other projects.

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Contractor: D. L. Santos Construction - North Bend, Wash.

SemMaterials, the single largest supplier of SBS-modified emulsions in North America, filed for bankruptcy in July 2008. This, coupled with the shortage of SBS block copolymer during the peak paving season in 2008, led to a lack of availability of SBS-modified emulsion for use in polymer-modified chip seal projects last season. SBR latex and SBS block copolymers are the two most common polymers used to modify asphalt emulsions for the chip seal application.

"It was necessary to have a comparison of performances of both polymers," said Mike Voth, pavement and materials technical leader for Federal Lands, who oversees the polymer study/report.

An important role in the study has been assumed by industry, he noted.

"Private industry has been a very good partner with us in this effort," Voth said, referring to both pro bono and at-cost laboratory work provided by the private sector. Materials from the NPS projects selected for the study have been sent to a number of private labs for testing and analyses.

Voth said that Chris Lubbers, former senior technical service engineer for BASF Corporation's construction polymers and now technical sales manager for the paving and roofing business unit at Kraton Polymers, was instrumental in securing a supply of SBS polymer-modified asphalt emulsion for the Crater Lake job. At BASF, which early on provided pro-bono funding and professional assistance, Lubbers had performed research and materials testing for the study, efforts he has continued after relocating his family to California and joining Kraton Polymers.

A Fair Comparison

Lubbers wanted to make sure the Crater Lake project utilized both SBS and SBR polymers to provide a fair comparison.

"The idea was to show the government agencies that we were not trying to promote a particular type of polymer, but to convince them that the use of polymer-modified asphalt emulsions in pavement preservation treatments would ultimately benefit everybody in the industry," said Lubbers."So it was necessary to hold off completing the study until it included a project employing SBS polymers," he added.

Results of the study are expected to help transportation officials choose appropriate pavement preservation treatments. Polymer-modified asphalt emulsions are increasingly being used to improve such treatments as chip sealing, micro surfacing and thin-lift overlays, but until this study, little information has been collected in one place on the proper use, application techniques and benefits of polymers in emulsion-based surface maintenance treatments.

In addition to providing a comparison of different polymer-modified asphalt emulsions, Crater Lake offered researchers an opportunity to study the products' performances in a climate markedly different from the hot and dry conditions experienced in other project areas, according to Federal Lands' Voth.

"We were concerned about the effects of ambient and pavement temperature fluctuations experienced in a cool, wetter climate," Voth said.

Crater Lake was a perfect test case for comparing climate and altitude effects on polymer-modified asphalt performance.

Emulsion is sprayed at the rate of 0.41 gallons per square yard, followed by chips being broadcast at the rate of 22.5 pounds per square yard.

Left: About 22 miles of roads around Crater Lake were chip sealed as part of a new National Park Service pavement preservation program.

The Perfect Climate

As described by NPS, the centerpiece of Crater Lake National Park lies in a basin called a caldera that was formed from the explosion and collapse of the center of a volcano more than 5000 years ago. As the floor of the caldera cooled, springs, snow and rain began to fill the basin. Evaporation and seepage balanced the incoming flow. Today Crater Lake measures up to six miles wide and has a maximum water depth of 1943 feet, making it the deepest lake in the U.S., the second deepest in the Western Hemisphere, and the seventh deepest in the world.

The Crater Lake chip seal project covered about 22 miles of two-lane, 22-foot-wide road. Included in the job were ten miles of Crater Lake Highway, five miles of the North Entrance Road, and six miles of West Rim Drive. The latter is part of Rim Drive, a 33-mile road encircling the lake that has elevations averaging between 7000 feet and 8000 feet above sea level. At this altitude, even in the middle of summer, daytime temperatures can average in the mid-80 degrees Fahrenheit and plunge in the evening to the low 40s. Furthermore, snowfall averages about 44 feet per year. It is an ideal climate to study and compare polymer-modified asphalt emulsion performance with that of, say, California's Death Valley, where a chip seal treatment was applied as part of the study.

While applying the chip seals in late July, temperatures were conducive to the process, according to FHWA's Chuck Luedders.

"We experienced average ambient daytime temperatures of 85 degrees and pavement temperatures of about 140 degrees during the seven days of construction," said Luedders. "At night, it got down to the 40s and 50s," he said. Temperatures dictated that they work each day between 10 AM and 6 PM.

Different Polymers, Same Specs

For the West Rim Drive portion, Santos' crews began work at the intersection with the North Entrance Road on the northwestern side of the lake, and proceeded southward to the Rim Village Visitor Center. The existing pavement consisted of hot mix asphalt that had been covered with a single chip seal application some years before. One section of road employed SBR latex-modified emulsion, the other SBS-modified emulsion. Application rates for aggregate and emulsions were the same for each section, as were compaction procedures.

A 4500-gallon BearCat asphalt distributor applied emulsions at the rate of 0.41 gallons per square yard, spraying a total of 520 tons. Western States Asphalt from their Pasco, Washington facility provided D. L. Santos with the SBR latex-modified emulsion. BASF Corporation supplied the SBR latex polymer to Western States Asphalt. SBS-modified emulsion was provided to the contractor by Albina Asphalt, with Dynasol US supplying the block copolymer to Albina.

Right behind the asphalt distributor, Santos' BearCat chip spreader broadcast 3/8-inch-minus aggregate at the rate of 22.5 pounds per square yard. They applied a total of 4000 tons of aggregate, which was supplied by Knife River Company of Medford, Oregon. The contractor compacted the material with HYPAC, HYSTER and BOMAG pneumatic rollers.

Luedders observed that the 1-1/4-mile-elevation influenced the emulsions equally.

"The high elevation affected them in that the cure time for both SBS- and SBR latex-modified emulsions was shortened," he said. "The contractor was able to put traffic on completed portions of the road in just 15 minutes following application."

He pointed out that crews completed about 1-1/2 miles of lane at a time, using flaggers to control one-way traffic. After a one-lane section was finished, they waited 15 minutes, allowed traffic on it, and returned to the beginning of the section to do the other lane. Production started on the project on July 20 and was completed July 30.

Finishing The Study

All construction materials from the Crater Lake project were sent to five private laboratories for pro-bono and at-cost testing and analyses: BASF Corporation, PRI Asphalt Technologies Inc., Paragon Technical Services Inc., Ultrapave, and Kraton Polymers.

Their work finishes the laboratory testing of field samples, providing data essential for the completion of the technology study. The final report is expected to be published before the end of 2009. ■

Federal personnel involved in the chip seal project, seen here flanked by Crater Lake, are Charles Luedders, P.E., FHWA program manager – pavement preservation; Steve Deppmeier, Federal Lands pavements engineer; and Kaha'a Rezantes, FHWA civil engineer.

A BearCat asphalt distributor sprays emulsion on Rim Drive, which surrounds the lake and runs between 7000 and 8000 feet above sea level.