



Pouring over details

Asphalt pavement stands up to northern Minnesota's extreme weather and attracts Hayes attention

By Allen Zeyher
Managing Editor

Density is usually a good thing in asphalt pavement. The more density, the better. Occasionally road builders want gaps in the asphalt, though, voids that make the asphalt layer permeable.

The asphalt lift on top of the concrete sub-base on U.S. 75, for example, was supposed to be permeable. Knife River Materials in Bemidji, Minn., was repaving the highway in northwestern Minnesota in 2012. The contractor did such a good job that it was awarded a Quality in Construction Award from the National Asphalt Pavement Association (NAPA), Lanham, Md.

The \$6.1 million project was named one of four finalists for NAPA's Sheldon G. Hayes Award for this year.

"The soil is clay up in that area, and moisture comes up from underneath the pavement," Jeremy Ganske, general manager

for Knife River, told *ROADS & BRIDGES*. He was describing the reason for the permeable asphalt course immediately on top of the concrete sub-base of U.S. 75. "That allowed it to drain off to the side instead of being trapped underneath the hot mix that's nonpermeable."

The concrete was left from the original construction of the highway. It was overlaid with asphalt in the early to mid-1990s, but in the brutal climate of northern Minnesota, that asphalt was seriously deteriorated.

"The cracks from the concrete were showing through, and it was just deteriorating and very rough," Ganske said.

U.S. 75 runs through farm country in Marshall County, Minn., where sugar beets are a primary crop and many of the 1,400 vehicles that use the road each day are agricultural trucks.

The problem for asphalt pavement is that the locale has, in Ganske's words, a "very, very heavy freeze-thaw cycle. We get feet of frost in the ground. It's as harsh as it gets for

pavement climate. We have hundred-degree heat in the summer, and we've been down to 40 below—regular temperature—this winter.”

The prime challenge for Knife River was the condition of the existing, deteriorated pavement.

“Whenever you have bituminous over concrete, it’s tough to determine how bad the concrete is underneath the bituminous that’s there,” Shawn Groven, a resident engineer for the Minnesota Department of Transportation (MnDOT), told *ROADS & BRIDGES*. “We always plan for having some full-depth concrete removals in conjunction with resurfacing over the old concrete.”

MnDOT’s plan was predictive.

“There was a fair amount of that type of work,” Groven said, “where we had to tear out the old concrete, put in some aggregate base, patch in some asphalt and then pave over it.”

Trickle-down pavement

The permeable base of 1½ in. over the concrete base had another purpose, which was to limit cracking.

“We’ve found up in our district that by using a porous asphalt as the bottom, or the first layer over concrete, helps to prevent reflective cracking from the existing concrete joints,” Groven said.

“Maximum size of the aggregate was an inch and a half on the permeable lift,” Ganske



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added, “and then it was graded on down to ¼-in. rocks.” The asphalt cement used in the permeable lift was a performance graded (PG) 64-22. “When it hardens, it creates a matrix of rocks that has voids in it. It’s like a popcorn structure. You have to wait until it cools to 150° and then use steel drum only,” and no vibration, Ganske said, to compact it, from a temperature of 280-300° F behind the screed.

Knife River used a Caterpillar AP1000 paving machine working with a windrow elevator, so no asphalt trucks bumped the paver or made it stop and wait to be reloaded. The two-lane width of the roadway required two passes from the paver. The plant that produced the mix was located about 22 miles from the jobsite, an average haul distance for Knife River, so nothing unusual there.

It is a somewhat rare sort of asphalt mix, though.

“We’ve done a couple jobs before. It’s pretty rare that we have the opportunity to do it,” Ganske said, but the crew was comfortable

with handling the permeable mix.

Another complication of the permeable mix was keeping traffic off of it long enough to place the next lift over it.

“It’s a real sticky material,” Groven said. It is very easy to get “tire pickup,” when the tires of a passing vehicle pull stones out of the pavement, and then “it starts to ravel a little bit.”

The basic plan for dealing with traffic was to close the road except to local traffic and use flaggers and pilot cars to get traffic through the project on one lane.

“Basically, traffic alternates turns to go through the construction area,” Ganske explained. “And then we had it open to two-lane traffic at the end of each night, local traffic.”

The lift Knife River hurried to place over the permeable lift was actually two lifts totaling 3½ in. of a Superpave hot mix with ¾-in. maximum aggregate size and PG 58-34 liquid asphalt cement, which is a more flexible oil than what MnDOT uses on everyday projects. Normal would be PG 58-28.

“The basic reason is so the cracks in the concrete don’t show through,” Ganske said. “They want more flexibility to reduce transverse cracking.”

Knife River tested the mix frequently.

“We have to take mix from behind the paver, take it back to the plant and then test it and meet all the DOT requirements” for aggregate properties, Ganske said. They took a sample every 2,000 tons. The project required a total of 65,000 tons of the wearing course and 25,000 tons of the permeable base.”

“That’s the QC part of it,” Groven added, “and the QA is they have to pull a verification sample on every sample that they pull for themselves, and we randomly choose one of theirs per day and have it sent to our district lab to have it tested and compared to their results.”

Better than one

Placing the asphalt in two lifts instead of one helps with smoothness and with density.

“The ride is much better on thinner lifts



Knife River used Ingersoll Rand DD158 steel-drum rollers for intermediate and finish compaction after using a Cat 360 rubber-tire roller for the breakdown function and achieved 89% of the available bonus for smoothness and 98% of the available bonus for density.



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Knife River milled off the old asphalt, laid a 1½-in. permeable base and then 3½ in. of Superpave mix in two lifts with ¾-in. aggregate and PG 58-34 liquid asphalt cement over 16.8 miles of U.S. 75 in Marshall County, Minn., at a total bid cost of \$6.1 million.

than thicker lifts," Ganske said. Plus, it is easier to get good compaction with two thin lifts than one thick lift. When the paving operation was complete, a profilograph verified the result. The tactic worked.

"We basically just follow best practices for ride, using averaging beams and good operators," Ganske said. "We achieved 89% of the available bonus [for smoothness] and 98% of the available bonus for density."

Knife River averaged around 94.5% density, with 93% required for full pay and 94.6% for the maximum bonus pay. The company used Ingersoll Rand DD158 steel-drum rollers for intermediate and finish compaction after using a Cat 360 rubber-tire roller for the breakdown function. Vibration aided compaction at the intermediate and finish rolling stages.

Attention to detail

This particular Knife River crew was well familiar with going for the bonus.

"This exact same crew the prior year had a project that was one of the seven finalists for this award," Ganske said.

"They're a great crew. It boils down to attention to detail. They do all the small things right."

The crew has a lot of experience, but importantly, the members also are willing to share their experience with the new guys.

"It's a combination of experience and being willing to share that experience with new members of the team," Ganske said. "It's very hard to find experienced people. You've got to hold onto the good people you have." At the same time, "You have to continuously strengthen the bench."

"The biggest challenge was the poor condition the road was in, and just the amount of effort and detail that the crew put into improving the ride and quality of this road by such a large margin was exceptional," Ganske summed up. "From start to finish, from labor to paver operator to plant operator, they all really paid attention to detail. When you pay attention to detail from start to finish, the result is a project like this, with quality control, with rolling, with paving, with cleaning the road, with everything. Attention to detail was everyone's top priority on this project."

"Like my chief inspector said," Groven added, "it was a job that they really seemed to care about." **R&B**

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