



Fighting a beating

Congested hot-mix asphalt intersection in Maryland shows little signs of wear-and-tear

by **Dan Brown**

It's the kind of challenge seldom seen in the highway construction business. Faced with a rutting problem on some aging pavements, the Maryland State Highway Administration (SHA) decided to compare the performances of hot-mix asphalt (HMA) and portland cement concrete (PCC).

In 1994, the SHA gave the HMA and PCC industry one intersection each—both along U.S. Route 40 in north-eastern Maryland—and charged them

especially during Maryland's hot summers, produce a high potential for a rutted pavement. What is more, Route 40 sees a number of freeze-thaw cycles in the winter. The estimated equivalent axle loadings through the year 2014 is 12,744,000.

Each industry selected its own pavement design. The HMA industry chose two Superpave mixes to use in rebuilding its intersection, the corner of Route 40 and Maryland Route 213

and nights. Without counting the cost of user delays, the PCC pavement cost \$104.25 per sq yd. In contrast, the HMA cost \$36.11.

The performance results: the HMA pavement is still in place and performing well, while the PCC began cracking in 1998 and had to be saw-cut and removed last summer.

Taking over

The whitetopping had been placed for a distance of some 800 ft in the passing and travel lanes of the east-bound side of Route 40.

"Cracking in the whitetopping was first evident in 1998, and it continued to deteriorate through 1999," said Brian Dolan, president of the Maryland Asphalt Association.

"The concrete was spalled and cracked in many areas of the 800-ft-long section," added Scott Kiebler, project manager with T.C. Simons Inc. Transverse joints were installed at 40-ft intervals in the concrete. "Almost every joint was cracked, and there were areas where the whitetopping had failed between the transverse joints," said Kiebler.

In the latter part of July 2000, T.C. Simons Inc. hired East Coast Concrete Cutting, Baltimore, Md., to saw-cut the concrete. One lane was closed at a time to allow the sawing contractor space to work. "We sawed each 12-ft-wide lane down the middle," said Kiebler. That made 6-ft-wide strips of concrete. Then East Coast cut the concrete across the lanes at 8-ft intervals, making 6- x 8-ft slabs of concrete. The total area of saw-cut concrete was 800 x 24 ft.

Then at 7:00 p.m. on Aug. 1, 2000, T.C. Simons began concrete removal. "I submitted a traffic plan to shut down the travel and passing lanes and to shift traffic onto the deceleration lane on the right side," said Kiebler.

The entire removal and repaving operation took less than 24 hours.

"We used two Gradall XL-4100



Faced with a rutting problem, the Maryland State Highway Administration decided to compare the performances of hot-mix asphalt and portland cement concrete by giving each industry one intersection to rebuild along U.S. Route 40.

with rebuilding the two intersections. Traffic gives Route 40 a beating. It has an average daily traffic of 29,200, including 12% trucks. The four-lane highway has right- and left-turn lanes, and it runs through suburbs with traffic lights every half-mile or so. All those trucks sitting at traffic lights,

near Elkton, Md. The PCC industry rebuilt the adjacent intersection of Route 40 and Landing Road using 6½ in. of unreinforced whitetopping over existing pavement.

In 1994, T.C. Simons Inc., Fallston, Md., laid 15,000 sq yd of new HMA pavement in 11 nights, working from 7:00 p.m. to 6:00 a.m. with little disruption to traffic. The PCC contractor installed about 1,800 sq yd of pavement, working around the clock for 12 days

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excavators with stripping buckets,” said Kiebler. “We picked up the concrete slabs and stacked them into eight tandem-axle dump trucks.”

Concrete removal took just six hours.

Under the whitetopping was a 1-in.-thick course of HMA that acted as a bond breaker.

“We milled out the bond breaker in four hours with a Caterpillar 465 milling machine,” said Kiebler. “Then at 7:00 a.m. we started paving.”

Simons’ paving operation consisted of one Barber Greene 225 paver fed by six tandem-axle end-dumps hauling HMA.

“We paved 12 ft wide and laid down two lifts at a 4-in. depth to make the 8 in.,” said Kiebler.

The mix design: a Superpave with 25 mm top size aggregate and a PG 70-22 grade of asphalt cement. Compaction was handled with two Ingersoll-Rand rollers, a DD-90 and a DD-110. Paving took just eight hours, and by 5:00 p.m. on Aug. 2 the pavement was opened to traffic.

“At a later date we topped that with a 2-in. surface course of Superpave (12.5 mm top size aggregate) and PG 76-22



The hot-mix asphalt industry chose two Superpave mixes to use in rebuilding its intersection, the corner of Route 40 and Maryland Route 213 near Elkton, Md.

Today, the estimated design loading at both intersections is between 10 million and 30 million ESALs (equivalent single axle loadings) over the

evaluations made at different points in time by SHA officials addressing the performance of the Superpave intersection built in 1994.

Two years after construction, here’s what John Knight, the SHA’s district maintenance engineer, had to say: “With two years’ service and close monitoring of the pavements, we’re very pleased with the performance of the HMA project. In fact, it still looks real good, just like the day we put it down. There’s no noticeable rutting.

“The HMA section has performed so well that we’ve just recently reconstructed another troubled intersection along I-95 adjacent to a truck stop using the same design considerations. We think we’ve found the solution to our rutting problem while maintaining all the advantages of HMA construction,” Knight concluded.

“This (HMA) material has been down for over five years and I really am impressed with how well it’s performed,” said Mike Lewis, a Maryland state resident engineer, in 1998. “It’s been a real good solution. I haven’t had to be out here in the last five years to do any maintenance. We have done no milling to the intersection, and if you look at the intersection today you can see there’s no evidence of rutting anywhere.”

“The HMA intersection is still out there and performing well,” said Sam Miller, head of the Materials Division, Maryland DOT.



“With two years’ service and close monitoring of the pavements, we’re very pleased with the performance of the HMA project,” said John Knight, SHA district engineer.

grade of asphalt cement,” said Kiebler. “That mix was polymer-modified.”

The removal of the whitetopping and the reconstruction was part of a \$4.5 million project that included various safety improvements along U.S. Route 40.

20-year design life of the pavement, said Dolan.

As good as new

Meanwhile, the HMA at the Maryland 213 intersection has performed very well. The following are three



Gradall excavators with stripping buckets were used for concrete removal.

Early decisions

A good deal of planning and design work went into the HMA project. With the challenge in hand, the HMA industry formed a small task force composed of representatives from the Maryland Asphalt Pavement Association, the National Asphalt Pavement Association and the Asphalt Institute. The goals of the task force were to determine how much of the existing 8 in. of HMA should be removed, the new mixes to be used and a construction schedule.

Extensive materials testing was conducted prior to construction. The Superpave mix designs developed at the Asphalt Institute in Kentucky were replicated at the Koch Materials laboratory in Pennsauken, N.J. Samples of the proposed mixes were sent to Koch's laboratory in Terre Haute, Ind., where Hamburg Wheel Tracking Tests confirmed that the proposed mixtures were quite rut resistant.

HMA officials felt that it was important to know the exact depth of rutting in the existing pavement. Existing data showed the pavement consisted of 8 in. of HMA over 9 in. of PCC. But to learn how deep the rutting went, a 1-ft cut was taken out of the travel lane on Route 40 and one core was taken from each of the four eastbound lanes.

The cores confirmed the expected pavement thickness. The cut taken from the eastbound travel lane showed that rut depths extended to 6 in. or more. In the eastbound lanes, rutting was evident 835 ft back from the stop bar, and extended for an additional 435 ft through the intersection.

The scope of the original project was reduced somewhat to meet budget. On



Tests confirmed the HMA mix was quite rut resistant.

eastbound Route 40, total removal of 8 in. of HMA would take place only in the travel, passing and right-turn lanes. The left-turn lane was to have 5 in. removed. The westbound lanes, which had appreciably less rutting, had only 2 in. removed from the travel, passing and left-turn lanes. The right-turn lane

had failed structurally, so 5 in. were removed.

Contractor T.C. Simons Inc. replaced the milled pavement with 3-in. lift(s) of base course and one 2-in. lift of surface course. Changes to the initial plan were agreed upon by both the SHA and the HMA industry when the SHA agreed to use only the east-bound travel and passing lanes when making comparisons between HMA and PCC.

Increasing the dosage

HMA officials decided to use two Superpave mix designs, a base mix with 25 mm top size aggregates and a



The paving operation consisted of one Barber Greene 225 paver.



Concrete removal took just six hours.

surface mix with 19 mm top size aggregates. The task force decided to “bump up” the Superpave-recommended grade of asphalt cement from PG 64-22 to a PG 76-22 to correct for standing traffic.

The selection of the coarse gradation for the base mix was an effort by the task force to use as high a percentage of large aggregate in the mix as possible. More large aggregate in an HMA mixture creates more stone-on-stone contact and gives the mixture a stronger structural framework. After testing three trial mixes in T.C. Simons Inc.’s parking lot, the project team decided to use 4.6% asphalt cement in the base course and 4.9% in the surface course.

Following construction, both the HMA and PCC pavements were tested for smoothness with a profilograph. The results: the HMA pavement had values more than twice as smooth as the PCC test section. And more than one year after the paving was completed, the results were the same: no rutting. R_B