CONSTRUCTIONEER

New Jersey DOT’s Route 46 Paving Concludes Nationwide Field Demonstrations
New Jersey DOT’s Hosting of Advanced Hot Mix Asphalt Placement on Busy Arterial Cuts

Riverdale cold feed bins supply virgin aggregate to drum mixer for Route 46 project. Mix also used 15 percent recycled asphalt pavement.
With the recent paving of Route 46 in the Clifton area, the New Jersey Department of Transportation (NJDOT) became the final state agency to install asphalt pavement overlay containing highly polymer modified asphalt (HiMA) binder as part of a program of nationwide field demonstrations. The program was initiated to advance pavement preservation practices.

Pavement preservation calls for treating pavements while they are still in good condition, before the onset of serious damage. Essentially, it calls for the placement of a protective cover on an existing, structurally sound pavement. This treatment postpones costly rehabilitation and reconstruction.

Examples of preventive treatments include asphalt crack sealing, chip sealing, slurry or micro surfacing and thin asphalt overlay. Studies show that the benefit-to-cost ratio for pavement preservation treatments such as these far exceeds that of reconstructing a road that has been allowed to decay too long.

Polymers Hike Pavement Performance

As the use of pavement preservation treatments by state and municipal transportation agencies has grown, so has the development of products aimed at boosting the effectiveness of these methods. Polymers are among the products used increasingly in asphalt mix paving for this purpose. When blended with liquid asphalt binders, polymers increase the durability of hot mix by improving its resistance to cracking, rutting and raveling. In addition, adding more polymer yields even more benefits – to a point. There is a practical limit to polymer dosage.

Usually, as polymer content is increased to more than 3 percent, binder viscosity increases, making it more difficult to produce asphalt mix in the plant and diminishing workability for the paving crew.

But polymer used in HiMA binder, such as that used in the New Jersey demonstration, is Kraton D0243, a new styrene-butadiene-styrene (SBS) product developed and manufactured by Houston-based Kraton Performance polymers, Inc. This product does not increase binder viscosity even in polymer dosages more than twice the conventional dosage.

AASHTO TSP2 Program Participants

In addition to the NJDOT; New Hampshire DOT; Vermont Agency of Transportation; Minnesota DOT (MnDOT) and Oregon DOT (ODOT) have held demonstrations using HiMA binder in overlay applications.

For the demonstration program, commonly referred to as the AASHTO TSP2 thin lift program, each HiMA mix overlay was placed adjacent to a state DOT’s concurrent conventional overlay to facilitate performance evaluations. The same local contractor installed both mixes in each demonstration.

Although the program was initially intended to showcase thin overlays (typically 1 inch) two agencies chose to install a 2 inch overlay to allow comparison to a concurrent conventional overlay. MnDOT, a member of the Midwestern Pavement Preservation Partnership (MPPP), and ODOT, a member of the Rocky Mountain West Pavement Preservation Partnership (RMWWPPP), decided to incorporate HiMA in sections of their regular maintenance overlay contracts. These agencies employed their own asphalt mix designs but substituted HiMA binder for their usual binder.

Tilcon Proposes, NJDOT Agrees

The success of the AASHTO TSP2 program relied on the collaborative efforts of many organizations and individuals. Among these were pavement preservation groups, academic and industry researchers, materials suppliers, the host DOTs, and the paving contractors, who needed to be professionals with the experience and resources necessary to create a product true to the intent of the planners.

For the Route 46 demonstration, that contractor was the New Jersey Division of Tilcon New York Inc.

Tilcon had a contract with the NJDOT for the 2 inch mill-and-fill of a congested section of Route 46 near Clifton. Travel volume for the highway falls within a range of between 3 and 30 million ESALs (equivalent single-axle loads of 18,000 pounds). The divided four lane highway, with two 12 foot lanes in each direction, had an asphalt pavement scarred by excessive cracking and potholes.

Key Tilcon personnel for demonstration: Richard Linton, left, Tilcon’s Quality Control Manager and Scott Laudone, Tilcon New Jersey General Manager.
Scott Laudone, Tilcon New Jersey General Manager, having been apprised of the AASHTO TSP program by a Kraton representative (see accompanying sidebar), spoke with NJDOT officials regarding the possible use of the Route 46 mill-and-fill project as a candidate for the demonstration.

NJDOT officials agreed to the demonstration, with one stipulation. They wanted to use their own specifications for both the conventional overlay and the trial mix, but substitute HiMA binder. Plans for the demonstration, which would involve a 6,000 foot, one-lane section of highway, were undertaken.

Crafco Supplies ‘Boutique’ Binder

NJDOT’s conventional overlay, labeled M76, consists of a well-graded 12.5mm (½ inch) stone and a PG76-22 asphalt binder. It includes 15 percent recycled asphalt pavement (RAP), which contributed 0.8 percent of the 5.5 percent asphalt binder. The trial mix adhered to the same specs but substituted HiMA binder. Plans for the demonstration, which would involve a 6,000 foot, one-lane section of highway, were undertaken.

HiMA was achieved with approximately 990 tons of HiMA mix to be produced at Tilcon’s CMI plant in the Town of Riverdale.

About 990 tons of HiMA mix was to be installed on Route 46. The aggregate for both mixes was broken granite stone and unweathered stone sand. Unfortunately, since a relatively small amount of HiMA binder would be needed, a supplier would have to be located that would agree to produce the small quantity of pre-blend HiMA and ship it to the Riverdale plant.

Before the HiMA mix could be produced, Crafco was contacted to see if the company was willing to produce the custom blend asphalt binder. Crafco agreed.

“For the Tilcon project we were asked to take a 52-28 asphalt, thin it to reach a penetration below 200, then blend in 7.5 percent Krayton polymer,” said Tom Kelly, National Sales Manager for Crafco’s Highway Products division.

“We provided 70 tons of this high polymer modified binder to Tilcon,” he said. He added that Crafco produces many custom blend products, including boutique binders for hot mix producers who need to meet special requirements of some transportation agencies.

HiMA Mix Behaves Differently

Before the HiMA mix could be produced at the Riverdale plant, the binder had to meet the approval of Richard Linton, Tilcon’s Quality Control Manager.

Linton noted the HiMA mix in the lab behaved differently from the M76 lab mix.

“Differently, but actually better than the M76 mix,” Linton said. “But not at first.”

“We compacted the M76 lab mix at 310 degrees Fahrenheit, which is in the allowable range for a PG 76-22, and got a reading of 3.4 percent voids,” he said.

When they compacted the HiMA mix at that temperature, he said, it recorded voids at 2.8 percent, too low a reading. However, Kraton Representative Peter Montenegro advised them to lower the temperature for the HiMA mix compaction to that normally used for a mix containing a PG 64 binder. When Tilcon compacted the HiMA mix in the lower specified range, it registered a voids content of 3.4 percent. In other words, the HiMA mix was behaving physically like a mix with a PG 64 binder. Additionally, the binder actually handled and pumped like a PG 64, according to Linton.

Paving Crew Likes Improved Workability

The installation of the HiMA mix was scheduled to take place on the night of September 24 and 25, 2013, between the hours 8 PM and 6 AM.

According to Ken Ryan, Tilcon’s Quality Assurance Specialist, the condition of the road after crews milled off two inches of existing pavement was good. He said delivery trucks arrived after a 40 minute haul from the plant with asphalt mix showing temperatures between 320 and 335 degrees.

Tilcon employed a ROADTEC SB2500D material transfer vehicle to accept mix from haul trucks and convey the material to their ROADTEC RP19S paver. Temperatures directly behind the screed ranged between 295 and 305 degrees.

Two CAT CB64 steel rollers performed compaction. The rollers made a total of ten passes—six by breakdown roller operating in vibratory mode, and four by the finish roller in static mode. The breakdown roller was on the mat immediately after the paver, at approximately 290 degrees, while the second roller achieved final density of 95 percent at 180 degrees, and finish rolled at 130 degrees.

“We found that the density with the HiMA was achieved with approximately the same number of passes as our standard 76-22 oil,” Ryan said. “The crew did like the improved workability that it seemed to offer.”

A Unique Demonstration Program is Created

The NJDOT and Tilcon NY/NJ represent the final contributors of HiMA paving data for the AASHTO TSP2 thin lift asphalt program. The two join with the New Hampshire DOT, Vermont Agency of Transportation, Minnesota DOT, Oregon DOT and their respective contractors placing HiMA thin lift pavements to generate testing data of the actual plant mix used on the paving jobs. All test data is published on the AASHTO TSP2 website managed by the National Center for Pavement Preservation (NCPD) at Michigan State University. Pete Montenegro, Market Development Manager at Kraton Performance Polymers, initiated the design of an AASHTO TSP2 thin lift asphalt paving program utilizing the Kraton SBS HiMA polymer with the NCPP in the summer of 2010. The NCPP surveyed their four, regional groups of DOTs regarding interest in utilizing HiMA technology for pavement preservation and determined that there was considerable dialogue by the Northeast Pavement Preservation Partnership (NEPPP) members in particular.

The NCPP and Montenegro engaged Dr. Waha Mogawer, P.E. at the University of Massachusetts Dartmouth and his Highway Sustainability Research Center to manage the development of a regional HiMA thin lift asphalt paving specification for the NEPPP. Officials from nine DOTs in the NEPPP completed the work with Dr. Mogawer in 2010. Eileen Sheehy and Robert Blight participated on behalf of the NJDOT in the design process with Dr. Mogawer. The specification contains substantial performance-based testing as part of the HiMA research.

Field paving commenced in 2011 with Montenegro coordinating the administrative and technical support from Kraton. DOT budget shortfalls and weather events pushed the AASHTO TSP2 planned fieldwork into 2012 and 2013. Montenegro created a Kraton team approach for supporting the agencies and their contractors over the two year span. He directed the professional assistance of Mr. Chris Lubbers, technical sales manager, and Dr. Bob Klutz, chief asphalt chemist. Dr. Mogawer and his staff collected sample mix at the project sites for testing at their lab in Fall River, Massachusetts.

Once testing is completed, the NJDOT HiMA data will be published on the AASHTO TSP2 website alongside the data from the four other participating states. There are job stories and a video documenting the AASHTO TSP2 program in addition to the draft regional specification and the testing results; www.tsp2pavement.pavementpreservation.org/research.