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GEORGIA DOT CHOOSES HIGHLY MODIFIED ASPHALT FOR BUSY INTERSECTION

C.W. Matthews places Superpave overlay containing a new SBS high polymer modified binder to resist rutting at Routes 138/155 junction in Henry County

By Paul Fournier

A new type of asphalt binder that was developed to improve pavement durability and resistance to rutting and shoving is being tested by the Georgia Department of Transportation (GDOT) at the junction of two busy state highways in Henry County.

GDOT approved the substitution of Kraton highly modified asphalt binder (HiMA) for the binder originally specified for a Superpave hot mix overlay that was recently installed by C.W. Matthews Contracting Co., Inc. at the intersection of Routes 138 and 155 in Stockbridge.

The agency is concerned about pavement rutting and shoving at the intersection, which is located at the foot of a hill and experiences repeated hard braking by motorists. Vehicle travel has risen dramatically in recent years in Henry County, which is part of the fast-growing Atlanta Metropolitan Area, while Stockbridge is the county's largest city.

"The population has been growing in the Stockbridge area, and those two state highways serve as corridors to several Interstates," said Peter Wu, P.E., who is responsible for technical assistance in GDOT's Office of Materials and Research. "This means there's a lot of traffic going through that intersection – about 25,000 vehicles a day – and about 1,400 of those are trucks," he said. Wu explained that paving was part of a larger contract awarded to C.W. Matthews to reconstruct the intersection, including widening and adding turning lanes in each direction. He added that specifications originally called for a Superpave overlay using a performance graded PG 76-22 asphalt binder but GDOT area office personnel agreed to allow the use of HiMA at the request of C.W. Matthews on behalf of Kraton Polymers LLC, which developed and manufactures its newest SBS polymer modifier and wished to demonstrate its effectiveness.



A ROADTEC RX500 is used by C.W. Matthews Contracting to mill pavement during night project in Stockbridge, Ga.

Mommy, Is It Getting Better Yet?



We are sliding into the fourth quarter of 2010. It hasn't been a great year for many – the media and divorce court seriously chewed sports figures up; actors and actresses fell prey to the same carnivorous monsters; the entertainment press started publishing "The 10 worst movies of 2010 – so far;" unemployment numbers are either static or up depending on the source; construction spending is down as is construction employment and equipment sales; summer brought with it record-breaking heat waves; but we still go on. School is back in session; the November elections are right around the corner; Thanksgiving and Christmas are rapidly approaching; the Highway Trust Fund Bill comes up for re-renewal.

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Georgia DOT Chooses Highly Modified

ASPHALT

For Busy Intersection

*Owner: Georgia Department of Transportation
General Contractor: C.W. Matthews Contracting Co., Inc.*



Equipment pieces are ready to go for the night shift paving of busy Routes 138/155 intersection in Henry County's largest city.

Page 3: C.W. Matthews' Astec plant in Stockbridge, Ga., produces hot mix asphalt containing highly modified asphalt binder (HiMA).

Specifying Superpave

GDOT had specified Superpave with the PG 76-22 binder because of the type of traffic seen at the Routes 138/155 intersection, said Wu.

Superpave (from Superior PERforming Asphalt PAVements) is a hot mix asphalt design system resulting from the \$150-million Strategic Highway Research Program launched in 1987 to improve performance, durability, safety, and efficiency of the Nation's highway system. Superpave consists of a performance graded asphalt binder specification, a hot mix asphalt design method, and tests and performance prediction models. GDOT's Superpave specifications for the Routes 138/155 intersection require a PG 76-22 binder, a designation that means the asphalt binder must perform satisfactorily under anticipated traffic throughout a range of plus 76 to minus 22 degrees Celsius (plus 169 degrees and minus eight degrees Fahrenheit).

A PG 76-22 designation also indicates the asphalt binder is modified with an additive. Following a practical guide used by engineers and asphalt producers, when the difference between high and low temperatures exceeds 90 degrees Celsius, a modifier to the asphalt binder is usually required. This modifier is often a polymer because polymer modifiers extend the effective temperature range of a binder. They also help prevent stripping of asphalt from aggregate, and improve resistance to rutting that can be caused by high temperatures and thermal cracking created by low temperatures.



GDOT approves use of HiMA at an intersection located at the foot of the steep hill which experiences repeated hard braking by motorists.

Raising The Threshold

Adding more polymers usually increases the desirable qualities of a binder. However, there is a point of diminishing returns – generally around three percent. Beyond this threshold, adding more polymer to the asphalt may boost some desirable mix qualities but also increases viscosity, making hot mix asphalt difficult to produce at the plant and increasingly unworkable for paving crews. It also adds to the up-front costs of manufacturing and laying down the hot mix asphalt. Chemists at Kraton Polymers believed these problems could be overcome by modifying the structure of conventional styrene-butadiene-styrene polymer (SBS), to produce asphalt binders that have increased durability while reducing costs through thinner pavements.

To further this line of thought, in 2004 Kraton Polymers researchers joined with those at the Engineering Section of Delft University of Technology, the Netherlands' largest and oldest public technical university, to investigate whether SBS modification of base layers of pavement would increase service life and/or enable layer thickness reductions of the asphalt pavement. Following several years of experimenting and testing, researchers developed a new variation of SBS polymers that could produce the desired results.

In June 2009, Kraton Polymers also engaged the National Center for Asphalt Technology (NCAT) to build a thinner pavement to further field test the highly modified pavement design. The design incorporated a 7.5-percent SBS polymer modified binder at 20-percent thickness reduction. This study is a two-year trial and is expected to demonstrate the improved durability relative to standard thickness pavement designs.

"The new variations can be added to asphalt binders at quantities of between seven and eight percent," said Robert Kluttz, a chemist at Kraton. "We learned that the proven performance of SBS modified asphalt in wearing courses could be extended to base courses." Kluttz said that employing modified SBS binders, now referred to as HiMA, requires no changes to a conventional mix plant or construction procedures, improves pavement durability and enables designers to reduce the thickness of hot mix asphalt pavement base courses. Thinner base courses result in savings in energy costs and natural resources, which more than offset the higher initial cost of HiMA, he said.

Up To The Task

For the Routes 138/155 intersection project, GDOT specified a Superpave design with 1-1/2-inch compacted pavement thickness and a dense gradation using 12.5-mm (½-inch) maximum aggregate. The crushed granite stone was supplied by Vulcan Materials' quarry, located next to C.W. Matthews' Astec double-barreled plant in Stockbridge where the HMA was manufactured.

The HiMA binder was produced by Ergon Asphalt & Emulsions Inc. at its plant in Bainbridge, where the improved SBS polymer supplied by Kraton Polymers was mixed with Ergon's liquid asphalt binder. According to Robert Kluttz, the finished binder contained 7.5 percent by weight of the SBS variation, which is designated Kraton D0243 polymer.

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Mix containing highly modified SBS binder leaves plant at approximately 325 degrees Fahrenheit.



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Kluttz pointed out that since the depth of the overlay had already been set for the intersection project, this demonstration would not prove that the HiMA binder could reduce the thickness of the pavement. But it would show, he said, that HiMA binder is feasible for this type of application and can outperform the conventional PG 76-22 binder when subjected to the same type of traffic.

Ergon shipped the HiMA binder to C.W. Matthews' Stockbridge plant for the production of the Superpave mix to be used at the intersection project. According to Andrew Brooks, P.E., C.W. Matthews' general manager of quality control, the binder easily met GDOT's requirements for PG 76-22 binder when tested at the contractor's fully equipped laboratory.

"We can test the quality of many binder performance grades, and this HiMA binder actually met the requirements for the PG 82-28," he said. Mix was produced in the Astec plant at approximately 325 degrees Fahrenheit and hauled 10 miles to the job site where it was placed by the paving crew at about 315 degrees. Brooks said the plant operator indicated the binder reacted similarly to an unmodified PG 67-22 binder during the manufacturing process.



Contractor employs a ROADTEC SB-2500D shuttle buggy to feed material to a ROADTEC RP-190 spreader paving machine.



As day fades into dusk, a Kenworth tractor/trailer picks up first load of hot asphalt mix.

Laying Mix And Following Up

Before paving, Matthews' crew milled off 1-1/2 inches of existing pavement using a ROADTEC RX500 milling machine. Paving took place at night. The contractor employed a ROADTEC SB-2500D shuttle buggy to accept mix from haul trucks and feed the material to the paving machine, a ROADTEC RP-190 spreader. Three rollers compacted the mix: a 14-ton CAT CB634D vibratory roller with a seven ft. drum performed breakdown rolling; a 14-ton CAT PS150C pneumatic roller followed and an 11-ton CAT CB534D static roller with a 67-inch drum did the finish rolling.



Three CAT rollers compact mix: a CB634D vibratory roller, a PS150C pneumatic roller, and a CB534D static roller.

Brooks said sample cores taken from the finished pavement met GDOT Superpave compaction specs that required 93 percent of theoretical specific gravity, or stated differently, seven percent air voids.

Peter Wu said a GDOT technical representative at the job site observed that the HiMA mix appeared to have similar workability as the regular SBS modified mix it replaced. Wu said the department would closely monitor the performance of the new mix design over the next few years. 🚧