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TELL IT TO THE MARINES:

Porous Warm Mix Goes On Parade

An innovative warm-mix design eliminates fibers from porous asphalt

By Tom Kuennen

An innovative warm-mix asphalt design for a porous asphalt pavement at the U.S. Marine Corps Parris Island, South Carolina, Recruit Depot eliminated fibers often used for stability of the open-graded mix, while giving the Marine Corps a “green grinder,” or parade ground, it can be proud of.

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The porous asphalt design also eliminated the expense of creating a detention pond and associated environmental requirements.

Porous asphalt pavement is an environmentally sustainable infrastructure design that helps property owners manage storm water effectively and inexpensively.

Typically, a porous asphalt pavement will be composed of, from the bottom, an uncompacted soil subgrade which will optimize infiltration of water into the aquifer; a geotextile fabric that will permit water to pass but preclude movement of fines up into the structure; a stone recharge bed with same-sized aggregate and 40 percent voids; an optional stabilizing or “chocker” course of single-size crushed stone smaller than that in the recharge bed; and an open-graded asphalt surface with 20 percent voids that permit storm water to flow through the pavement into the stone recharge bed.

**Porous Design Saved Money**

The porous asphalt pavement design saved taxpayers money. A conventional paved surface would have required additional construction of a detention pond from which storm water would have been discharged into the surrounding swamps. A porous concrete alternative would have created a budget overrun and caused the ribbon cutting of the barracks to be delayed.

In addition, new regulations required that any drainage alterations of the existing site – such as for a detention pond – would have to return the site to original condition, requiring a costly, extensive document search for decades-old site surveys, which was precluded by use of the porous pavement.

"Instead of having catch basins and retention ponds to hold the runoff, this project will allow rain to pass through the asphalt, through stone layers, through a permeable fabric, and sink into the soil naturally," said Gordon L. Wright, quality control manager, Rea Contracting LLC, a division of The Lane Construction Corp. "It saves having to install storm drains, cleanouts, pipe, and construction of detention ponds. It not only saves money for the taxpayer, but represents environmentally sustainable construction."

Building the 'Green Grinder'

Porous asphalt pavements let water drain directly into a recharge layer below, and the air-void target is 20 percent. The "green grinder"

And to top it off, use of a warm-mix asphalt additive permitted an open-graded mix without the addition of mineral or cellulose fibers to prevent drain-down. Drain-down, the phenomenon in which liquid asphalt cement migrates to the bottom of a load of asphalt, or in a lift of asphalt during placement, is a special concern constructed at Parris Island in May 2011 was not intended to reduce spray, hydroplaning or noise – like open-graded friction courses for highways – but simply to provide the most efficient means of draining water from the paved surface and into the soil, while avoiding conventional detention ponds.
Porous Warm Mix continued

The Parris Island porous asphalt pavement was placed 2 inches deep in parallel, same-direction “pulls” atop a 2-inch choker layer and a 6-inch-deep recharge layer of #57 stone. This structure rested on a geotextile fabric intended to mitigate migration of fines from soil upward to the recharge layer. The complete pad was 330 by 380 ft. in size, with approximately 1,500 tons of porous asphalt being placed.

A material transfer vehicle (MTV) was used in paving to protect the recharge bed from disruption by heavy trucks. The vehicle ran beside the paver on sheets of plywood placed in strips to match its wheel base. If the MTV needed recharging at the end of a pull, the dump truck used the same plywood strips. As the MTV and paver moved forward, the plywood sheets were moved into position for the next pull, all of which required a larger-than-normal crew.

“They wanted to be able to make one pull at a time without disturbing the gravel base,” said Dean Frailey, business development manager, MWV Asphalt Innovations. “They were concerned that trucks would leave tire grooves in the choker layer, which despite being compacted lightly, is an unstable thing.”

Warm Mix Makes It Greener

In addition to the parade ground’s ability to filter water into the ground, the project’s “green” status was enhanced by use of a low-energy, low-emission warm-mix asphalt design that enabled workability long after the mix had left the plant. The elimination of fibers from the Parris Island mix was achieved by use of a warm-mix asphalt additive, Evotherm 3G from MWV Asphalt Innovations.

Most warm-mix processes generally enable the complete coating of aggregates at temperatures 35 to 100 degrees F lower than conventional hot-mix asphalt. Warm-mix technologies reduce compaction challenges associated with cooled mixes or cold weather, decreasing the risk of failed compaction with stiff mixtures.

PG Binder Required

At the Marine Boot Camp at Parris Island, the U.S. Army Corps of Engineers did not have a specification for an open-graded asphalt...
porous asphalt mix, so it studied specs of the South Carolina DOT, Frailey said. The mix designers opted to go with South Carolina’s OGFC standard: 70 percent #7 stone (12.5 mm or 1/2 inch), 22 percent #789 stone (nominal maximum size is 3/8 inch), and 8 percent wash screenings (#4 sieve or 4.75 mm).

“That’s a large stone mix, with 6 percent polymer-modified PG 76-22 asphalt binder,” Frailey said. “Typically, with a mix like this they would put in lime as a stabilizer, adhesion promoter, and for protection against moisture susceptibility, and then add fibers.”

At the plant, the liquid additive was removed from a “tote” via a metering pump and injected into the liquid asphalt line directly ahead of the drum mixer.

“The liquid asphalt was modified with styrene-butadiene-styrene polymer,” said Ron Corun, manager, asphalt technical services, NuStar Asphalt Refining, LLC, Ocean City, Md., supplier of the binder. “It’s a standard grade for use on high-level highways, and a necessity for use on a porous pavement, as the polymer modifier adds extra strength and extra film thickness. On an open-graded mix or porous pavement, the only thing holding the mix together is the asphalt. Polymer is vital to that.”

The warm-mix additive stops the drain-down of liquid asphalt by enabling lower mixing temperatures. “We were able to make the mix at 285 degrees F, instead of 350 degrees F, and completely eliminated the problem of drain-down,” Frailey said. The mix emerged from the truck at approximately 275 degrees F and from the screed at about 245 degrees F. No liquid asphalt was visible in the truck bed as mix was fed to the MTV.

Another benefit of warm-mix asphalt is that the lower mix temperature precludes potential “premature aging” of binder at the plant and ensures better performance in the field.