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Durable Open-Graded Mixes Enhance Safety And Reduce Noise

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Open-graded friction courses (OGFC), with their proven durability and special environmental and safety features, have a variety of uses for Massachusetts and Vermont highway agencies.

The Massachusetts Highway Department (MAHD) first used an open-graded friction course (OGFC) on Inter-state 93 near Dartmouth 17 years ago. Today, MAHD is using the mix on many of its interstate and primary highways for environmental, safety and durability purposes. On the recent resurfacing project on 1-93 in Methuen, Massachusetts, an obvious safety characteristic of the OGFC is the sharp contrast between pavement surface and line striping.

While some fading may occur, the mix retains its dark color due to the heavy asphalt film thickness that the properly designed mix requires. Additionally, the surface absorbs headlight glare on wet or dry surfaces.

Noise Reduction

An environmental characteristic of the OGFC is its ability to reduce noise. In Canada, it is referred to as "carpet seal," to emphasize its sound absorbing capacity. In Ontario, Canada, the local Ministry of Transportation (MOT) selected an OGFC specifically to reduce noise. A number of states in the U.S. and several European countries also use OGFC mixes in whole or in part for this purpose.

Perhaps OGFC's best known feature is its ability to reduce splash from large trucks. Even motorists that know little or nothing about pavement surfaces comment on the effectiveness of the OGFC. Time and time again, they have asked the MAHD, "What is that surface on 1-495," or 1-290, or Route 24? This is proof that the properties of the OGFC are not just esoteric engineering measurements but provide significant visible and audible differences for the average motorist.

The OGFC is a special mix that was originally designed to reduce hydroplaning and to enhance skid resistance on multilane highways and airports. The sheet of surface water that causes hydroplaning is drained through the mix to the edge of the pavement. The OGFC mix works because it is composed of an open, porous gradation that does not conform to the principles of dense-graded mix design.

In dense-graded asphalt mixtures, a thin film of asphalt plus compaction effort are required to keep the mix glued together. In short, the final density of dense-graded mixes is a direct measure of the strength and durability of the mix. The OGFC mix, however, uses a grading of mostly 3/8 inch stone. The idea is to build up a thick film of asphalt on the stone without the mixture draining or flushing. The asphalt film thickness is usually four to six times that of a dense-graded mix.

If properly designed, the asphalt in an OGFC does two jobs. First, it acts as a binder or glue. Second, since the mix is open to water and air, it acts as a waterproofing agent and protective coating to resist oxidation and rapid aging of the asphalt cement itself.

Sensitive Mixes

Paving contractors must be aware that OGFC mixes are more sensitive to temperature control. They require a lower and narrower placement temperature range so the thick film of asphalt does not drain from the 3/8-inch stones. The ambient temperature must also be higher than normal during placement, which may shorten the OGFC construction season.

As a special mix, OGFC has features that generally limit its use on lower volume roads and urban streets. Exceptions exist and potential users should consult with local county and city engineers. Asphalt Institute publication CL-10 "Open-Graded Asphalt Friction Courses," provides further details about general use.

One adverse characteristic of friction courses discovered by its users is difficulty in removing ice or hard-packed snow from the OGFC pavement. These same users found, however, that removal was easier after the first winter but never quite as easy as removal on a dense-graded mix.

A final benefit of OGFC may be emerging. In Vermont, as in other states with cold climates, low temperature transverse cracking is a continuing problem. An OGFC pavement that was placed in Vermont over 12 years ago is not only performing well, but appears to be limiting new low temperature cracks from occurring as well. The mix also inhibits old cracks from reflecting through as severely. One Vermont Agency of Transportation (AOT) engineer said the OGFC seems to "heal" over at existing cracks.

In the state of Maine, a section of OGFC pavement was placed 15 years ago on Interstate 93 in the Oakland to Waterville area. According to Arthur Pillsbury, state mix design technologist, that section of pavement is one of the best looking in the state and shows very little distress for its age.

Encouraged by the overall performance of OGFC, the Vermont AOT is using it again. For the AOT, OGFC may become an easy-to-apply hot-mix seal that reduces aging in the surface of a standard dense mix. Only time and study will confirm this.

Meanwhile, HMA open-graded friction courses are building another testimony of asphalt's versatile engineering characteristics. These mixes are providing a special surface for a special purpose on the nation's cold-region, high-volume highways.

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