

**ASPHALT INSTITUTE**  
**Executive Offices and Research Center**  
Research Park Drive  
P.O. Box 14052  
Lexington, KY 40512-4052  
USA  
Telephone 859-288-4960  
FAX No. 859-288-4999

---

### **Open Graded Asphalt Surfaces Offer...**

by Ed Schlect, Asphalt Institute District Engineer

---

Washington, Oregon and California are using open-graded asphalt surface mixes to provide environmental benefits, skid resistance and added durability to new construction and asphalt overlays. Over the past five years, the Oregon Department of Transportation (ODOT) has placed more than 3,600 lane miles of open-graded surface mix. Washington State DOT (WSDOT) has placed over 386,000 tons of open-graded mix.

In addition to the Pacific Northwest, open-graded surface mixes are being used extensively in northern California for both new construction and rehabilitation overlays. The mixes are being specified on an increasing basis throughout the Northwest. Much of their popularity is due to the several environmental benefits they provide, as well as their proven durability.

The safety characteristics of open-graded asphalt surface mixes include good skid resistance and a quick draining surface. Even following heavy rains, there is a minimum of standing water on the pavement surface. Open-graded surface pavements are designed and constructed with 15 to 25 percent voids, a range that allows surface water to enter the pavement structure, then quickly drain through and out of the structure. Standing water will cause hydroplaning but when the water has drained through the pavement, no risk remains.

#### **Sound Reduction**

Environmentally, open-graded surface mixes reduce road noise for both the driver and those who work, live or play near asphalt highways and streets. A number of studies in Europe and North America have found that open-graded pavement surfaces, when compared to dense-graded asphalt pavements, reduce roadside noise levels by 3 to 7 decibels (dba's). Studies also show that a reduction of 3 decibels has a significant impact on most people.

Placing an open-graded asphalt overlay to mitigate noise may be a viable alternative to the construction of sound barriers. Barriers generally reduce the noise level by 3 to 5 decibels and cost between \$15 and \$20 per linear foot to construct.

Particularly on major projects, a considerable cost saving may be achieved by using open-graded mixes rather than barriers. ODOT is currently designing a parkway in Bend, Oregon, to relieve traffic congestion on State Route (SR) 97. This rapidly growing city in central Oregon is a major recreational area that attracts a high volume of traffic. During the planning phase for the parkway, local citizens expressed concern about traffic noise. SR 97 was overlaid with an open-graded mix in 1992 and the apparent reduction in noise levels minimized the concerns regarding traffic noise.

Although ODOT has not conducted any noise reduction studies, it has contracted with Oregon State University to do so. This study will involve both noise and truck spray reductions associated with an open-graded overlay on two lane miles of existing pcc pavement.

### **Rut Resistant**

Another important plus to open-graded mixes is their resistance to deformation and rutting. They are substantially less susceptible to deformation than most dense-graded mixes because of the interlock between the larger aggregates and the use of highly fractured aggregates.

Durability of open-graded pavements has been a problem in some areas although several have provided 10 to 15 years of service. Over time the pavement may age and oxidize and eventually begin to ravel. But most open-graded asphalt pavements are now designed and constructed using polymer modified asphalt cements.

ODOT specifies a performance-based asphalt cement-3 (PBA-3) or PBA-6 meeting Pacific Coast specifications for hot-mix open-graded mixes to improve low and high temperature performance characteristics. These polymer-modified asphalts also provide thicker films on the aggregate particles. Hence, the oxidation is minimized and the tendency for raveling is reduced. Asphalt rubber binders have also been used in open-graded mixes.

### **Excellent Durability**

Open-graded asphalt pavements currently being constructed exhibit excellent durability and resistance to wear in several climatic and traffic conditions. These conditions include the full range of climatic conditions existing in the Northwest-hot and dry desert; moderate and wet coastal areas; snowy and cold mountain areas.

Open-graded asphalt overlays have been placed on sections of Interstate Highways 5, 84 and 90-in urban and rural settings, as well as on several secondary highways. All these pavements have excellent performance records with minimal maintenance requirements. An asphalt emulsion fog seal can be applied immediately following placement of the open-graded mix to enhance film thickness and to minimize surface raveling. A fog seal can also be applied after approximately five years of service life for the same reason.

The California Department of Transportation (CALTRANS) is currently using open-graded mixes to correct asphalt bleeding problems, particularly in warmer climates. The high voids in these mixes provide a reservoir for any excess asphalt bleeding from the underlying lift. Hence, asphalt cement does not flush to the surface.

### **Thickness Varies**

The thickness of open-graded pavements varies, depending on the design philosophy of the agency involved and the purpose for which an open-graded mix is selected. Caltrans-as part of its maintenance program-limits the thickness to a 3/4-inch maximum. The WSDOT makes extensive use of 3/4-inch friction courses on the interstate system. On the other hand, ODOT designs its open-graded overlays- both hot-mix and cold-mix-at a 2-inch depth. New construction, such as the Bend Parkway, may use a 7-inch deep section of open-graded mix. Most open-graded asphalt cold mixes in the northwest are 2-inch thick overlays.

Both Oregon and Washington DOTs, as well as Caltrans, plan to continue the use of open-graded pavements for various roadways in the future. They appreciate the combination of safety, environmental and performance benefits that open-graded pavements offer.

***This article appeared in the Winter 1993-94, Volume 7, No. 3, ASPHALT magazine.***