



SSSSSHH!
**That's the Sound
of a Quiet Asphalt
Pavement**

Modern research is verifying what highway users have known all along: Hot Mix Asphalt (HMA) pavements make quieter roads.

The source which contributes most to roadside vehicle noise at highway speeds is the tire/pavement interaction. Using "quiet pavements" to reduce tire/pavement noise at the point of contact makes a lot of sense.

**HOT MIX
ASPHALT**

**IS THE
BEST BUY
ALL OF
THE
TIME**



SSSSSHH!

Barriers alone can't do the job

Efforts to limit propagation of highway noise have tended to focus on noise barriers. But barriers alone can't do it. Sound walls pose problems of their own. Residents are often concerned about their appearance, and worry that they place stranded motorists at risk of assault.

Noise-absorbing HMA pavements actually cut down on the amount of noise generated at the tire-pavement interface.

Trees — such as stands of thick evergreens — have the potential to replace noise barriers, and are aesthetically pleasing, but are effective only in deep stands, requiring additional strips of right-of-way, as much as 100 feet wide.

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Noise is a significant problem

In an age of skyrocketing traffic volumes, heavier trucks, faster cars, and more intense urban development, noise from highways and arterial streets has taken its

place as an environmental impact that must be controlled.

State Departments of Transportation and other road agencies are spending more on noise mitigation. On new projects, sound walls that were once considered an extravagance now are standard procedure.

The contribution that HMA pavements can make to reduced noise can pay off for local governments and road agencies, because sound walls can be costly. A study by the University of Louisville showed that the national average cost of noise barriers is \$1.25 million per mile. Specifying a quiet HMA pavement in the first place can sometimes make noise barriers unnecessary.

Sophisticated asphalt pavements reduce noise

More sophisticated HMA pavement designs — like the new generation of Open Graded Friction Courses (OGFCs) with modified asphalt cement — offer even greater tire/pavement noise reduction. Their porous nature has other advantages, too: it allows fast drainage of water and eliminates the problems of tire spray and hydroplaning. Glare is also reduced.

Drivers cheer OGFCs, principally because of their quiet ride and lack of spray. Some respond to the point of personally calling public officials to express their delight. "We probably get more calls in that regard than any single thing we do," said an official at the Georgia Department of Transportation, a leader in use of OGFC.

Asphalt pavement's smooth, quiet nature is just one more reason HMA is the best buy all of the time.

HMA is quieter

Significant new research in the United States is showing that HMA pavements are quieter than PCC pavements.

In their paper presented at the Transportation Research Board 1998 Annual Meeting, *Comparative Field Measurements of Tire Pavement Noise of Selected Texas Pavements*, McNerney, Landsbeger, Turen and Pandelides presented the results of tests that could be used in future quiet pavement technology research.

Using on-board and roadside microphones, sound measurements from a variety of typical Texas pavements were made. This "apples-to-apples" comparison involved sound from a single type of tire, at a consistent speed of 62 mph (100 km/hour), with consistent ambient conditions.

Although the intent of the study was not to study the influence of pavement type on noise, the conclusion that HMA is quieter is indicated by the data. All of the top five quietest pavement types were asphalt pavements, as were seven of the top nine.

The Texas research repeats the experience in South Africa and in Europe, where noise from highways has been studied more intently, for more years, than in the United States. There, the use of porous asphalts in suppressing tire spray and noise has been studied for decades.

In the U.K., it was reported that porous asphalt roads have been measured to reduce noise by four decibels in dry conditions and up to eight in wet conditions. That's equal to cutting the volume of traffic in half or doubling the distance of the listener from the road.



Old problem, new solutions

Noise pollution from roads is getting attention in the new European Union as it draws closer to consolidation. In a report within the European Commission's Green Paper on Noise Pollution (1996), the E.U. notes that in France, low-noise porous road surfaces (OGFCs) have the ability to attenuate road noise.

It quotes research in France which recognizes porous road surfaces reduce both the generation and propagation of noise. Results there have shown that noise emitted can be reduced from equivalent non-porous road surfaces by between 3 to 5 decibels on average. By optimizing the surface design, even greater noise reductions are possible, they report.

Highway too loud despite sound barriers? Try HMA!

When a new six-lane Portland Cement Concrete highway, S.R. 85 in Santa Clara County, California, was completed in 1994, residents immediately complained about the noise level, which they found excessive despite the continuous line of noise barriers constructed along both sides of the highway. The California Department of Transportation (known as Caltrans) commissioned a report from an independent consultant on how to mitigate the noise. The consultant's report, published in 1997, discussed several alternative approaches, including reducing the traffic flow and speed limit, covering the roadway, increasing the height of the sound barriers, and overlaying the pavement with HMA.

The consultants, Acentech Inc., concluded that lowering the speed traveled along the roadway by 10 mph would be the lowest-cost solution, reducing noise by about 3 decibels and incurring only the costs of changing signage and increasing the activities of law enforcement. Reducing traffic flow by closing one lane in each direction at rush hour

would decrease noise by a further 1.8 decibels, but it would lead to severe congestion and force traffic onto roadways in the adjoining communities, again increasing the noise level. The report cited potential "political difficulties" arising from these approaches.

If a noise-reducing HMA pavement had been specified in the first place, the noise level reaching nearby residents would have been reduced by more than half.

Covering the roadway — essentially, creating a tunnel to put it through — would have reduced noise, but it would have cost an estimated \$423 million.

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But overlaying the PCC pavement with HMA would reduce noise by more than one-half, said the consultants. "The resurfacing of the roadway [with OGFC] would reduce the Route 85 traffic noise by over 4 decibels and benefit all areas where Route 85 traffic is audible." (Each 3 decibels represents a doubling of sound.) This alternative would have cost an estimated \$1 million.

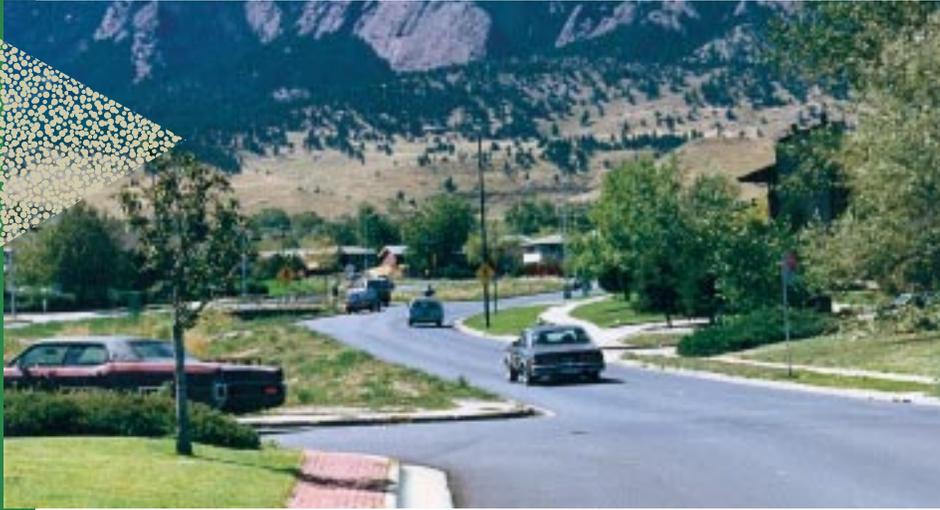
Decibel

Level Example

30	Quiet library, soft whispers
40	Living room, refrigerator, bedroom away from traffic
50	Light traffic, normal conversation, quiet office
60	Air conditioner at 20 feet, sewing machine
70	Vacuum cleaner, hair dryer, noisy restaurant
80	Average city traffic, garbage disposals, alarm clock at two feet
The following noises can be dangerous under constant exposure	
90	Subway, motorcycle, truck traffic, lawn mower
100	Garbage truck, chain saw, pneumatic drill
120	Rock band concert in front of speakers, thunderclap
140	Gunshot blast, jet plane
180	Rocket launching pad

How sound is measured

Sound and noise can be a relative experience. A quiet night actually produces some 30 decibels of sound. A rock concert produces sound levels at about 120 decibels. Highways, roads, and streets routinely produce readings of from 65 to 85 decibels.



Shout it loud: HMA works

What is your solution to highway noise?

Noise barriers may be too expensive or unsightly. It may be impossible to slow traffic down. But there's one variable that is easy to control.

Hot Mix Asphalt (HMA) pavements are proven to be quieter than other pavements. And enhanced porous asphalt or open graded friction courses (OGFCs) attenuate sound while they also reduce glare and eliminate tire spray and hydroplaning.

Want more information? It's available from your NAPA-member Hot Mix Asphalt contractor, HMA producer, or from the National Asphalt Pavement Association.

What is an Open Graded Friction Course?

Open Graded Friction Courses (OGFCs) have been used since 1950 in the United States to improve the frictional resistance of asphalt pavements, promote drainage of water from pavement and thus reduce tire spray, and reduce noise from the tire/pavement interface.

Spaces within the "open-graded" or "gap-graded" mix — amounting to as much as 20 percent of the mix, or more in some newer European mixes — help drain water and attenuate (absorb) tire noise.

OGFCs are attaining a new popularity as states take a look at refined mix designs incorporating additives like polymer modifiers, rubber-asphalt, fibers, and hydrated lime. But it wasn't always this way. Kandhal and Mallick of the National Center for Asphalt Technology (NCAT) at Auburn University published a 1998 survey, *Open Graded Asphalt Friction Course: State of the Practice*. The survey showed that, when they were introduced in the 1950s, some states had problems with them. Improvements in OGFCs have made a vast difference. "These improvements have been achieved with the help of good design and construction practices," they wrote.

The secret is modification of the asphalt binder. "A vast majority of agencies reporting good experience using modified asphalt binders," Kandhal and Mallick said.

Georgia's experience reflects the OGFC survey. "Early mixes used were very susceptible to premature failure due to weathering," stated Georgia DOT (GaDOT) researchers in GaDOT's *Progress in Open-Graded Friction Course Development*, presented at the Transportation Research Board annual meeting in 1998. Because of early problems, Georgia put a moratorium on OGFCs in 1982. But in the 1990s, the state developed a mix which incorporates a high degree of single-sized coarse aggregate, polymer-modified asphalt binder, stabilizing fibers, and hydrated lime. "This mix has been used extensively statewide since 1993," they reported.

Now Georgia, pleased with its success, is urging other state DOTs to reassess OGFCs. "[Agencies] should reconsider the possibility of using this modified OGFC on high-volume traffic facilities," they said. "It is now GaDOT policy to use modified OGFC as the final ride surface on all interstates and on state route projects which have daily traffic volumes exceeding 20,000 and are not in a reduced speed zone area."

OGFCs sometimes utilize asphalt-rubber with good success. The Arizona Department of Transportation (ADOT) placed an open-graded asphalt-rubber Hot Mix Asphalt overlay over Portland Cement Concrete pavement on I-19 south to Tucson. Studies indicated an 80.4 decibel sound level on the existing PCC pavement, but a 73.7 decibel level on the OGFC overlay. The 6.7 decibel difference is a noise level reduction of about 78 percent.

Oregon is another leader in OGFCs. Oregon's Type F mix is similar to the European-style porous asphalts. Oregon DOT use of OGFCs has trickled down to the state's counties, which are trying ODOT's mix design.



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