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What Are We Doing About Tire/Pavement Noise?

Urban noise is very much on the minds of many people, from residents who must live with it to those are faced with doing something about it.

Among those working the issue are federal, state, and local agencies; other public officials; academia; and, of course, industry organizations such as ACPA.

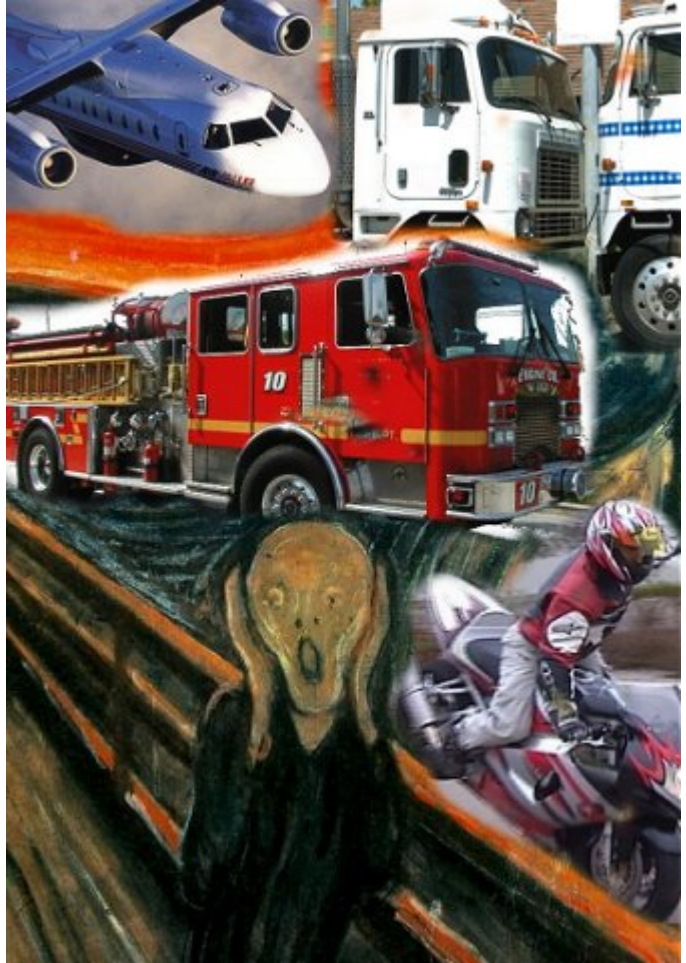
It's important to note that the concrete pavement industry presently offers solutions to the tire/pavement noise issue.

For its part, the concrete pavement industry is working to address one form of noise — sound at the tire/pavement interface — commonly called tire/pavement noise.

ACPA is pursuing research and testing with two things in mind, said Gerald F. Voigt, ACPA President and C.E.O.

"We will not trade off safety or long-term performance, and we will strive to avoid significantly increasing initial costs or life-cycle costs."

The industry is drawing from experience in European countries (including Belgium, England, France, and Germany), with the goal of optimizing a texture for the United States.



Urban noise, in its various forms, is a serious issue to the general public, who must endure it, as well as industry and public officials, who must address it.

A number of tire-pavement noise research and testing initiatives are currently underway, according to Larry Scofield, P.E., ACPA's Director of Environmental Engineering. Included within the range of research and testing are:

Field Experiments - the Center for Portland Cement Concrete Pavement Technology/Federal Highway Administration/ACPA are working together on a far-reaching research project to evaluate pavement surface characteristics.

The research seeks to understand the relationship between noise and pavement texturing (and grinding for imparting texture); to evaluate the noise/texture/time relationship; and to develop construction techniques that are repeatable and cost-effective.

The testing will evaluate new construction to measure noise, texture, smoothness, friction. The experiments also will evaluate in-service pavements to measure noise, texture, smoothness and friction periodically.

A third phase of the testing will measure noise and texture for the purposes of establishing an inventory of pavements and studying noise-texture relationships.

Laboratory Testing - At Purdue University - and with support from the ACPA and its affiliate, the International Grooving and Grinding Association - testing is being conducted using a custom-built grinding head, a key component of the tire-pavement test apparatus (TPTA). (See "[Tech Corner](#)" for a detailed look at this testing.)

Sound Intensity Testing - The Association has invested in an apparatus to conduct tire/pavement noise testing. Scofield noted that ACPA and its affiliate organization, the [International Grooving & Grinding Association](#), are conducting limited evaluations for contractors and agencies using a well-defined and consistent protocol that employs a standard test vehicle and specific brand and type of tires. Scofield added that these data are being collected and correlated against other research results.

Other field testing - ACPA has conducted or participated in field experiments in Arizona, Kansas, and California. He noted that these field evaluations are yielding some surprising and positive results that underscore the benefits of certain existing technologies used to impart surface characteristics.

A number of other noteworthy initiatives will also prove useful to the ongoing research and evaluation of surface characteristics and noise, Scofield said, noting the efforts of the Federal Highway Administration, the National Cooperative Highway Research Program, and others. (See related story, [Quiet Pavements: FHWA Policy and Current Activities](#).)

"We're pleased to be working closely with many of the key stakeholders who are committed to understanding and solving this issue," he said. "Our industry, with support from our members and affiliates, is both serious and focused on sharing current solutions while also exploring new technologies that address tire/pavement noise without trading-off durability or increasing costs."

For questions or additional information about tire/pavement noise and pavement surface characteristics research initiatives, contact [Larry Scofield](#), P.E., at 480-775-0908.

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Understanding Smoothness, Texture Key to Addressing Tire/Pavement Noise

When addressing tire/pavement noise, it's important to draw a distinction between pavement smoothness and pavement texture. Both may be factors in noise, but are often confused.

Pavement smoothness is a measure of the evenness of the pavement over a given distance. Expressed another way, a smooth pavement is one that

exhibits as few bumps in the road as possible.

Uneven spots (hence, a rough pavement) can occur in a pavement for many reasons, but typically occur because of the:

- Natural shifting that occurs beneath the pavement surface over time,
- Wear and tear on the pavements over time, or
- Workmanship or quality issues in construction, which also may become more pronounced over time.

Texturing -- whether designed and built into a pavement -- or imparted by equipment onto an existing, hardened concrete pavement, can improve skid resistance, surface drainage, and, of course, sound qualities.

Pavement Texturing

The answer to achieving a relatively quiet concrete pavement often lies in the pavement's texture. Since the late 1970's, the Federal Highway Administration (FHWA) has required that concrete pavement surfaces being used on federally-funded highway applications to be textured.

This led to the widespread use of transverse tining, now known to produce loud, whining road noise in many areas.

The concrete pavement industry presently has powerful tools to produce quiet, safe, and smooth pavements, according to Steve Waalkes, P.E., ACPA's Managing Director of Technical Service.

"We're opening up the industry to new ideas," Waalkes said. "There are alternative textures that are just as safe as transverse tining."

Smooth ride ahead ... The slipform paver represents one of the first opportunities to impart smoothness. Experts say addressing the tire/pavement noise issue requires a basic understanding of the difference between pavement smoothness and surface characteristics.



Rough going ... Shoving on asphalt pavement (above) is fundamentally a smoothness issue.

He cited longitudinal tining, Astroturf drag, and other methods for imparting texture. Diamond grinding also can improve both smoothness and sound qualities, he said.

"Diamond grinding is used successfully to restore the smoothness and texture of existing pavements, and in some cases to enhance the qualities of new pavements," he said.

Looking forward, FHWA has recently released a new technical advisory on surface texturing. The advisory provides greater flexibility to states to use longitudinal and other proven textures, said Larry Scofield, P.E., ACPA's Director of Environmental Engineering.

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Quiet Pavements: FHWA Policy and Current Activities

**By Mark Ferroni, Leader, Noise Team,
Federal Highway Administration**

Because of increasing concern about the impacts of highway traffic noise on communities, the Federal Highway Administration (FHWA) and many state Departments of Transportation (DOT's) are engaging in research and other activities relating to highway traffic noise.

One popular area of study is the area of pavement as a noise mitigation measure, also known as "quiet pavements."

While noise reduction is important, the selection of pavement type and texture is based on sound engineering and economic analysis, specifically taking into account safety and durability considerations.

Pavement safety and durability should never be jeopardized to obtain noise reductions, regardless of pavement type.

FHWA issued a memorandum on January 19, on the area of quiet pavements. State DOT's that are interested in exploring the possibilities of pavement as a noise mitigation measure can opt into either the Quiet Pavement Pilot Program (QPPP) or Quiet Pavement Research, which are both voluntary.

Arizona is the first state to implement a QPPP with FHWA, and California is currently involved in several quiet pavement research projects. A number of other states have also expressed interest in quiet pavement research.

Pilot Plan Details

The main goals of the Quiet Pavement Pilot Program are to demonstrate the effectiveness of quiet pavement strategies, and to evaluate any changes in the noise mitigation properties of pavement

"Pavement safety and durability should never be jeopardized to obtain noise reductions, regardless of pavement type."

— **Mark Ferroni, FHWA**

over time. This will be accomplished by documenting the noise reduction benefits of specific pavement types and textures.

A monitoring period of at least five to 10 years should be included to collect acoustic, texture and frictional characteristics, and document public reaction. This monitoring period could be longer, depending on the pavement studied and results obtained. A QPPP should include a Program Plan and a Data Acquisition Plan. The Program Plan should be state-specific.

The Data Acquisition Plan should monitor noise characteristics, safety and durability factors, measured over time. A QPPP should also contain a firm commitment to maintain in perpetuity any noise reduction attributed to the pavement type or surface texture. Quiet Pavement Research should contain a Research Plan, as well as a Data Acquisition Plan.

The Research Plan should outline the research purpose, and data acquisition and reporting requirements. The Data Acquisition Plan should include a minimum of four studies in different locations within the state to ensure geographic dispersion of data, wayside acoustical data, and noise characteristics and safety and durability data for at least 5-10 years (or longer, based on the pavement life). Different construction contractors would be involved in the acquisition of data. Both the QPPP and Quiet Pavement Research will gather the same type of data.

This allows data for a specific pavement type from either source to be compared directly, and can help determine any correlation between pavement characteristics, safety, durability, and noise reduction. There are differences between the QPPP and Quiet Pavement Research. In a QPPP acceptable documentation is known, so a specific pavement type or texture can be used in the FHWA Traffic Noise Model (FHWA TNM) and a specific pavement type or texture can be used as a mitigation measure.

In Quiet Pavement Research, acceptable documentation is not known, so specific pavement type or texture cannot be used in the FHWA TNM or as a mitigation measure. These determinations will not be made until the Quiet Pavement Research is completed.

The other difference between the QPPP and Quiet Pavement Research is that a QPPP is required to make a commitment to monitor noise levels and take appropriate actions, if the noise reduction benefits do not last in perpetuity. For Quiet Pavement Research, this is not a requirement, since no change in the state's program policy is being made.

Activities Related to Quiet Pavements

FHWA is leading several activities relating to quiet pavements, including:

>>> Tire/Pavement Noise Clearinghouse: FHWA is developing this web-based clearinghouse to provide a one-stop-shop for the research findings, activities and issues surrounding quiet pavement and tire/pavement noise.

>>> Expert Task Group for Tire/Pavement Noise: This group is currently developing an AASHTO Provisional Standard for onboard sound intensity methods. Following the development of this provisional standard, the ETG will continue developing measurement standards for the other measurement types (i.e. wayside and close-proximity).

>>> National Road Map for Quiet Pavement: Following a National Tire/Pavement Noise Implementation workshop in September 2004, this road map was developed. A subsequent workshop is being planned for Spring 2006.

>>> Tire/Pavement Noise 101 Workshops: These workshops provide training on noise component of tire/pavement noise for pavement professionals.

>>> National Cooperative Highway Research Program (NCHRP) research: NCHRP currently has two pending research projects related to quieter pavements. They are:

- 1-44 Measuring Tire-Pavement Noise at the Source: This research will develop rational procedures for measuring tire-pavement noise and demonstrate applicability of the procedures through testing of in-service pavements.

- 08-56 Truck Source Mapping: This study will use acoustic measurement and noise-source mapping techniques to accurately identify, locate, and quantify the noise sources on typical commercial truck and tractor/semi-trailer combinations operating on U.S. roadways.

Click [here](#) more information on pavement technology, or contact [Mark Swanlund](#), Senior Concrete Pavement Engineer, Federal Highway Administration, at 202-366-1323.

Click [here](#) for more information on FHWA's noise program, or contact [Mark Ferroni](#), Leader, Noise Team, Federal Highway Administration, at 202-366-3233.

Click [here](#) to for more information about the NCHRP projects on noise.

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The Phoenix Experience

ACPA's Scofield Shares First-Hand Experiences with Addressing Tire/Pavement Noise

Mention tire/pavement noise and someone will usually mention Phoenix, or more accurately, Maricopa County, where rubberized asphalt overlays were placed over some concrete pavement highway sections in response to consumer complaints.

"What's often overlooked is that the rubberized asphalt overlays in Arizona represent a pilot program conducted to consider pavement type as a noise mitigation strategy," said Larry Scofield, P.E., Director of Environmental Engineering for the American Concrete Pavement Association (ACPA).



PRODUCTS & SERVICES SPOTLIGHT

Curing Blankets ... Powerblankets™ are new concrete-curing blankets designed for use for all cold weather applications.

Powerblankets™ (patent pending) will thaw frozen ground and allow concrete to be poured in freezing temperatures. The product also can be used to cover fresh concrete to ensure optimal curing temperatures.

The product is said to actually speed up the curing process allowing paving contractors to stay on schedule, meet specs, and eliminate environmental concerns.

They produce no noxious fumes; use no flammable or toxic liquids; and do not require the use of awkward and expensive equipment.

The curing blankets also use an extremely efficient and effective heating element and are simply plugged into a 110V outlet. The heat discharged from the blankets will thaw frozen ground, and speed up the curing process.

Their simple design makes them quick and easy to use and operate. Also, three blankets can be plugged in together allowing 750 sq ft. of coverage.

The product also can easily be designed for custom applications, providing 2000+ sq ft. of coverage. The product is designed to help projects stay on time and on budget; produce optimal curing temperatures; ensure a strong, durable slab; avoid costly delays and potential penalties. A limited number of Powerblankets™ will be made available in September to ACPA contractor members for testing and evaluation.

Please visit www.concrete-curing-blankets.com or call 801-557-3722 for more information. Please mention you saw the product in **CONCRETE PAVEMENT PROGRESS!**



Cold weather paving?

Concrete curing blankets use 100V electric current to either cover fresh concrete or thaw frozen ground prior to paving.

A Closer Look at the Tire/Pavement Test Apparatus

As noted in the story, "[What Are We Doing About Tire/Pavement Noise?](#)" ACPA and its affiliate, the International Grooving & Grinding Association, are conducting laboratory tests (among other research and testing) to evaluate pavement surface characteristics.

The laboratory test employs the Tire/Pavement Testing Apparatus (TPTA), housed at Purdue University, Lafayette, Ind.

Using the TPTA, it becomes more cost effective and efficient to vary the factors controllable by a grinding



to environmental or traffic control factors.

TPTA testing is conducted at 0 to 30 mph. The equipment uses two test tires and also features environmental controls. The TPTA apparatus is capable of performing sound intensity (SI) or close proximity (CPX) testing.

Double Wheel Paths

The special grinding unit, designed by Terry Kramer of Diamond Surface, Inc., and constructed by Steve Garrison, Web Burnett, and Alex Ugalde of Diamond B, can grind two 8-in. wheel paths at the same time.

This allows twelve test sections to be constructed on the TPTA for one series of tests.

By limiting a wheel path to only 8 inches, it becomes less expensive to change out blades and spacers.

ACPA is optimistic the TPTA evaluations at Purdue will provide excellent quality results in a controlled setting. ACPA also plans to correlate TPTA results with field data taken from whisper-ground pavement sections.

At press time, the first series of tests were about to be completed.

More questions about the TPTA testing or other evaluations or research of concrete pavement surface characteristics? Contact [Larry Scofield](#), P.E., At 480-775-0908.



A close-up view of the grinding unit shows this specially designed and constructed equipment, which can grind two 8-in. wheel paths at the same time.

Tech Corner Online

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President Signs U.S. Transportation Bill into Law

President George W. Bush on Wednesday signed into law the \$286.4 billion transportation bill, "Safe, Accountable, Flexible, Efficient Transportation Equity Act - A Legacy for Users" (SAFETEA-LU).

The signing ceremony marked the end of a long journey to reauthorize the Federal-aid highway and transit programs, which will now see funding increase through fiscal year (FY) 2008.

"If we want people working in America, we got to make sure our highways and roads are modern," the President said.



The President, flanked by Administrative and Legislative leaders, signed the bill (left), as invited guests and media watched. (Photo: ACPA ON THE GRADE.)

"We've got to bring up this transportation system into the 21st century," he added.

Commenting on the successful reauthorization of the highway bill, ACPA President & C.E.O., said, "We applaud the leadership and tenacity of both the U.S. Senate Environment & Public Works Committee and House Transportation & Infrastructure.

"We also appreciate and laud the other key Leaders of the Senate and House, and, of course, President Bush and the Administration for their efforts."

Voigt, who was present for the signing ceremony, added, "SAFETEA-LU provides much needed funding for the critical needs of the Federal-aid highway system."

Total SAFETEA-LU Funding by Fiscal Year is as follows:

TOTAL Funding	Highway Funding
• FY 2005 - \$ 43.55 billion	• \$35.90 billion for FY 2005
• FY 2007 - \$ 49.17 billion	• \$37.96 billion for FY 2006
• FY 2009 - \$ 53.55 billion	• \$40.20 billion for FY 2007
• FY 2006 - \$ 46.58 billion	• \$41.56 billion for FY 2008
• FY 2008 - \$ 51.29 billion	• \$ 43.21 billion for FY 2009

The signing ceremony was held at a Caterpillar plant in Montgomery, Ill. An estimated 5,000 tickets were issued to the event, which was held in the Congressional district of U.S. House Speaker Dennis Hastert (R-IL).



President Bush greets a crowd of federal, state, and local political figures, as invited guests (top left). In his opening remarks (top right), the President cited jobs and the imperative to bring the transportation system up to the 21st century. (Photos: ACPA ON THE GRADE.)

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