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What's All the Noise About?

Asphalt Center Study Shows Concrete Among Quietest Pavements

A recent study on tire/pavement noise conducted by the National Center for Asphalt Technology (NCAT) demonstrated that concrete pavements are just as quiet as asphalt pavements ([Ref. 1](#)). The research findings show concrete is quiet, but the report may erroneously lead some to believe that asphalt is the only quiet pavement surface.

The reason is that the researchers drew their conclusions on the average of all of the sections of each pavement type and attempted to "best fit" curves through a small number of points. A few heavily textured concrete sections increased the concrete pavement noise average, obscuring the quiet concrete section results. The heavy textures on the concrete sections were mandated by the Michigan DOT for skid resistance and public user safety.

But the reality is that tire/pavement noise of nearly all of the sections were within about 3 decibels (dBA) of each other. Noise differences within 3 dBA are barely perceptible to the human ear ([Ref. 2](#)). Therefore, the difference in noise between all of the pavement sections is considered by acoustics experts to be negligible.

Tire/pavement noise has been the subject of great controversy within the paving industry. At the center of the controversy are the testing methodologies. Although the more conventional and widely accepted pass-by method--which measures noise where it would most likely be heard--provides more realistic readings. The close-proximity (CPX) method--which measures noise at the tire--does not provide a measurement useful for environmental impact analysis. The use of the CPX methodology raises serious questions about applying the research results to convince public officials to

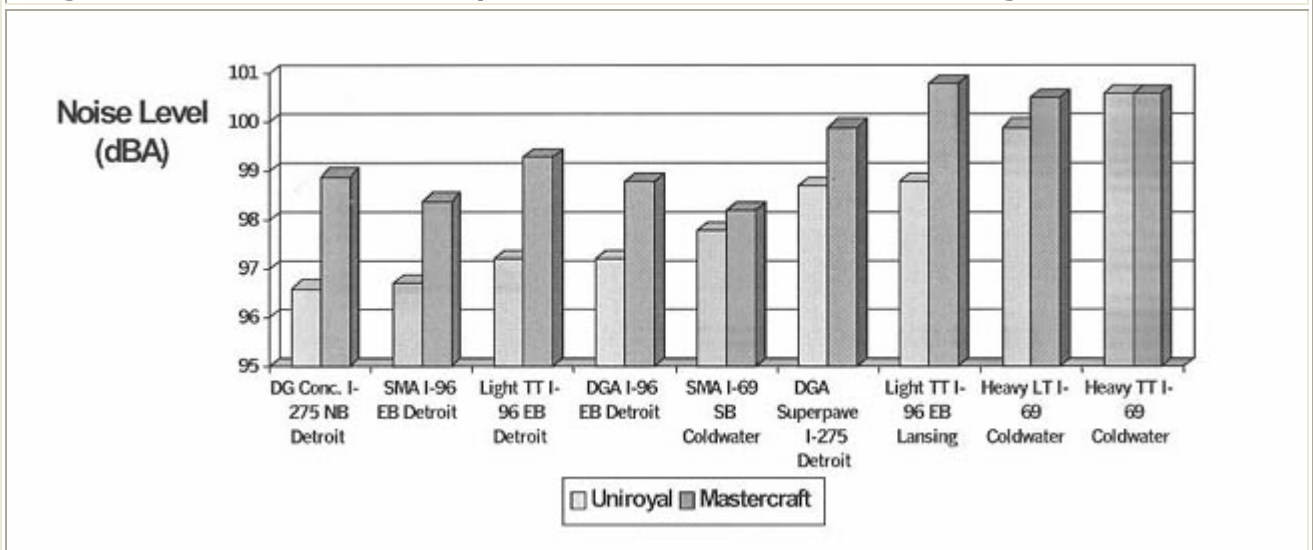
overlay pavements to abate noise, a practice which has already been done in at least one state.

The [American Concrete Pavement Association](#) and the [International Grooving & Grinding Association](#) are further investigating this issue. Look for more information about this in future issues of **Concrete Pavement Progress**.

Project Background/Research Methodology

In the Michigan DOT/NCAT study, the pavement sections were located on Interstate highways in southern and southeastern Michigan: I-69 eastbound in Lansing and southbound in Coldwater, and I-96 eastbound and I-275 northbound in the Detroit area. The surfaces tested included longitudinally tined, transverse tined, and diamond-ground concrete, as well as stone matrix, conventional dense-graded, and Superpave asphalt.

Figure 1 - Results of the tire/pavement noise measurement using the CPX method.



Surfaces Tested in the MDOT/NCAT Study	
Section	Surface Type
DG Conc. I-275 NB Detroit	Diamond Ground Concrete
SMA I-96 EB Detroit	Stone Matrix Asphalt
Light TT I-96 EB Detroit	Light Transverse Tined Concrete
DGA I-96 EB Detroit	Dense Graded Asphalt
SMA I-69 SB Coldwater	Stone Matrix Asphalt
DGA Superpave I-275 NB Detroit	Dense Graded Superpave Asphalt
Light TT I-96 EB Lansing	Light Transverse Tined Concrete
Heavy LT I-69 Coldwater	Heavy Longitudinal Tined Concrete
Heavy TT I-69 Coldwater	Heavy Transverse Tined Concrete

The NCAT researchers used the CPX method to measure the noise levels on nine different pavement sections. The CPX method, which is **not** the FHWA-recommended standard measuring method for noise levels along highways, involves placing a receiver (microphone) near the tire on a trailer being pulled along at highway speeds.

The current FHWA environmental policy (Highway Traffic Noise Analysis and Abatement Policy and Guidance) ([Ref. 3](#)) states that "unless definite knowledge is available on the pavement type and condition and its noise generating characteristics, no adjustments should be made for pavement type in the prediction of highway traffic noise levels...The use of specific pavement types or surface textures must not be considered as a noise abatement measure."

The standard pass-by method involves measuring the noise at ground level near the receptors (houses, buildings, etc.) along a roadway. The receptors are usually 25 to 50 feet from the noise generator (edge of the roadway). The farther a receptor moves away from the noise generator, the quieter the noise seems - doubling the distance from the source can reduce noise intensity by as much as 6 dB. Therefore, slight differences in noise due to pavement surface type are far less influential at distances normally used for measuring noise along a roadway ([Ref. 4](#)).

In the NCAT study, two different tires were used to test the noise on the Michigan pavement sections, a Mastercraft® tire and a Uniroyal® tire ([Ref. 5](#)). The Mastercraft tire has a much more aggressive tread pattern than the Uniroyal, which makes the noise measurements higher and exaggerates the tire/pavement noise effect. Figure 1 shows NCAT's results of the tire/pavement noise measurement using the CPX method. Note that the diamond-ground concrete section was the quietest of both asphalt and concrete sections with the Uniroyal tire. Most important of all, nearly all of these readings were within 3 dBA--a difference equivalent to the sound of leaves rustling.

References/Endnotes

(1) "Tire/Pavement Noise Study" for Michigan Department of Transportation, conducted by the National Center for Asphalt Technology, October 2002.

(2) "Policy Memorandum Surface Finishing of Portland Cement Concrete Pavements," Final Report FHWA SA-96-068, Tire Pavement Noise and Safety Performance, May 1996, Federal Highway Administration, Office of Engineering, Washington, DC. View the report at http://www.fhwa.dot.gov/legisregs/directives/policy/sa_96_06.htm.

(3) "Highway Traffic Noise Abatement Policy and Guidance," June 1995, Federal Highway Administration, Washington, DC. View the full policy at <http://www.fhwa.dot.gov/environment/polquid.pdf>.

(4) Additional information is available in ACPA's "Concrete Pavement Surface Textures" publication (SR902P, copyright 2000, American Concrete Pavement Association, Washington, DC). To order the publication, contact ACPA's order processing department at (phone) 1-800-868-6733, (fax) 847-966-966-9666, or visit the ACPA website at <http://www.pavement.com/ecommerce/main.html>.

(5) **Editor's Note:** Brand names are included only to characterize the actual tires used in the tests. The inclusion of this information neither expresses nor implies a commercial product endorsement.

Whitetopping Proves Effective in Rehabilitation of Colorado Highway *Project wins two ACPA pavement awards*

When the Colorado Department of Transportation (CDOT) Region 6 sought to solve a rutting problem and break the cycle of continual asphalt maintenance, they used whitetopping technology on a high-traffic highway in Denver.

"The benefit of whitetopping is that it's maintenance-free and thus won't disturb traffic for repairs to the road," said Roy Guevara, CDOT design engineer.

Interstate Highway Construction (IHC) completed the 3.5-mile project ahead of schedule, producing a smooth-riding, long-lasting pavement.

CDOT designers covered existing asphalt with 6 in. of concrete. CDOT also decided to vary pavement thickness and joint spacing on a 400-foot test section.

The contractor milled the existing asphalt less than an inch to enhance the bond and paved the road in 38-foot widths.

IHC received incentives for ride, thickness, and strength. The ride averaged 8.1 in/mi on a one-tenth blanking band. IHC received an incentive of \$12,000 for completing the job three days ahead of the 70-calendar-day limit.

The project included three major intersections. The contractor closed each intersection in the morning and opened it by noon the next day.

The 7-1/2-sack mix achieved 2,500 psi in 20 hours. The straight cement (no fly ash) mix design included three pounds per cubic yard of fiber reinforcement.

IHC project manager Greg Scott said the public commented that they "got in and out so fast." He attributes the success of the project to the teamwork between the contractor, highway department, and "all our great subcontractors."

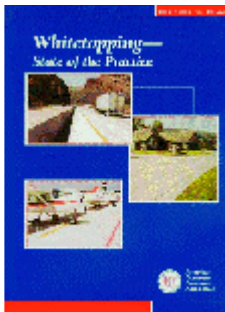
"Compare concrete and asphalt prices and maintenance costs - look at the long-term costs. Concrete has lower maintenance. We can put down concrete that will last 20 years so they don't have to go in every five years with more asphalt and more inconvenience to the public," Scott said.



The American Concrete Pavement Association named the project a 2002 Excellence in Concrete Pavement Awards winner in two categories: Traffic Management and Concrete Overlay.

ACPA Literature Showcase

Whitetopping - State of the Practice



This 70-page, best-selling engineering manual (EB210P) includes comprehensive coverage of all aspects of concrete overlays on existing asphalt pavement. It includes information on the benefits, history, performance, design practices, and construction of all types of whitetopping.

A special chapter discusses ultra-thin whitetopping (UTW), including an interim procedure for determining the load-carrying capacity of UTW based on research and performance surveys.

The cost of this publication is \$25.00. To order EB210P, access <http://www.pavement.com/ecommerce/main.html>; call toll-free 1-800-868-6733; or fax requests to 847-966-9666.

South Carolina Concrete Highway Doubles Design Life

Pavement received minimal CPR once in 40 years

Built in 1962 and designed for a 20-year life, a 10-mile concrete section of I-26 has doubled its original design life.

The South Carolina Department of Transportation has evaluated the concrete section over the past four decades.

Results show that the concrete pavement has only received minimal concrete pavement restoration (CPR) once.



Although over 40 years old, the 10-mile concrete section of I-26 in South Carolina still carries an average daily traffic (ADT) of 2,000 vehicles with 20 percent trucks.

The asphalt pavement on either side of the concrete section, however, has been overlaid several times.

The highway is today carrying much more than it was designed for, including heavy trucks from the Port Authority in Charleston. The average daily traffic (ADT) is 2,000 vehicles with 20 percent trucks. The design is only nine inches thick with 25-foot joint spacing, undoweled with asphalt shoulders.

The only restoration the road has needed was some CPR three years ago. The CPR included full depth patching, diamond grinding, and joint resealing. Andy Johnson, state materials manager, expects it to last six or seven years.

This stretch of I-26, as well as other sections in Columbia, Charleston, and near Greenville, were the only concrete interstate roads built by South Carolina in the early 1960's. The impressive performance of these concrete pavements encouraged the DOT to start using more concrete pavement in the 1970s, according to Johnson.

The success of this section of I-26 and its sister pavements from the same time period has influenced the DOT's current decision-making. Johnson says the DOT's focus is plain jointed concrete due to the successful performance of the sections on I-26.

"We're looking at what has worked for us. We learn from what went right, and use this knowledge gained over 40 years to design our new pavements."

The DOT uses the same materials and similar mixtures as in 1960, but has changed the design of the concrete pavements. They have added dowels, tied concrete shoulders, and shorter joint spacing.

**The only
restoration the
road has needed
was some CPR
three years ago.**

"If one pavement with design flaws could go for so long, think how long our new pavements will last, possibly longer than 40 or 50 years," said Johnson, who added, "We're looking at more concrete pavement in South Carolina now."

Technical Tip

Does the color of a pavement affect snow and ice melt?

A common question this time of year has to do with the difference between melting rates on light-colored and dark-colored pavements. There is no clear relationship that darker pavements (new asphalt or dark-colored concrete) will affect ice and snow control to an advantage over lighter surfaces.

Older reports have shown a possible 6 to 8°F temperature differential between concrete and asphalt surfaces exposed to sunlight in cold climates. However, this is primarily applicable to high altitude locations where sunshine is predominant during cold temperatures.

Many northern states and Canadian provinces receive very little sunshine during the winter months, especially during snowfall events, reducing the effect of solar radiation. A snow/ice-covered roadway or runway has the same heat retention characteristics, regardless of pavement type, until the snow and ice are melted by deicing chemicals. The pavement surface is then exposed and able to absorb and/or retain heat according to its makeup. If a darker colored pavement surface enhances snow melt, it might also cause a hazardous situation, due to re-freezing overnight, causing black ice.

In general, other factors such as temperature, wind velocity and direction, sunshine, terrain, roadway grade, and deicing chemicals have a larger influence on snow control than pavement surface color. In fact, studies (Montana 1967 and SHRP H-643, 1993) have shown that salt demand is slightly higher on asphalt surfaces than on concrete.

Contact [Steve Waalkes](#) at 847-966-2272 for more information or if you have any questions about this article. Would you like to submit a technical question? Send an e-mail to [ACPA](#) or call Bill Davenport or James Martinez at 847-966-2272.

Concrete Pavement News Ticker

ACPA Appoints Haislip as Streets, Local Roads Director ... ACPA appointed Scott Haislip as Director of Streets & Local Roads ... In this role, Haislip will be responsible for providing technical support to public officials and others involved in municipal or county road specification and construction/reconstruction. To contact Haislip, call 847-966-2272 or e-mail: shaislip@pavement.com.

ACPA posts final results from Michigan smoothness study ... ACPA has posted a report on its website of the final results of the ACPA and [Michigan Concrete Pavement Association](#) smoothness study in Michigan ... The study confirmed problems with lightweight profiling equipment ... The study shows that the high speed and lightweight profilers evaluated were sufficiently repeatable on typical dense-graded hot mix asphalt surface and un-textured concrete pavement, but only some profilers were repeatable on concrete with transverse tining ... None of the profilers were repeatable on concrete with longitudinal tining.

Conducted by Steve Karamihas, [University of Michigan Transportation Research Institute](#), the study also shows that high speed and lightweight profilers are not able to reproduce profiles sufficiently on any surface types, concrete or asphalt, with the poorest reproducibility observed on both longitudinally or transversely tined concrete ... The findings are evidence that it is premature to use lightweight or high-speed surface profilers for construction acceptance specifications until improvements are made ... Access the report on ACPA's website at <http://www.pavement.com/Downloads/ProfilerPerformanceAssessment.pdf>. If you have any questions regarding the report, please contact [Mike Ayers](#) at 847-966-2272.

ACPA Announces New Technical Course ... ACPA has scheduled the "Concrete Pavements 101" course for April 22 through 24 at the ACPA offices in Chicago ... This three-day course is designed for contractors, consulting engineers, design professionals, agency personnel, and others who want basic knowledge of concrete pavement design, construction procedures, and products and processes ... Prior background in these areas is not required.

This course covers design, construction, and rehabilitation of concrete pavements. It features an overview of the [Portland Cement Association](#) (PCA) pavement design method, the AASHTO design procedure, and an introduction to the soon to be released mechanistic-empirical design method (AASHTO 2002 Design Guide) ... The course is

\$695 for members and \$850 for non-members ... The cost includes the three-day course, handout materials, shuttle service to and from hotel and course, a reception and dinner, and lunch each day. Transportation, hotel, and other meal costs are not included.

For more information about the course, contact [Mike Ayers](#) at 217-621-3438 ... To register, please contact [Debbie Howard](#) at 847-966-2272.

ACPA Announces Fall Airport Pavement Design Seminar ... Responding to strong demand, ACPA has scheduled the 2003 Fall Airport Pavement Design Seminar ... The 2003 Spring Airport Design Seminar (February 25 - 27) sold out within weeks of its announcement ... ACPA urges those interested to sign up as soon as possible ... Scheduled for October 7- 9 at ACPA offices in Chicago/Skokie, the three-day seminar is geared toward entry-level and project engineers.

It will consist of: A comparative analysis of the [Federal Aviation Administration](#), [Portland Cement Association](#), and military design methods, an explanation of FAA specifications and design requirements, and preparation for construction and construction techniques for pavements, concrete mix designs, and adjustments ... Teaching materials and lesson plans will be provided ... The seminar is \$650.00 for ACPA members, FAA employees, and state aviation officials; \$875 for nonmembers ... To register, contact [Maryann Beckman](#) at 847-966-2272 ... For more information or questions about the seminar, contact [Jim Lafrenz](#) at 202-842-1010.

ACPA Concrete Pavement Progress is published four times a year and covers current practices and case histories in the concrete pavement industry. ACPA **Concrete Pavement Progress** is distributed free of charge to public officials, ACPA members, executive committee, board of directors, and affiliated chapter/state paving associations.

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