

The Next Generation Concrete Surface (NGCS)

The Quiet Pavement Solution

THE NEXT GENERATION CONCRETE SURFACE is the strategy of choice for ensuring quiet pavement solutions whenever and wherever they are needed. Using conventional diamond grinding equipment, NGCS textures can be quickly and efficiently constructed without impacting other roadway features such as guardrails, barriers, or curbs. A thin layer of the concrete surface is removed through the grinding process, achieving a smoother texture, and longitudinal grooves are installed. The grinding process can be accomplished in either a single or double pass operation.

Developed by Purdue University between 2006 and 2008, the surface represents the quietest non-porous concrete surface developed to date. The Purdue research, funded by the concrete industry, evaluated numerous diamond ground and cast-in-place textures on their Tire Pavement Test Apparatus. The “epiphany” moment during the research was the realization that upward protruding textures create much of the tire-pavement noise generation and that by minimizing these textures, a quieter concrete surface could be produced.

The NGCS approach is to develop a flatter and smoother surface that still possesses good microtexture and excellent macro texture. The smoother surface provides less protruding texture resulting



in a lower overall noise level, while the grooves, which provide significant macrotexture, increase the resistance to hydroplaning by moving water out of the tire contact patch area. The NGCS surface can be constructed on new roadways or existing roadways.

>>> IT'S A QUALITY OF LIFE ISSUE

Today, in many urban areas, noise is clearly a quality of life issue for the public and represents one of the many competing factors in urban design and living. Safety, smoothness, capacity and noise are all important design issues that every owner/agency contends with when considering highway improvements. The quality of life issue is even being addressed within neighborhood groups, as well, as they become more and more aware of noise generation issues.

Recently there has been a growing interest in controlling noise at the source, namely, the pavement surface. Traditionally, noise is controlled through the use of walls or berms which are expensive but permanent. By controlling at the source, however, the noise levels generated are greatly reduced and may eliminate the need for the berms or walls.

For typical highway applications it should be

noted that the noise contribution of cars and large trucks is quite different. Passenger cars, for example, generate about 70 to 90% of their total noise through the tire-pavement interaction. This fact implies that modification of the roadway surface (through techniques such as the NGCS surface) can meaningfully impact the overall tire-pavement noise when passenger cars are the main source of noise. Truck noise generation is less affected by pavement type and when trucks become the dominant noise source, pavement solutions of any type become less effective.

>>> THE BEAT GOES ON

Upon completion of the Purdue Research, which relied upon a device that simulated real world construction techniques, it was important to validate that the same results would be obtained when the NGCS surface was constructed on a real highway using real diamond grinding equipment.

The proof of concept testing was conducted in 2007 at the Minnesota DOT MnROAD low volume road facility. A test strip was successfully placed and tested; results verified both the Purdue research and the fact that conventional diamond grinding equipment could successfully place the texture. That same year, the first highway installation of this texture occurred on Chicago's I-355 Tollway.

Minnesota constructed the first large NGCS project, implementing it as a noise solution for I-35 in the downtown Duluth area. Residents of the city were very pleased with the results, as indicated by the fact that local newspaper Duluth News Tribune published an article acknowledging its success on the front page.

According to the Sept. 21, 2010 article, “The surface treatment reduces noise substantially – by six decibels on the northernmost section of the I-35 megaproject, according to John Bray, MnDOT regional spokesman. Six decibels



>>> BENEFITS

- **Smoother Ride:** IRI measurements indicate that NGCS provides a smoother, more uniform ride.
- **Increased Safety:** Diamond grooving provides improved traction and allows the road to maintain its texture longer, creating a safer road over the long-term.
- **Decreased Noise:** A smoother surface with a less protruding texture results in a lower overall noise level

translates to an 80 percent reduction in the overall sound of vehicle tire noise. “It was shocking,” Bray said of the difference in noise levels. “I think it could be the key to reducing noise levels in big cities across the country.”

Justin Steinbach, general manager of the nearby Edgewater Resort and Waterpark, stated that before the installation of the NGCS, “the sound of I-35 traffic had been the number one complaint of hotel guests.” After the work was completed and the highway reopened, “we haven’t fielded one complaint,” Steinbach said.

Since its inaugural year in 2007, 11 states have or are placing NGCS surfaces. Currently California has more installed NGCS surfaces than all other states combined. However, in 2014, Texas awarded the largest NGCS project ever bid, demonstrating that the technology continues to grow.

The two largest quiet pavement research programs in the country, Virginia and California, have both evaluated the NGCS surface as part of their efforts. The Virginia Study, conducted by Virginia Tech Transportation Institute, reported the results as “... a measurable and noticeable decrease of more than 5 dB(A) for the NGCS. The NGCS is therefore a significantly better technology for concrete projects designed to decrease noise. Another advantage is that the NGCS seems to be the most

reliable in terms of noise variability between different locations. Given the potential for improved lateral stability and the better hydroplaning resistance benefits of the NGCS, it is reasonable to conclude that this technology represents an attractive option as a quiet surface for concrete pavement projects.”

The California research study, conducted by U. C. Davis, reported that “...The GnG* surface texture was found to be quieter than the conventional diamond grinding (CDG), with lane average on-board sound intensity (OBSI) values on the GnG texture ranging from 99.5 dBA to 101.7 dBA, with an average of 100.8 dBA, compared with a range of 100.6 dBA to 104.7 dBA, and an average of 102.8 dBA measured on the CDG surface texture. The average OBSI level for all GnG sections was 100.8 dBA compared with an average of 102.8 for all CDG sections.” The research report also stated, “The IRI measurements showed that both CDG and GnG texturing treatments improved smoothness substantially compared with the pretreatment values. The average IRI was reduced from 142 in./mi for the preconstruction surface textures to 64 in./mi on average after the CDG treatment and to 49 in./mi on average after the GnG texture treatment.” The California results indicate that although placed as a noise solution, the NGCS also improves ride quality as well.

**In California the NGCS is called GnG*

ABOUT IGGA

The International Grooving & Grinding Association (IGGA) is a non-profit trade association founded in 1972 by a group of dedicated industry professionals committed to the development of the diamond grinding and grooving process for surfaces constructed with Portland cement concrete and asphalt. In 1995, the IGGA joined in affiliation with the American Concrete Pavement Association (ACPA) to form what is now referred to as the Concrete Pavement Preservation Partnership (IGGA/ACPA CP3). The IGGA/ACPA CP3 now serves as the lead industry representative and technical resource in the development and marketing of optimized pavement surfaces, concrete pavement restoration and pavement preservation around the world.

References

- D.E. Mogrovejo, et al., “Short Term Effect of Pavement Surface Aging on Tire-Pavement Noise Measured with OnBoard Sound Intensity Methodology,” VTTI, TRR 2403, 2014
- I.M. Guada, et al., “Evaluation of Grind and Groove (Next Generation Concrete Surface) Pilot Project in California,” Research Report No. UCPRC-RR-2013-01, November 2012

