Southeastern Superpave Center News

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National News

National Center for Asphalt Technology
NCAT
AUBURN UNIVERSITY

Southeast Superpave Center Develops Noise Trailer for Arizona DOT

by Doug Hanson, NCAT

Traffic noise is a serious problem. Many areas in the United States are building large sound barrier walls at the cost of up to one million dollars per roadway mile. Engine and exhaust noise as well as aerodynamic noise also contribute to roadway noise. However, in automobiles at high speeds, tire pavement noise is the dominant noise source (1). Thus, if quiet pavement surfaces can be developed a significant reduction in roadside noise can be achieved.

Figure 1. The Arizona Noise Trailer

In 1999 Dr. Roger Wayson with the University of Florida conducted a survey (2) of state DOTs to determine their views with regard to pavement/tire noise. The result of that review was that the number one concern was the need to conduct comparison studies of sound levels from common pavement surfaces. To conduct a noise study, the first requirement is to obtain or develop equipment that can be used to measure pavement/tire noise. There are two generally accepted approaches for measuring the influence of roadway surface characteristics on the generation of tire/surface noise: The Statistical Pass-By (SPB) method and the Close-Proximity (CPX) method. The International Standards Organization (ISO) has developed draft standards for both of these procedures.

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Noise Trailer *Continued from Page 1*

In the SPB method, the noise generated by random vehicles is sampled and statistical averaging is used to determine the overall noise. The FHWA has promoted a method for bypass testing which has been adopted by AASHTO. In this method, microphones are placed at 50 feet from the center of the near travel lane at a height of five feet. It also requires a flat open location free of large reflecting surfaces and that there be low-ambient noise levels from sources other than traffic. It can be used to classify surfaces in typical and good condition according to their influence on traffic noise. An advantage of this method is that it includes all of the generated noise, including engine and exhaust noise. But, due to the severe requirements on the acoustical environment at the measurement site, it cannot be used for new or rebuilt surfaces at any arbitrary location or in most urban areas where noise is a significant problem.

In the CPX method, the noise generated by a standard tire in an enclosed acoustical chamber is measured by two microphones located about eight inches from the tire and four inches from the surface of the roadway. The advantages of this system are that it can be used to:

1. Determine the noise characteristics of the road surface at almost any arbitrary site.
2. It could be used for checking compliance with a noise specification for a surface.
3. It could be used to check the state of maintenance, i.e. the wear or damage to the surface, as well as clogging and the effect of cleaning of porous surfaces.
4. It is much more portable than the SPB method, requiring little setup prior to use.

It appears that the CPX method is faster, more practical and more economical than the SPB method, but it is limited in that it is relevant only in cases where tire/road noise dominates and the power unit noise can be neglected. Further, it does not take into consideration the heavy vehicle tire/road noise as fully as the SPB Method can, since it does not make use of truck tires for testing. A Swedish report states "the elimination of all power-train noise would have the effect of reducing the overall noise only by 2 dB (A)."

The Arizona Department of Transportation (ADOT) is faced with increasing traffic noise levels. As a result they are building noise walls (at the cost of about one million dollars per mile) to protect the citizens of Arizona from the effects of traffic noise. They would like a better way - if the pavement could be made quieter then the need for noise walls would be reduced. But, to design a better way, they need to able to evaluate the effect of various pavement surface types on the pavement/tire noise. Therefore, ADOT asked the SE Superpave Center to design and build a CPX noise trailer in accordance with International Standards Organization (ISO) Standard 11819-2. The trailer (see Figure 1) was built and delivered to ADOT in January. They are now initiating studies using the trailer. The SE Superpave Center has started action to build a trailer for use in studies that are being initiated to develop safe and quiet HMA pavements. This study will be done in conjunction with a Center study to develop an improved Open Graded Friction Course.

References

1. Wayson, R.L. Relationship Between Pavement Surface Texture and Highway Traffic Noise, National Cooperative Highway Research Synthesis No. 268, National Research Council, Washington, D.C. 1998, 85 pgs
2. Wayson, R.L. "A Survey of State DOTs Views Regarding Pavement/Tire Noise" TRB Preprint, January 2002.

Relationship Between "Internal" Angle and Density

by Allen Cooley,
Southeast Superpave Center

The Superpave gyratory compactor (SGC) was developed as a tool in the Superpave mix design system to better simulate the field compaction of hot mix asphalt (HMA). All SGCs are designed to meet specifications found in AASHTO T312; however, AASHTO T312 does not contain a precision statement. Therefore, it is not clear what should be the acceptable difference in measured sample density between various SGCs. Many agencies within the U.S. have reported significant differences in the bulk specific gravity of compacted HMA samples from different SGCs that have been properly calibrated.

One of the potential causes of these observed differences in density is the method of measuring the angle of gyration. The gyration angle for the majority of compactors can be measured in un-loaded and loaded conditions. Research has shown that the gyration angle decreased during compaction, depending on the mix characteristics. The primary reason for the changing gyration angle is the flexing of the SGC frame. The Federal Highway Administration has taken a lead in identifying this problem and also providing a potential answer. FHWA developed a device to measure the "internal" angle within the SGC mold during compaction. This device has been called the angle verification kit (AVK) or the dynamic angle verification (DAV) kit. The internal angle device is placed in the SGC mold with a sample of HMA and dynamically records the gyration angle during compaction. An "internal" angle is then measured.

The verification of the gyration angle is crucial to the proper design of HMA mixes. The state of Alabama acknowledged this potential problem and initiated a research study with the National Center for Asphalt Technology (NCAT) to use the device within all state approved SGCs. Through the study, NCAT is to utilize the internal angle device on almost 140 SGCs. A significant amount of information about the internal angle will be learned from this study.

Some preliminary results from NCAT's study are shown in the Figure. Results within the figure represent five different SGC models. Based on the figure, it appears that there is a relationship between internal angle and the resulting density of HMA samples. Excluding

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Relationship Between "Internal" Angle and Density

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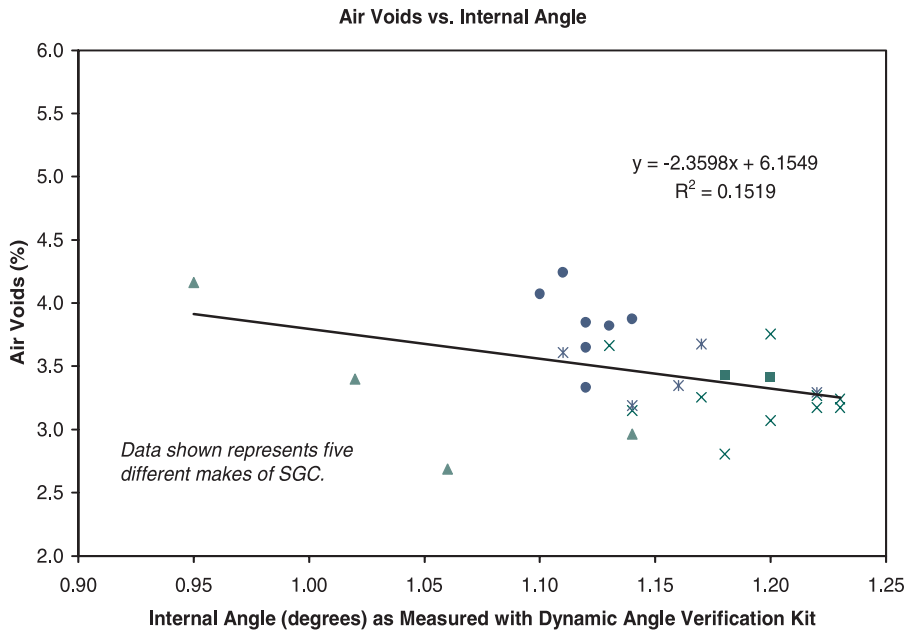
the one SGC type (triangles within Figure), the relationship for the remaining four SGCs is relatively strong. This suggests that the measurement of the internal angle is a step in the right direction towards achieving similar compaction with different SGCs. However, there also appear to be some other factors that influence density, because the relationship is not perfect. Factors such as wear on the SGC, uniformity of mold diameter, smoothness of the mold, etc., also likely affect the resulting SGC density. All of these factors need to be evaluated further and quantified.

All in all, the measurement of gyratory angle internally appears to be a move for the better. However, there are still some issues that need to be evaluated further.



Flexible Pavement Construction and Rehabilitation

The Flexible Pavement Construction and Rehabilitation committee (A2F02) meets each year at the annual meeting of the Transportation Research Board (TRB). The chairman for this committee is Ray Brown of the National Center for Asphalt Technology. This committee is concerned with factors related to construction and rehabilitation of flexible pavements. The primary focus of the committee is the production and placement of hot mix asphalt (HMA) pavements and the construction-related factors that affect the quality of HMA pavement types including but not limited to, dense-graded mixes, open-graded friction courses, stone-mastic asphalt, and asphalt drainage layers. The committee focus also includes: aspects of construction equipment that improve production rate, efficiency or quality of flexible pavement construction or rehabilitation; improved construction methods or procedures for longitudinal and transverse joints; and issues related to quality control and quality assurance of flexible pavements.

At the 2002 annual meeting of TRB, committee A2F02 sponsored four technical sessions. One of the technical sessions was entitled, "Asphalt Pavement Construction Issues Related to Performance." Within this session, papers were presented that presented research on full-depth reclamation, cold-in-place recycling, and stone matrix asphalt. Another of the technical sessions dealt with general pavement construction issues. Topics covered in this session included temperature and density differentials within pavements, segregation, construction and performance of longitudinal joints, and tender mix behavior. The third technical session was concerned with pavement density and profilometer issues during construction. Papers were presented within this session on methods of determining the density of constructed pavements, and the use of profilometers to measure pavement smoothness. The final TRB session sponsored by A2F02 was on the quality control of asphalt pavement construction.

At each year's TRB meeting, the A2F02 committee meets to discuss current research needs within the HMA industry. At this year's meeting, a number of issues were discussed. A list of topics the committee identiifies as important follows:

- Longitudinal Joint Construction
- Real Time Process Control for Laydown Operation
- Development of Test Methods to Measure Workability and Compactability of Hot Mix Asphalt
- Automated Analysis of Aggregate Shape Properties
- Optimizing Voids in the Mineral Aggregate (VMA) for Superpave HMA Mixtures
- Construction Factors That Influence Flexible Pavement Performance
- Asphalt Tack Coats

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Calendar of Events

2002

Aug 27-28 and 28-29 **Binder ETG and Mix ETG**
Minneapolis, MN

Sept 23-24 **3rd International Symposium on Binder Rheology and Pavement Performance**
San Antonio Marriott Riverwalk
Contact: Abatech Inc., (267) 880-1295

Oct 11-15 **AASHTO Annual Meeting**
Anchorage, Alaska
Website: http://www.aashto.org/mtng_events/a_me.html

Oct 21-25 **Pavement Evaluation**
The Hotel Roanoke & Conference Center Roanoke, VA
Contact: www.conted.vt.edu/pavement.htm

Nov 19-21 **SEAUPG**
Hilton Hotel Lexington, KY
Contact: Jill Baumgardner E-Mail: SEAUPG@aol.com

2003

Jan 12-16 **Transportation Research Board 82nd Annual Meeting**
Washington, DC
Contact: TRB (202) 334-2934 Fax: (202) 334-2003 Website: http://trb.org/

Jan 11-17 **NAPA's 48th Annual Convention**
San Diego Marriott Hotel San Diego, California
E-mail: cprouty@hotmix.org
Website: http://www.hotmix.org/meetings/napa48th.html

Mar 10-12 **Meeting of the Association of Asphalt Paving Technologists**
Marriott Griffin Gate Resort Hotel Lexington, KY
Contact: AAPT, (651) 293-9188 Website: http://www.asphalttechnology.org/

Mar 18-20 **World of Asphalt™ Show**
Nashville, Tennessee
Website: www.worldofasphalt.com

Mar 17-19 **Asphalt Pavement Conference**
Nashville, Tennessee
Website: http://www.asphaltalliance.org/registration/superpave2003.htm

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