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Research
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The R D & T Newsletter

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SCDOT to Hold Second Research Workshop in September

In August 2003, the SCDOT held its first Research Workshop to promote the Department's Research Program and to discuss research needs. Over 90 people, including representatives from the SCDOT, Federal Highway Administration (FHWA), United States Geological Survey (USGS), academia, and industry, attended the one-day event. The workshop was considered a success with over 150 potential research topics identified, approximately half of which were identified as high priority topics.

The second SCDOT Research Workshop will be held September 27, 2005. As with the previous workshop, the Transportation Technology Transfer Service (T3S), South Carolina's LTAP Center, will provide logistical and administrative support for the one-day event. The workshop will again include a presentation on the Research Program, including a discussion on availability of funds. Attendees will then disperse into one of six pre-assigned breakout groups covering various areas of the Department's work. Each breakout group will discuss specific research needs and develop a prioritized list of research topics. A closing session with all participants will then be held and the moderator of each group will present some of the top topics identified by their group.

During the workshop, a contact person from the DOT will be identified for each of the high priority topics. The contact will be responsible for developing a problem statement for the topic, with assistance as needed from Research Unit personnel. The Department's Research and Development Executive Committee (RDEC) will ballot the topics and develop a prioritized list to pursue as research projects.

For additional information on the workshop, contact Terry Swygert by phone at (803) 737-6652 or by e-mail at swygerttl@scdot.org.

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In This Issue...

SCDOT Gains Knowledge from NCAT Test Track

The South Carolina Department of Transportation (SCDOT) is currently participating in Pooled Fund Study No. TPF-5 (072), "NCAT Pavement Test Study." The study, which is sponsored by the Alabama Department of Transportation and the Federal Highway Administration, is being conducted by the National Center for Asphalt Technology (NCAT) at Auburn University. Other states participating in the study are Florida, Georgia, Indiana, Mississippi, Missouri, North Carolina, Oklahoma, and Tennessee.

The first phase of this project was Pooled Fund Study SPR-3 (085), "Accelerated Loading Pavement Study." The Alabama DOT funded construction of a 1.7-mile oval test track in 2000 at a site near Auburn University. Participating agencies then purchased sections to place asphalt mixes using their own materials.

The track consisted of 46 sections, averaging 200-feet long. Twenty-six of the sections are in the tangents (straightaways) and another 20 sections are in the curves. After the test sections were constructed, a total of ten million ESALs were applied over a two year period. The ESALs were applied with four fully loaded trucks with three trailers per tractor. Each tractor pulled a load of approximately 152,000 pounds, 20,000 pounds for each of seven loaded axles and approximately 12,000 pounds for the front steer axle. This is the equivalent of approximately twenty years of interstate type traffic applied in a two year period. The first cycle of testing was conducted from 2000 to 2002. In the current study, a second round of testing began in 2003.

The SCDOT placed two tangent sections in 2000. Section S-8 consisted of 12.5 mm Superpave as the surface layer and 19.0 mm Superpave as the intermediate layer. Section S-11 consisted of 9.5 mm Superpave as the surface layer and 19.0 mm Superpave as the intermediate layer. In 2003 the SCDOT retained their two sections from the first study for continued loading and added two new tangent sections and a curve section for the current round of testing. Section N-13 consists of 12.5 mm SMA as the surface layer and 19.0 mm Superpave as the intermediate layer. Section S-1 consists of 12.5 mm Superpave as the surface layer and 19.0 mm Superpave as the intermediate layer. The curve section, section W-3, consists of 9.5 mm Superpave as the surface layer. Different aggregate sources from South Carolina were used in the mixes for the second round of testing.

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Evaluation of the Use of Gyratory Compacted Asphalt Specimens for Tensile Strength Ratio (TSR) Determination

In December of 2004, SPR Project Number 637, "Evaluation of the Use of Gyratory Compacted Asphalt Specimens for Tensile Strength Ratio (TSR) Determination" was completed. The principle investigator was Mr. Chad Hawkins, Asphalt Materials Engineer for the SCDOT.

The objective of this research was to compare Tensile Strength Ratio (TSR) test results of Hot Mix Asphalt (HMA) mixtures from the smaller diameter Marshall specimens with those from the larger diameter gyratory specimens. The TSR value shows how susceptible the HMA will be to stripping or a reduction in strength under a wet conditioning process.

Since the implementation of Superpave, the SCDOT has had concerns about the use of 4" diameter Marshall specimens used in SC-T-70, Laboratory Determination of Moisture Susceptibility. This concern is due to the increased coarse aggregate content in Superpave mixtures.

The Marshall specimens (4") and the gyratory specimens (6") of the same mixes were used to determine if the test results reasonably compared. To meet this objective, several variables were researched. The first variable was the mixture type, the second variable was the type of aggregate used, and the third variable was the anti-strip additive. The results of this research were used to revise SC-T-70 to include the use of 6" gyratory specimens for determining the wet conditioned strengths and TSR.

Five different mixture types were used to determine if the mixture gradation had an affect on the comparison between the Marshall and gyratory TSR values. It was determined from statistical analysis (F and t-tests) that there were no statistically significant differences between the Marshall and gyratory TSR values with the same type of mixtures.

Several different types of aggregate were used to reflect the types of aggregate found in SC. The types of aggregate (crushed granite, limestone, gravel, and natural sand) were varied for coarse and fine aggregate sources. It was determined that when the same aggregate source was used, it did not affect the TSR result for the identical Marshall and gyratory specimen. The mix designs all performed identically when compared to the same Marshall and gyratory mixture as determined by statistical analysis.

The third and final variable used to compare the Marshall and gyratory TSR values was an anti-stripping agent. SCDOT requires the use of 1% hydrated lime as an anti-stripping additive in all asphalt mixtures. There was no significant difference between the Marshall and gyratory TSR values; however, there was a noticeable difference between the mixtures with and without lime.

By evaluating the use of the gyratory compactor versus the Marshall hammer for asphalt specimen TSR values, it was determined that the two methods reasonably compare with each other from a statistical analysis standpoint.

If you are interested in a copy of the report, contact Terry Swygert, by phone at (803) 737-6652, or by e-mail at swygerttl@scdot.org.

Heed early warning signs of trouble on your projects and in your job

From his lighthouse post in a southern Indian wildlife sanctuary, the lookout noticed something unusual. A herd of antelope was stampeding from the shoreline toward a nearby hilltop. When the tsunami struck 10 minutes later, the animals were safe.

At Yala National Park in Sri Lanka, the elephants, leopards, deer, and other animals were unharmed though 30,000 people living nearby were killed. The deputy director says animals managed to escape because they heeded a warning.

Whether the animals were able to hear the tsunami or sense it through some unknown warning signal, they nonetheless responded to an early warnng and survived.

According to Malcolm Gladwell, the author of Blink, the Power of Thinking Without Thinking, one tennis coach says he knows when a player is about to double fault. He is right 16 out of 17 times but he doesn't know why he knows. He thinks some set of unknown cues tips him off to the series of faults.

These examples make us aware that there are cues all around us. Is it possible that we can use this information in our work?

Sometimes we get the feeling that something just isn't right on a project, with the way a machine sounds or with how your work is meshing with the work of others. When it happens, don't be afraid to rock the boat, because there are few situations that can't be improved. Ask yourself:

- Is there something I can do?
- Should I present my ideas to the team?
- Would it be best to discuss it with the boss before talking to others?

(Continued from page 2)

Field performance testing is conducted at the test track. An inertial profiler equipped with a full lane width dual scanning laser "rutbar" is run weekly around the entire track to determine individual wheelpath roughness, right wheelpath macrotexture, and individual wheelpath rutting for every experimental section. Additionally, 3 random locations were selected within each section in a stratified manner to serve as the fixed test location for nondestructive wheelpath densities. Transverse profiles are measured along these same locations each week so that rutting may be calculated using a contact method. Every month, surface friction and falling weight deflectometer testing are conducted. In addition structural high speed response data is collected along with videologging to provide a permanent visual record of surface performance. Every quarter, cores are cut from the wheelpath of each section to examine layer densification.

Trucking operations on this second phase of the study will conclude in November 2005. The test sections have provided the SCDOT with valuable information about the specific asphalt mixes and aggregates tested in their sections from both a structural and safety standpoint. The SCDOT is considering participation in the next cycle of testing to begin in 2006.

Additional information can be found at the official NCAT Pavement Test Track website: http://www.pavetrack.com.

Research Projects Started Between January 1, 2005 and June 30, 2005

SPR No. 656, *Life Cycle Cost Analysis for Pavement Design*
Principal Investigator: Dr. Prasada Rangaraju, Clemson University

SPR No. 657, *An Assessment of South Carolina Road Users to Measure Public Knowledge and Understanding of Traffic Control Measures*
Principal Investigator: Kim Alexander, Clemson University - Center for Safety Research and Education

SPR No. 658, *Better Management for Speed Control in Work Zones*
Principal Investigator: Dr. Wayne Sarasua, Clemson University

SPR No. 659, *SCDOT Maintenance Outsourcing*
Principal Investigator: Dr. Ronnie Chowdhury, Clemson University

Research Projects Completed Between January 1, 2005 and June 30, 2005

SPR No. 627, *Evaluation of Interstate Highway Capacity in Short-Term Work Zones*
Principal Investigator: Dr. Wayne Sarasua, Clemson University

SPR No. 636, *Evaluation of South Carolina Aggregate Durability Properties*
Principal Investigator: Dr. Prasada Rangaraju, Clemson University

SPR No. 637, *Evaluation of the Use of Gyratory Compactor Asphalt Specimens for Tensile Strength Ratio (TSR) Determination*
Principal Investigator: Mr. Chad Hawkins, SCDOT

If you would like a copy of the final report for any of these completed projects, please contact:

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Comments and Suggestions

The ***RD&T Newsletter*** is published on behalf of the SCDOT by the SC Transportation Technology Transfer Service (T^3S) at Clemson University.

If you have suggestions, comments or article submissions for the newsletter, please contact Mike Sanders at 803-737-6691, or mail them to:

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Digital Camera Rules of Thumb

The larger you want to print your pictures, the more pixels you need. A pixel is a small digital square and it is the smallest element in a digital picture. A megapixel equals one million pixels.

If you have a 2 megapixel camera (such as a Nikon Coolpix 2200), you can set your camera for the highest resolution and your pictures will each have 2 million pixels. You will be able to print out a good quality 5x7 print.

If you have a 3 megapixel camera, each picture will have 3 million pixels and you can print out good quality 8x10 prints.

Pixels have the ability to inflate like little balloons when you attempt to enlarge a photo. But this isn't good.
The best pixel is a tiny pixel. If you don't have many pixels in the picture to begin with, then the larger you make the picture, the more the pixels blow up and the more blurry and blocky the picture will be.

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