



ARTS Quarterly

ARTS Building Dedication Celebrated

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The ARTS research and outreach facility was dedicated on America Recycles Day, November 15, 2002. It was designed as a teaching lab for Clemson University Civil Engineering students and is used for research and development. It is unique because it provides the seed money to help counties and cities make this technology work for them. After all, finding solutions to the waste-tire problem is meaningless unless we can find a way to get the solutions into the communities.



Dr. Amirkhanian welcomes Larry Abernathy, the Mayor of Clemson. The building of the ARTS facility and the development of the program was made possible by a grant awarded to the Clemson University ARTS program by the South Carolina Department of Health and Environmental Control in cooperation with the City of Clemson.

By carrying out its mission, which is to promote the practical utilization of scrap tire rubber in hot mix asphalt and other civil engineering applications through research, training, and technology transfer, this research outreach program could literally, pave the way toward eliminating the approximate 4 million worn-out tires that clog South Carolina's landfills. This was the message shared by Dr. Serji Amirkhanian, Director of the ARTS facility. By grinding or shredding tires and mixing them with other materials, we can make everything from highways and secondary roads to exit-ramp embankments, retaining walls, running tracks, safer playground materials, golf-course cart paths and erosion-resistant beach walls. In many cases, considering life-cycle cost analysis, these new environmentally friendly construction materials will be less expensive and longer lasting than standard materials.

Vice President for Research at Clemson University, Dr. Christian E. G. Prziembel, welcomed the nearly 100 building dedication guests and said "What we learn through the ARTS program, will not only benefit South Carolina but may have international implications. We hope the ARTS program could become a model for other states as well as overseas. We know the technology can work, we're doing the research to make it better." The lab has already attracted international attention and the staff has met with interested guests from China, Spain, Italy, Scotland, and just two weeks ago, hosted eight visitors from Japan.

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Recycle Tid Bits:

In this decade, it is projected that Americans will throw away over 1 million tons of aluminum cans and foil, more than 11 million tons of glass bottles and jars, over 4.5 million tons of office paper and nearly 10 million tons of newspaper.

Almost all of this material could be recycled.

ARTS Building Dedication (continued)

Other officials on the agenda were C. Earl Hunter, Commissioner for South Carolina Department of Health and Environmental Control; Larry Abernathy, Mayor of the City of Clemson; and Clarence H. "Red" Hermann, Vice Chairman of the Recycling Market Development Advisory Council, and Doug Carlson, Deputy Director of the Rubber Pavements Association. The ARTS staff would like to take one more opportunity to thank these individuals for sharing their time with us on November 15.

In addition to these officials, the ARTS Building Dedication was attended by County Councilwoman Holly Ulbrich and Senator Thomas Alexander.

After the dedication ceremony, the guests were invited to join Mary Corley, Program Administrator for ARTS, for a demonstration and explanation of the new ARTS Blending Unit. Lab tours and refreshments followed. •

We would like to take this opportunity to recognize and thank Bill Culler and Jana White, Office of Solid Waste Reduction and Recycling, Department of Health and Environmental Control, for their faithful and continued support of the ARTS Program.



Doug Carlson, Deputy Director of the Rubber Pavements Association attended the ARTS Building Dedication from Arizona to present Serji Amirkhanian and the ARTS Program with the prestigious "Outstanding Market Development" Award For Its Promotion of the Utilization for Waste Tire Rubber in Asphalt in the State of South Carolina.



ARTS Portable Blending Unit

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Portable Blending Unit

ARTS has recently purchased a new portable blending unit to blend crumb rubber and liquid asphalt for paving projects. The 50 ft long, 30 ton, bright orange unit made by Heatec, Inc. is housed on a portable trailer and is available for lease to any contractor performing an ARTS paving project in the state of South Carolina.

The blending process involves several steps. First, a 2000-pound (1-ton) “super sack” of crumb rubber is lifted up over the rubber hopper by a forklift. Once the sack of rubber is positioned directly over the hopper, the bottom of the sack is opened to allow the rubber to pour out. The rubber is then transported to the first mixing tank by an auger.



Rubber is poured into the hopper and blended with the liquid asphalt.

When making conventional hot mix asphalt, the liquid asphalt is pumped from the supplier’s tanker into a storage tank at the hot mix plant. When rubberized asphalt is being blended at the plant, the heated liquid asphalt is simply pumped from the supplier’s tanker into the blending unit instead. This liquid asphalt is pumped through a booster heater and into the first mixing tank at the same time the rubber is added.

The paddles in the mixing tank constantly agitate the liquid asphalt and crumb rubber as they are

combined. Once the first tank is full, it overflows into the second tank. Similarly, once the second tank is full, it overflows into the final tank. The blending process takes roughly one hour, and the rubber modified liquid asphalt is maintained at approximately 350° F (177° C) the entire time.

Once the blending process is complete, the rubber modified liquid asphalt is ready to be combined with aggregate, or rock, to produce hot mix asphalt. The blending unit can either connect directly to the contractor’s asphalt hot mix plant for production, or it can connect to an agitated liquid asphalt storage tank at the plant. The contractor’s plant equipment is not harmed in either case.

The ARTS blending unit was successfully utilized for the final two projects of the 2002 season, Michelin Boulevard Phase 4 and Greenville County. For more information about the unit or for information about leasing the portable blending unit for your project, contact Mary Corley, (864) 656-6427 or mcorley@clmson.edu.



Pumping plain liquid asphalt into the blending unit.

Recent Visitors

ARTS Visited by Japanese Delegation

In November, eight representatives visited the ARTS facility from Japan to learn about how we are using rubberized asphalt in paving projects. By trade, these gentlemen were tire manufacturer representatives, contractors, and members of JATMA, Japan Automobile Tire Manufacturers Association.

Their visit included a presentation by Dr. Serji Amirkhanian, a tour of the lab facilities at the ARTS building, and an inspection of several of the rubberized asphalt projects recently completed by ARTS.●



SCDOT Research Peer Exchange Group

The South Carolina Department of Transportation (SCDOT) hosted a peer exchange of its research program November 12-14, 2002. The peer exchange was held on the Clemson University campus in Clemson, SC. The peer exchange team evaluated the current SCDOT research program and identified its strengths as well as potential opportunities for improvement. Brad Putman leads a tour of the ARTS laboratory facilities for the team.



From left to right: Moy Biswas (North Carolina DOT), a partially hidden Milt Fletcher (SCDOT), Jeff Smith (Maryland DOT), Lamar Caylor (Georgia DOT), and Randy Battey (Mississippi DOT). Those not pictured, but in attendance from SCDOT: Mike Sanders, Danny Shealy, Terry Swygert, and David Law (FHWA) and Jim Burati (South Carolina Transportation Technology Transfer Service)●



Recycle Tid Bit

Each year, Americans throw away enough wood and paper to heat five million homes for 200 years.

ARTS on the Road

ARTS Director Invited to Speak at Major Conference in Italy



Dr. Serji Amirkhanian was invited to Rimini, Italy to present a paper at the RICICLA Environmental Fair in November 2002. The topic was on ARTS and its activities in the field of rubberized asphalt and the implementation process. This conference was attended by recycling and public works representatives from all over Europe. •

ARTS Director Invited to Speak at Conference in Memphis

Dr. Serji Amirkhanian has been invited to present a paper at the Tri-Regional Scrap Tire Management Conference in Memphis, Tennessee in December 2002. His topic will be how ARTS is overcoming the hurdles of setting up the ARTS program. And to educate the attendees about why rubberized asphalt is more economical in the long run. Dr. Amirkhanian concluded with the future outlook for rubberized asphalt. •

SCDOT Certification Courses Taught at ARTS Facility

For over nine years the Civil Engineering Department at Clemson University has coordinated with the South Carolina Department of Transportation to teach a number of asphalt certification courses. Several of these courses are now being taught at the ARTS Research Facility. These courses are required for various SCDOT personnel as well as personnel employed by contractors and engineering consultant firms working on SCDOT paving projects.

Various testing procedures, SCDOT specifications, and material properties concepts are included in the curriculum. In addition to benefits from the new classroom setting, the hands-on portions of the courses are now taught in the fully-equipped, state-of-the-art laboratory facilities.

The courses offered at the ARTS lab are:

- Level 1 – HMA Quality Control Technician Course*
- Level 2 – HMA Mix Design Fundamentals Course*
- Level 2S – Superpave Mix Design Course*
- Level 3 – Quality Control Managers Course.*

If you would like more information about these courses, or a course schedule, visit our web site at

www.ces.clemson.edu/scdotcert

or contact Myrtle Mraovich at (864) 656-4183 or mmyrtle@clemson.edu. •

ARTS Educational Video Now Available

A new educational video, promoting the use of scrap tires in recycled materials, is now available through ARTS. This video, entitled "Where the Rubber Meets the Road" details the mission of the ARTS program and how it utilizes crumb rubber in hot mix asphalt to make more durable roads and reduce waste in South Carolina.

To purchase your copy, please send \$9.95 by check or money order for shipping and handling to:
ARTS, 2002 Hugo Drive, Clemson, SC 29634.

Please include your name, address and phone number and your choice of VHS or CD. Allow 2-3 weeks for delivery. •

Five ARTS Demonstration Projects Successfully Completed in 2002

One of the ongoing goals of the Asphalt Rubber Technology Service (ARTS) is to design and construct several demonstration projects each year utilizing recycled tire rubber. This summer and fall, ARTS completed five such projects around the upstate of South Carolina.

The first three projects were completed in May and included the resurfacing and new construction of roads using rubber modified hot mix asphalt (HMA) at the South Carolina Botanical Garden, resurfacing the access road for Clemson University's Outdoor Laboratory with a stress absorbing membrane interlayer (SAMI), and placing intermediate and surface courses made of rubberized HMA on parking lots and access roads for the newly constructed ARTS research facility.

Two more rubberized paving projects were completed by the beginning of October. The first of these was Phase 4 of Michelin Boulevard. This project involved placing a rubber modified HMA surface course over approximately 1.5 miles of the newly-constructed 4-lane road in Anderson County (a total of 6-lane miles). The rubberized surface course was placed on top of an intermediate course made of conventional asphalt and marked the final phase of the Michelin Boulevard project.

The final project of the season was Greenville County. This project involved placing rubberized HMA surface course on approximately 4 miles of roads in various locations around Greenville County. Some roads involved



**ARTS Project in Greenville County, SC
West Golden Strip, Mauldin, SC**



Michelin Boulevard, Phase IV, Anderson County, SC

resurfacing, while others required paving over a recycled asphalt base. The roads that were paved included portions of Ansel School Road, Slatton Shoals Road, West Golden Strip, and Adams Mill Road.

All five of the projects used rubber modified HMA mixes designed by ARTS. These mixes, which were specified as 9.5 mm Superpave mixes, used PG 64-22 binder modified with 10% ground tire rubber (#40 mesh). A design compaction level of 75 gyrations was selected for all of the projects except Michelin Boulevard, which required 100 gyrations. This compaction level was based on the expected traffic loading.

With a few exceptions, plant production of these mixes proceeded as with conventional asphalt mixes. The first three projects utilized terminally blended asphalt rubber. The asphalt binder supplier simply blended the asphalt binder and tire rubber at the terminal and shipped it to the HMA contractor on heated trucks. The final two projects utilized on-site blending. In this process, the contractor used the ARTS blending unit to combine 2000-pound super sacks of rubber with conventional (PG 64-22) liquid asphalt binder. The pre-blended rubber modified asphalt proved to be slightly more expensive than the asphalt blended on-site.

For both methods, the blended liquid was stored in a heated, agitated tanker at the HMA plant until it was needed.

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Five Demonstration Projects Successfully Completed in 2002 (continued)

The rubber modified HMA for all five projects was mixed at approximately 330° F to 340° F (166° C to 171° C), stored in silos, and loaded into dump trucks for delivery to the project. Normal production rates allowed the plant to produce as much as 1,500 tons per day. As seen in last year's projects, calibration of the plant's binder pump was necessary to accurately meter the highly viscous asphalt rubber.

After production, the HMA mix was hauled to the project site in dump trucks. The mix was then placed at a thickness of two inches using conventional paving methods and equipment. Compaction on each project was generally attained through the use of steel wheel rollers, both vibratory and static. In the Michelin Boulevard and Greenville County projects, the contractor discovered that pneumatic tire rollers could be successfully utilized as finish rollers after the mat had cooled down to approximately 150°F (66°C). Previously, pneumatic tire rollers had not been utilized due to the tendency of the asphalt to adhere to the tires. The roads with a recycled asphalt base proved to be the easiest to compact, and in general, the compaction requirements were met for all five projects.

One interesting characteristic of the rubber modified HMA was that it appeared to cool at a slower rate than traditional HMA mixes. This characteristic, which could be attributed to the insulating effects of the ground tire rubber, was observed to help in extending the allowable time for compaction. However, this effect could cause problems in a project if it becomes necessary to open a freshly-paved road to traffic and the mix has not yet cooled properly.

Overall, all five projects were considered a success by both ARTS and the agencies involved. They utilized a combined total of over 15,000 tons of rubberized hot mix asphalt.

For more information on these projects and those pending for next year, visit the ARTS website at www.ces.clemson.edu/arts. •

ARTS Welcomes New Administrative Assistant

Teri Oswald joined ARTS as the Administrative Assistant in September 2002. Teri filled Wendy Franzese's position after Wendy and her family moved back to New York in the fall. We would like to take this opportunity to thank Wendy for her many contributions to help the ARTS Program become successful.

Teri is a former internet skills trainer and marketer. She is married and has 3 sons. She is a Cubmaster for the Cub Scouts in Clemson, SC and enjoys spending time with her family in the outdoors.

Teri handles the publication and distribution of the ARTS Quarterly newsletter, the web site maintenance, administration of the ARTS training and workshops, as well as the administration of the demonstration projects across the State of South Carolina. •



Products Made from Recycled Tires

Alternate Fuels	Playground Cover
Anti-fatigue Mats	Railroad Crossings
Barn Stall Mats	Rubberized Asphalt
Carpet Cushion	Soaker Hoses
Civil Engineering Materials	Soil Amendments
Flooring	Sound Barriers
Floor Mats and Tiles	Speed Bumps
Interlocking Paving Tiles	Surfacing
Irrigation	Swings
Livestock Feeders	Threshold Ramps
Lumber / Decking	Traffic Cones
Office Supplies	Tree Care
Parking Curbs	Truck Bed Liners
Planters	Vehicle Ramps
	Wheel Chocks
	...And Many More!

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The Staff and
Researchers at
ARTS Wish You and
Your Family a
Happy Holiday
Season!

