

ARTS Quarterly

We'll Pay YOU to Take Advantage of Our Grant Program

ARTS Offers Incentives on New Grants

For a limited time, we will be offering incentives to agencies receiving ARTS grants. In addition to paying the "difference" cost for using asphalt rubber, or rubber in a civil engineering application, ARTS will also pay the agency a percentage of the base cost of the ARTS portion of the project (that is, the ARTS portion of the project cost without using rubber). For projects involving scrap tires in other civil engineering applications, the incentive will be on the cost of the project without using rubber. Here are the details:

Project costs up to \$100,000 will receive an incentive of up to 15% or \$15,000. Project costs that exceed \$100,000 will receive the 15% incentive, plus an additional incentive of up to 10% of the amount over the first \$100,000. Projects with costs exceeding \$200,000 will receive another additional incentive of 5% of the amount that exceeds \$200,000, up to \$300,000.

All incentives are subject to approval by ARTS and the South Carolina Waste Tire Committee. The total incentive amount shall not exceed \$30,000. This incentive offer is valid on all grant applications received and approved between August 14, 2001 and August 13, 2002.

Please contact the ARTS office if you have any questions about the grants available or the incentives. Phone: 864-656-6799 or Email: arts@ces.clemson.edu



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It Has Been Said:

- In 1965, a California chemist invented the Super Ball® by compressing a synthetic rubber material under 2,500 pounds of pressure per square inch. It had a resiliency of 92%, about three times that of a tennis ball, and could bounce for long periods.
- A ball of glass will bounce higher than a ball of rubber. A ball of solid steel will bounce higher than one made entirely of glass.

EXAMPLES

Project cost w/o Rubber	\$80,000
Project cost w/Rubber	\$96,000
ARTS Grant for Difference	\$16,000
Incentive	80,000 x 15% = \$12,000
New ARTS Grant Amount	16,000 + 12,000 = \$28,000

Project cost w/o Rubber	\$250,000
Project cost w/Rubber	\$300,000
ARTS Grant for Difference	\$50,000
Incentive	100,000 x 15% = 15,000
	100,000 x 10% = 10,000
	50,000 x 5% = 2,500
Total Incentive	= \$27,500
New ARTS Grant Amount	50,000 + 27,500 = \$77,500

Demonstration Projects Successfully Completed

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 past summer and fall, ARTS completed three of these projects around the upstate of South Carolina. One of the projects involved placing rubber modified hot mix asphalt (HMA) in parking lots and other areas at several schools in the Pickens County School District. The other two projects, located in Anderson County, also placed rubber modified HMA in two different phases on a newly constructed road.

All three 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 (minus #40 mesh). The design compaction level for the Pickens County School project was 75 gyrations while the two Anderson County projects were designed with 100 design gyrations due to the high level of expected traffic.

With a few exceptions, plant production of these mixes proceeded as with conventional asphalt mixes. The Pickens County School project and the first phase of the Anderson County project both utilized on-site blending of the asphalt rubber (Figure 1). This means that blending of the asphalt binder and tire rubber was performed at the plant site using equipment specifically designed for asphalt rubber blending. Minimal plant modifications were necessary for the use of this equipment. The second phase of the

Anderson County project however, utilized terminally blended asphalt rubber. For this project, 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. Both the on-site and terminal blending methods worked well and were little to no problem for the HMA contractor to utilize.

The rubber modified HMA for all three projects was mixed at approximately 330° F to 340° F, 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. It was found however that calibration of the plant's binder pump was necessary to accurately meter the highly viscous asphalt rubber.

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Standard paving equipment was used to place the rubber modified hot mix asphalt (HMA)



Figure 1: Portable blending equipment such as the piece in the foreground was used for two of the projects.

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Figure 2: Compaction of the rubber modified HMA was similar to that of most HMA mixes

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 three steel wheel rollers, both vibratory and static (Figure 2). Like many Superpave mixes, a "tender zone" was encountered during the rolling process when the asphalt mat reached temperatures between approximately 200° F and 250° F. This problem was resolved by altering the rolling pattern to avoid compacting the asphalt during this temperature range. Pneumatic tire rollers were not utilized due to the tendency of the asphalt to adhere to the tires. In general, the compaction requirements were met for all three projects.

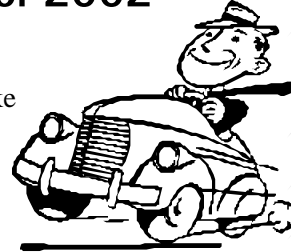
One interesting characteristic of the rubber modified HMA was that it appeared to cool at a slower rate than traditional HMA mixes. This characteristic, which could be attributed to the insulating effects of the ground tire rubber, could help in extending the allowable time for compaction.

Overall, the Anderson County projects (Figure 3) and the Pickens County School District project were considered a success by both ARTS and the agencies involved. For more information on these projects, visit the ARTS website at www.ces.clemson.edu/arts.

A New Approach to Seminars for 2002

This year we would like to offer more individualized opportunities for you to hear about ARTS and the grant program.

Rather than asking you to come to us and participate in a day-long event, we would like to visit you.



In our meeting we can discuss potential projects and how to go about applying for grant monies. This will give us the opportunity to "ride the roads" with you, in your municipality, and determine which application of rubberized asphalt would be best utilized. If you choose to invite potential contractors, we will be able to answer their questions in open and project-specific discussions. If you don't yet have a specific project in mind, and just need an overview of the ARTS program, we are more than happy to make a presentation that will cover all the facts you need to get started.

If you would like to set up a meeting with a member of the ARTS team, please contact Wendy Franzese at 864-656-6799 or via Email: arts@ces.clemson.edu



Figure 3: Michelin Boulevard in Anderson County

Asphalt-Rubber Prevents Reflective Cracking

Asphalt-rubber is a type of modified asphalt binder with improved temperature susceptibility and flexibility. It is formed by the interaction of ground reclaimed tire rubber with asphalt binder at elevated temperatures for a certain period of time. This type of modified binder has several advantages. The ground tire rubber not only increases the binder's elasticity, but also increases its resistance to aging due to anti-oxidants contained in tires.

For over 30 years, the Arizona Department of Transportation (DOT) has utilized asphalt-rubber in its state highway system with very rewarding results. Arizona DOT's method of producing asphalt rubber involves blending at least 15% ground tire rubber with a standard, unmodified asphalt binder. This asphalt-rubber mixture is blended at an elevated temperature for about an hour to react the rubber (reaction time) with the binder and achieve the target viscosity. This type of modified binder has several advantages. The ground tire rubber not only increases the binder's elasticity, but also increases its resistance to aging due to anti-oxidants contained in tires. The properties of the mixture are affected by the base asphalt binder source, the amount and gradation of crumb rubber modifier (CRM), and the reaction time and temperature.

The Arizona DOT utilizes asphalt-rubber in several ways. From reducing rutting in hot climates like Phoenix to resisting cracking in cold climates like Flagstaff, asphalt-rubber has proven to be a very versatile material for Arizona. The various applications of asphalt-rubber most commonly used by the Arizona DOT include uses such as gap-graded hot mix asphalt (HMA), open-graded friction course (OGFC), stress absorbing membrane (SAM), and stress absorbing membrane interlayer (SAMI). SAM and SAMI, which are basically surface treatments that use asphalt-rubber instead of an emulsion or cutback, are particularly efficient at controlling reflective cracking.

A SAM is an alternative wearing course to an HMA overlay for cracked pavements. It is constructed by spraying a thick layer of asphalt-rubber containing 20% to 30% ground tire rubber on the roadway. The asphalt-rubber is applied at a rate of 0.6 – 0.8 gal/sy and immediately covered with aggregate at a rate of 30 – 40 lbs/sy. The SAM is then rolled with rubber tire rollers for proper embedment.



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BEFORE and AFTER SAM APPLICATION



Arizona highway **BEFORE** SAM application

Arizona highway **15 years AFTER** SAM application

(Continued on page 6)

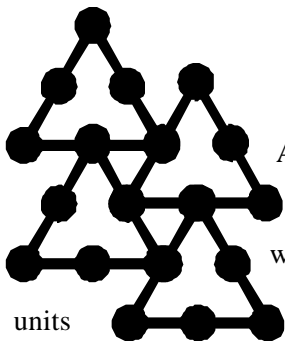
Welcome Mary Corley

Mary has joined ARTS as Program Administrator. Kevin Vaughan departed December 3 for an irresistible opportunity in Georgia. We wish him well, and thank him for his assistance in a very successful inaugural year. We are extremely pleased to have the opportunity to welcome Mary as part of our team. Mary holds both bachelor's and master's degrees in civil engineering from Clemson University. She will be instrumental in the

program's success by completing mix designs and providing quality assurance throughout each project. She can be reached via:

864-656-6427, or

Email: mcorley@clemson.edu



units
strong

A polymer is a chemical compound with high molecular weight consisting of a number of structural units linked together by strong bonds.

Examples of polymers are polyethylene, polystyrene, and natural and synthetic rubber. When used to modify asphalt binders, polymers form an elastic network within these binders. Polymer-modified binders possess an increased resistance to both rutting and fatigue cracking. An increase in viscosity causes the decreased amount of rutting, while reduced cracking results from an increase in elasticity. Used frequently in open-graded friction courses (OGFC) and SuperPave surface courses, these polymer-modified binders improve both the quality and lifespan of pavements.

Although ground tire rubber doesn't combine with asphalt binders in quite the same way as a polymer, it offers many of the same benefits when used as a modifying agent. The increased viscosity in polymer-modified binders results from the swelling of polymer molecules. Similarly, crumb rubber particles also swell and cause an increase in viscosity when combined, or "reacted", with asphalt. In addition, ground tire rubber facilitates an increase in elasticity similar to that seen in

Polymers Are Sticky Business

polymer-modified binders. Thus, rubber-modified binders also prevent rutting and cracking.

In addition to offering advantages similar to those gained with polymers, crumb rubber can extend pavement life in a different way. During the process of manufacturing tires, items such as carbon black and anti-oxidants are added to the rubber to prevent the aging. This is an obvious benefit to the tires, but it is an often-overlooked benefit to the pavement. When crumb rubber is used to modify the binder for a pavement, the anti-aging additives in the tire rubber become anti-aging additives for the pavement. Reduced oxidation of the binder can reduce cracking and increase aggregate retention in the pavement, thus decreasing the amount of maintenance required while extending the lifespan of the pavement.

Using crumb rubber as a binder modifier is not only a good way to recycle scrap tires, but it also offers benefits similar to those offered by polymer modifiers. Crumb rubber even has the added benefit of reducing the pavement aging process. If your agency is interested in applying for a grant to perform a project utilizing rubber-modified asphalt, please contact the ARTS office at (864) 656-6799 or see our website for more information at www.ces.clemson.edu/arts.



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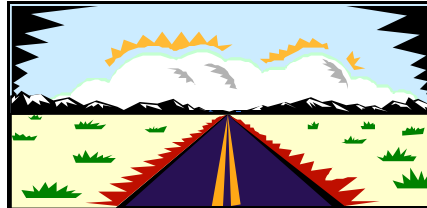


We're on the Web!
www.ces.clemson.edu/arts

Arizona Prevents Reflective Cracking with A-R

(Continued from page 4)

A SAMI is very similar to a SAM with the exception that it is used in conjunction with a HMA overlay rather than as an alternative to it. SAMIs can be used in either two-layer systems or three-layer systems. In a two-layer system the SAMI is applied directly to the existing roadway, and an HMA overlay is then placed over it. This type of two-layer system may be used if the existing pavement is cracked, but it still has a level surface. However, if the existing pavement does not have a level surface, a three-layer system must be used. A three-layer system is constructed by first placing a leveling course of HMA to level the irregular surface. A SAMI and final course of HMA are then placed in the same manner as in the two-layer system.



The SAM and SAMI systems prevent reflective cracking in several different ways. First, the heavy application rate of asphalt-rubber seals and waterproofs the cracks. In addition, the ground tire rubber increases the elasticity of the asphalt binder, which helps it better absorb the stress and strain caused by the underlying cracks. Finally, both SAM and SAMI retain more cover aggregate than a typical surface treatment because of the strong adhesiveness of asphalt-rubber compared to conventional binders.

If you think that either a SAM or SAMI could improve your agency's roads, please contact us to discuss the possibility of performing a demonstration project with ARTS.