Asphalt Rubber Technology Service

SUMMARY REPORT

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Asphalt Rubber Technology Service
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SUMMARY

FIELD EVALUATION OF THE USE OF RUBBER MODIFIED HOT MIX ASPHALT IN ANDERSON COUNTY, SOUTH CAROLINA
Michelin Boulevard (Phase III)

In the year 2000, the United States generated 273 million waste tires weighing approximately 3.6 million tons. In addition to this, there are approximately 300 million more waste tires in stockpiles throughout the U.S. The state of South Carolina generates approximately 4 million waste tires each year, which equates to roughly one tire per person per year in the state. It is clear that in terms of quantity, the disposal of waste tires poses a serious problem.

One method of recycling waste tires that has proven to be quite beneficial is that of rubber modified hot mix asphalt (HMA). Several agencies, such as the Arizona Department of Transportation have been using rubber modified HMA for years. Reported benefits include reduced pavement rutting and cracking as well as the recycling of tires. In order to better promote the use of rubber modified HMA in South Carolina, the Asphalt Rubber Technology Service (ARTS) was formed by Clemson University, the City of Clemson, and the South Carolina Department of Health and Environmental Control.

ARTS promotes rubber modified asphalt in various ways, one of which includes giving grant money to South Carolina public agencies who use rubber modified HMA. One such grant was awarded to Anderson County for placing approximately 4,000 tons of rubber modified HMA on a newly constructed county road.

The HMA mix designed for this project was a 9.5 mm Superpave (N_{des} = 100 gyrations) utilizing PG 64-22 binder modified with 10% ground tire rubber (#40 mesh). This mix was designed by ARTS specifically for use on this project.

The asphalt rubber was pre-blended at a suppliers terminal in Pensacola, Florida and shipped to the contractor's asphalt plant using tractor trailers equipped with heated tanks. A separate tractor trailer with a heated and mechanically agitated tank was stationed at the contractor's asphalt plant to be used as a temporary storage tank for the asphalt rubber. This temporary storage tank was connected

to the contractor's asphalt binder pump so that the asphalt rubber could be metered into the asphalt plant. No modifications to the contractor's asphalt plant were necessary.

In general, production of the rubber modified HMA proceeded normally. The HMA was mixed at approximately 330° F to 340° F (166° C to 171° C), stored in the silos, and loaded into dump trucks for delivery to the project. Normal production rates allowed the plant to produce as much as 1,250 tons per day. The total amount of rubber modified HMA produced for the project was 4,000 tons and took 5 days. No substantial problems were encountered during the production of the rubber modified HMA, although a higher level of communication and coordination with the binder suppler was used due to the long haul distance of the asphalt rubber from Pensacola, Florida.

Quality testing at the plant was conducted at regular intervals to determine mix properties. Initial tests of the rubber modified HMA indicated binder contents that were higher than specified, which subsequently caused other volumetric properties such as the air voids to not meet the requirements of the job mix formula. Once adjustments were made at the asphalt plant to correct the binder problem, all other criteria also fell within acceptable limits.

The HMA mix was hauled to the project site in dump trucks. The haul length to the project was approximately 35 miles and took between 45 minutes and 1 hour depending on traffic. Once at the site, the mix was placed in a two inch lift using conventional paving methods and equipment. Placement of the rubber modified HMA mix with standard paving equipment was similar to that of standard Superpave mixes. Like many Superpave mixes, a "tender zone" was encountered during the rolling process when the asphalt mat reached temperatures between approximately 250° F and 200° F. This problem was resolved by altering the rolling pattern to avoid this temperature zone. Compaction was attained through both vibratory and static steel wheel rollers. Pneumatic tire rollers were not utilized due to the tendency of the asphalt to adhere to the tires. In general, the compaction requirements of 92% of maximum specific gravity were easily met for this HMA mix.

Results from this project indicate the following:

- For the materials used, the Superpave mix design process can be used to develop an HMA job mix formula utilizing asphalt binder containing 10% ground tire rubber by weight of binder.
- Asphalt rubber using 10% ground tire rubber can effectively be blended at the binder supplier's terminal and shipped to the contractor's asphalt plant.
- Calibration of the asphalt pump for the asphalt rubber is recommended prior to starting production of the rubber modified mix.
- For the materials and methods used, mixes containing 10% ground tire rubber by weight of binder can be placed on the roadway using conventional paving and compaction methods. Like many Superpave mixes, a "tender zone" may be experienced that may be resolved by altering rolling patterns.
- Rubber modified asphalt pavements constructed in the manner performed in this project may be produced at costs approximately 39% more than conventional asphalt mixes. These costs are highly dependent on several factors including materials, project location, project size, material haul distances, and project bid method.

This project was performed by the Asphalt Rubber Technology Service with cooperation from the South Carolina Department of Health and Environmental Control, the City of Clemson, Clemson University, and Anderson County. This report reflects the views of the authors, Serji N. Amirkhanian and Kevin M. Vaughan. For more information, contact ARTS.
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