

NEW ENGLAND CONSTRUCTION



**Thousands of Scrap Tires
Help Preserve Newport Roadways**

PRESERVING CITY STREETS

All States Materials Group Places Protective Asphalt-Rubber Chip Seal on Several Miles of Roads in Popular Rhode Island Summer Resort

By Paul Fournier



A busy roadway skirting the scenic shoreline of historic Newport, Rhode Island, recently underwent a pavement preservation treatment that incorporated hundreds of scrapped tires.

All States Materials Group (All States), based in Sunderland, Massachusetts, placed asphalt-rubber chip seal over 3.7 miles of Ocean Avenue, which boasts one of Rhode Island's most spectacular seascapes. The

asphalt contractor/producer also installed this treatment over six other streets of the popular summer resort community.

This is not the first time the city has utilized rubberized asphalt treatment.

"We first tried the asphalt-rubber chip seal about eight years ago on a number of streets including a smaller section of Ocean Avenue, and those streets are still holding up quite well," said William Riccio, Director of the Department of Public Services.

A 30-year veteran of transportation design and construction, Riccio heads up a department that delivers an unusually broad slate of services through its six divisions – Engineering, Capital Programs, Recreation and Beach Operations, Facility Management, Grounds and Forestry, and Public Works. The latter includes Highways, which carries out the City's pavement management program that Riccio launched shortly after he joined the department as Director in 2007. Previously, he served

the Rhode Island Department of Transportation for 18 years as a Project Manager for highway and bicycle transportation projects.

Extending Pavement Service Life

Riccio is studying ways to extend the service life of pavements on Newport's 94 miles of roads – about 90 miles of which are asphalt paved, and approximately 4 miles surfaced with cobblestones. There are no gravel roads.

The Public Services Director believes in the



As Etnyre spreads chips on freshly placed asphalt rubber, Elgin sweeper at left removes loose aggregate from adjacent lane.



Hyster, Bomag, and Caterpillar rollers embed pre-coated stone aggregate into hot asphalt rubber binder.

MILLIONS OF SCRAP TIRES SHREDDED FOR ROADS

According to the Environmental Protection Agency, asphalt rubber is the largest single market for ground rubber, consuming an estimated 12 million tires each year. The agency notes that ground tire rubber beneficially modifies the properties of asphalt used in highway construction, and further, that reduced size scrap tire rubber can be used either as part of asphalt-rubber binder or as an aggregate substitution.

In practice, scrap tire is delivered to rubber processing plants either as whole tires, cut tires (treads or sidewalls), or shredded tires, with shredded tires being the preferred alternative. As scrap, the rubber is processed, particle size is reduced, steel belting and fiber reinforcing are separated and removed from the tire, and size reduction takes place. Crumb Rubber is the result of this process, and is used to create asphalt-rubber for chip seal, among other applications.

Asphalt-rubber chip seals, aka Stress Absorbing Membranes (SAM), have been researched extensively and applied with success in the U.S. since the 1970s. Among the conclusions stated by users after many years of experience: SAM's exhibit improved resistance to alligator cracking and unraveling of asphalt pavement, and when pre-coated chips are used, are also effective in reducing reflective cracking.

concept of pavement preservation as supported by the Federal Highway Administration. FHWA sees pavement preservation as a strategy that uses economical, preventive maintenance treatments to extend pavement life and improve safety. The treatments are applied to the surface of structurally sound pavements that are still in good condition and before deterioration starts. When they're used appropriately, they can restore pavements to almost original condition, postponing costly

rehabilitation and reconstruction. And they're less disruptive to traffic flow than the long closures associated with reconstruction projects. Typical treatments include asphalt crack sealing, chip sealing, slurry or micro-surfacing, thin and ultra-thin hot-mix asphalt overlay.

"We have been developing a pavement management program that includes preservation strategies such as chip seal and crack sealing, and we're currently putting together a list of streets that would make

good candidates for micro surfacing," said Riccio. "We're also looking at additional preservation treatments such as fog seals and cape seals. The City Council has been supportive by approving a budget that allows us to do such projects – they have a positive outlook for pavement preservation," he said.

Creating Newport's SAM

The asphalt-rubber chip seal applied by All States to the Newport roads is a pave-

ment preservation treatment technically called a stress absorbing membrane, or SAM. Construction of asphalt-rubber chip seal is very similar to the construction of a conventional chip seal, in which liquid asphalt binder in the form of an emulsion is sprayed on the existing pavement, crushed stone is spread on the asphalt binder, the stone is rolled to embed it firmly in the binder, and the chip seal is swept to remove any loose aggregate.

A live-bottom Mack truck feeds pre-coated aggregate to an Etnyre chip spreader as it broadcasts stone at the rate of 33 pounds per square yard.



SAM construction differs in that binder sprayed on the existing pavement is liquid asphalt rubber, and the stone has been pre-coated with a performance grade liquid asphalt before it is spread on the road and rolled.

All States created the asphalt-rubber binder at its asphalt terminal in Deerfield, Massachusetts, using the so-called wet process method, one of two principal ways to add scrap rubber to an asphalt paving mix. In the wet process, ground tire rubber (GTR), also called crumb rubber modifier (CRM), is mixed with a performance grade asphalt such as PG64-22 at high temperatures, causing the CRM to swell, soften and blend the two materials for use as a binder in an asphalt paving or surfacing application. The asphalt-rubber is shipped from the terminal to an asphalt mix production plant as a finished binder, with no additional handling or processing required. As an alternative, the asphalt and rubber may be field blended at the asphalt mix production plant using portable mixing and reacting systems.

The other method for creating asphalt-rubber, called the dry process, uses neat granulated rubber like an aggregate and adds it together with stone aggregate and asphalt binder to the mixing drum of a hot mix asphalt plant.

The 100,000 Square Yards of Application

All States' crew applied the asphalt-rubber chip seal to the seven Newport streets during the first week of July. The application covered about 100,000 square yards of roadway, which included 69,000 square yards on Ocean Avenue. William Boardman, P.E., represented the City for the project, while Michael Buckett was All State's Project Superintendent.

The City was responsible for preparing roadways for the chip seal application. All States brought a full contingency of chip sealing equipment to the job's staging area while Newport police organized traffic control measures. A pilot car facilitated traffic control for the 3.7-mile, two-lane Ocean Avenue, leading traffic back and forth over the single lane open for travel while work proceeded on the adjacent lane.

Chip seal application began with a Bearcat distributor mounted on a Mack truck spraying the existing pavement with

asphalt-rubber binder heated to nearly 400 degrees Fahrenheit. Applied at the rate of 0.60 gallons per square yard, asphalt-rubber material is thicker than asphalt binder used for conventional chip seals. This is because adding crumb rubber to asphalt cement significantly increases the viscosity of the resultant asphalt-rubber binder. (See adjoining sidebar regarding viscosity.)

Immediately behind the Bearcat distributor, All States' Etnyre Chip Spreader began broadcasting the aggregate at the rate of 33 pounds per square yard. The chips consisted of 3/8-inch crushed stone that All States had pre-coated with a thin layer (0.5 percent) of performance grade asphalt (typically PG64-22). Four Mack trucks with live bottom conveyors were used to haul the coated chips to the job and transfer them to the spreader hopper.

Special care was taken by the truck and equipment operators to avoid driving over uncovered asphalt-rubber.

Three pneumatic-tired rollers – a Bomag, Hyster, and Caterpillar – followed the spreader closely. They made a sufficient number of passes to ensure that chips were embedded in the hot asphalt-rubber to between one-half and two-thirds their depth.

Approximately 69,000 square yards of asphalt-rubber chip seal was applied to Ocean Avenue, a popular tourist attraction.



As a final step in chip seal production, Able Industrial Sweeping of Rehoboth, Massachusetts, removed loose stone from the road surface using several Elgin sweepers.

A Green Production

According to All State's spokesman Robert Betsold, Technical Marketing, the project was completed in four-and-a-half working days.

He indicated that the project illustrated a green or sustainable solution for the City by transforming about 7,500 space-wasting scrap tires into a product that will help extend the life of city street pavements for another eight years or more.

HOW THICK IS IT?

Engineers usually describe viscosity of asphalt-rubber in units of centipoise (cps). The lower the viscosity the more easily a substance flows. For example, water has a viscosity of 1 to 5 cps, while SAE 40 Motor Oil viscosity runs between 250 to 900 cps, and ketchup is about 50,000 cps. The viscosity of asphalt rubber is usually designed to be between 1,500 cps and 5,000 cps.

Viscosity of asphalt-rubber is important, according to the Federal Highway Administration, since "the benefit of increased viscosity of asphalt-rubber binder is that additional binder can be used in the asphalt mix to reduce reflective cracking, stripping, and rutting, while improving the binder's response to temperature change and long-term durability, as well as its ability to adhere to the aggregate particles in the mix, and to resist aging."

The federal agency has also pointed out that asphalt-rubber seal coats can be effective in maintaining low-volume roadways "in conditions under which conventional seal coat would oxidize and crack due to lack of use," or where "conventional seal coat could not withstand high traffic volume. In this situation, in which aggregate loss is potentially the greatest threat, pre-coated aggregate should be used, and proper asphalt-rubber seal coat design is critical."