

Putting old tires to new use in transportation projects

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Highway workers use a mixture of tire shreds and sand in road construction projects involving civil engineers at Purdue who've helped the Indiana Department of Transportation save more than \$1 million over the past two years. The tire shreds are a green alternative to more expensive materials, and they are more easily compacted, saving construction time and money. (Purdue University School of Civil Engineering photo)

Civil engineers at Purdue University helped the Indiana Department of Transportation save more than \$1 million over the past two years by using shredded tires as a new low-cost material in construction projects.

"It's a green project that saves materials and eliminates the landfilling of millions of tires," said INDOT Commissioner Michael B. Cline.

INDOT and the Indiana Department of Environmental Management

worked with professor Rodrigo Salgado and associate professor Monica Prezzi in Purdue's School of Civil Engineering to develop the [green technology](#).

Research started in the late 1990s, and in 2001 the state began using shredded tire chips mixed with sand. The bulk of the work has been done between 2008 and 2010, saving about \$1.2 million in material costs and using 1.1 million tires over that time.

"That's almost a dollar-per-tire cost savings," said Barry Partridge, research program director of INDOT's Joint Transportation Research Program.

The material has been used in nine construction projects so far.

"Mixtures of shredded tires and sand can be designed to be lightweight, which is particularly important when there is the need to construct fills supporting roadways and bridge abutments built over very soft and weak soil deposits," Prezzi said.

Tire shred-sand mixtures also can be used to shore up slopes prone to landslides and as a backfill behind retaining walls.

"The cost of the tire-shred mixture is significantly less than other materials - in some cases one-eighth the cost of using typical lightweight fill material," Partridge said.

Salgado and Prezzi worked with state transportation engineers including Nayyar Zia Siddiki, supervisor of Geotechnical Operations at INDOT, and Athar Khan, manager of the Office of Geotechnical Services.

The Purdue researchers conducted laboratory studies to evaluate strength, stiffness and other characteristics of the material. They

developed a method that allows engineers to plan construction, design structures and optimize performance by determining the proper mixing ratio of tire shreds to sand for specific applications.

The engineers also studied the effects of tire-shred size on construction procedures and the performance of various types of reinforcement, such as metal strips. Sensors were used in laboratory experiments simulating how the mixture works in the field, Prezzi said.

Findings have been detailed in journal and conference papers. Construction-related aspects of the research will be detailed in a paper being presented during the International Symposium on Testing and Specification of Recycled Materials from Feb. 2-4 in Baltimore. The research paper was written by INDOT engineer Malek Smadi, Siddiki and Prezzi.

A few other states also are using shredded tires in highway projects, but wider use of the materials would create a significant new market, Partridge said.

The tire shred-sand mixture is more easily compacted than other materials, saving energy and representing another source of cost savings. Eliminating the expense of tire disposal in landfills represents yet additional savings.

"Landfilling costs are significant - possibly equal to the savings in materials," Partridge said. "So you can almost double the overall cost savings."

Dillon Tires Recycling in North Liberty, Ind., and Elk Tires Inc., of Elkhart, Ind., supplied the tire shreds, which are produced using IDEM-approved processes.

Provided by Purdue University

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