



**Project Number**

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**Ground Tire Rubber (GTR) as a Component Material in Concrete Mixtures for Paving Concrete, Phase 2**

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**Current Situation**

The Florida Department of Transportation (FDOT) has found that high-strength-concrete pavement can experience problems with flexibility and thermal expansion/contraction.

**Research Objectives**

Using ground tire rubber (GTR) in concrete mixtures is a possible solution to mitigating flexibility and thermal expansion issues with high-strength concrete pavements. Florida State University researchers designed concrete mixtures using GTR and then tested concrete made with the mixtures. The general effects of added GTR on workability and mechanical properties of concrete were examined. The researchers also investigated implementation of GTR mixes at ready mix concrete plants.



*Workers put the finishing touches on a slab of concrete made with ground tire rubber.*

**Project Activities**

GTR selected for this project was 40 mesh. A mix design method yielded a range of mix designs for testing. In preliminary tests, GTR replaced up to 40% of sand; this was limited to 20% in final testing. Use of defoaming agent was also tested. Tests run on each mixture included workability, air content, unit weight, compressive strength, modulus of elasticity, flexural strength, coefficient of thermal expansion, and others. Setting times were determined in an environmental chamber, which allowed precise control of setting temperature, humidity, and wind conditions. Concrete samples were also examined using scanning electron microscopy to analyze the bonding between GTR and cement mortar.

Ready mix plant implementation of the optimum mix design as determined by laboratory testing was conducted at a concrete plant located near the researchers' laboratory. Scaling up GTR concrete production yielded important information about storage of GTR and its preparation for mixing, mixing procedures, and foaming and air content, as well as low slump, in fresh GTR concrete. Slabs of GTR concrete were cast, and test cores taken at 28 days.

The researchers also analyzed the sustainability of concrete production, including the contribution of using GTR. To conduct this analysis, they used the Building for Environmental and Economic Sustainability methodology and software, developed by the National Institute of Standards and Technology (NIST) and the American Concrete Institute (ACI).

**Project Results and Benefits**

Researchers found that the right GTR mix shows improved flexibility; however, no definite conclusion could be reached about thermal expansion properties. The sustainability analysis showed that including GTR in concrete had definite benefits that derive from using recycled material and improved quality of the concrete. GTR concrete was also shown to have benefits in lowering initial construction costs.

*For more information, please see [dot.state.fl.us/research-center](http://dot.state.fl.us/research-center)*