



## Florida Department of Transportation Research Ground Tire Rubber as a Stabilizer for Subgrade Soils BDK81-977-03

Over 250 million scrap tires are generated annually in the U.S. Historically, a significant portion of these tires have been processed into finely ground tire rubber (GTR), or crumb rubber, for use as an additive in hot mix asphalt (HMA) pavements to improve pavement performance. Recently, improved synthetic polymer additives have been developed that more economically provide the same performance improvements as GTR. This development has decreased the demand for GTR in HMA, potentially freeing supplies of GTR for other applications.

Over the past two decades the Florida Department of Transportation (FDOT) has conducted a significant amount of research on ways to reuse waste materials in roadway construction. Materials such as ash from energy generation, tires, glass, reclaimed asphalt pavement, and reclaimed concrete have all been studied and found applications. Continuing these studies, Florida Institute of Technology researchers investigated whether blending GTR with subgrade soils would be a beneficial practice by determining the effect of GTR on subgrade soil engineering properties.

A matrix of 15 blends of soil and GTR was tested. Unstabilized subgrade soils were selected with low, medium, and high bearing capacity as measured by limerock bearing ratio (LBR). Three sizes of GTR, 1 inch (25.4 mm), 3/8 inch (9.51 mm), and #40 (0.422 mm), representing a wide size range, were blended with each of the three subgrade soils in varying percentages – 4, 8, 16, 24 and 32% GTR by volume.

Each blend was evaluated for several properties. Grain size analyses were performed by dry sieving. Maximum dry density and optimum moisture content were determined based on modified Proctor compaction. LBR, using Florida Method (FM 5-515), was determined for soil/GTR blends at density and optimum moisture content targets required by FDOT Specification Section 160. Resilient modulus was determined



*Millions of tons of discarded tires are available annually for recycling.*

according to AASHTO T 307 at the FDOT State Materials Office (SMO). Consolidation testing was used to determine the drainage and settlement characteristics of the blends. Standard permeability tests were performed to determine the nature of laminar flow of water through the blended soils and further assess their suitability as a subgrade material. Creep, the tendency of a solid material to deform under constant stress, was also measured for each of the blends using standard creep test devices.

The extensive battery of testing showed that soil/GTR blends do not possess appropriate engineering properties to serve in subgrades. Blending GTR with each of the unstabilized subgrade soils reduced both LBR and resilient modulus significantly. While blending has minimal impact on consolidation or permeability, it increased creep in the tested soils but within acceptable limits. However, GTR/soil blends had lower density than soil alone, presenting the opportunity to use blends in low density fill applications.

While excluding one use for GTR, this project suggests other possible uses. FDOT will continue to search for appropriate uses for recycled materials, which can reduce the impact of waste materials and reduce demand for virgin materials.

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For more information, visit <http://www.dot.state.fl.us/research-center>