Florida Department of Transportation Research

Use of Aggregate Screenings as a Substitute for Silica Sand in Portland Cement Concrete (PCC)
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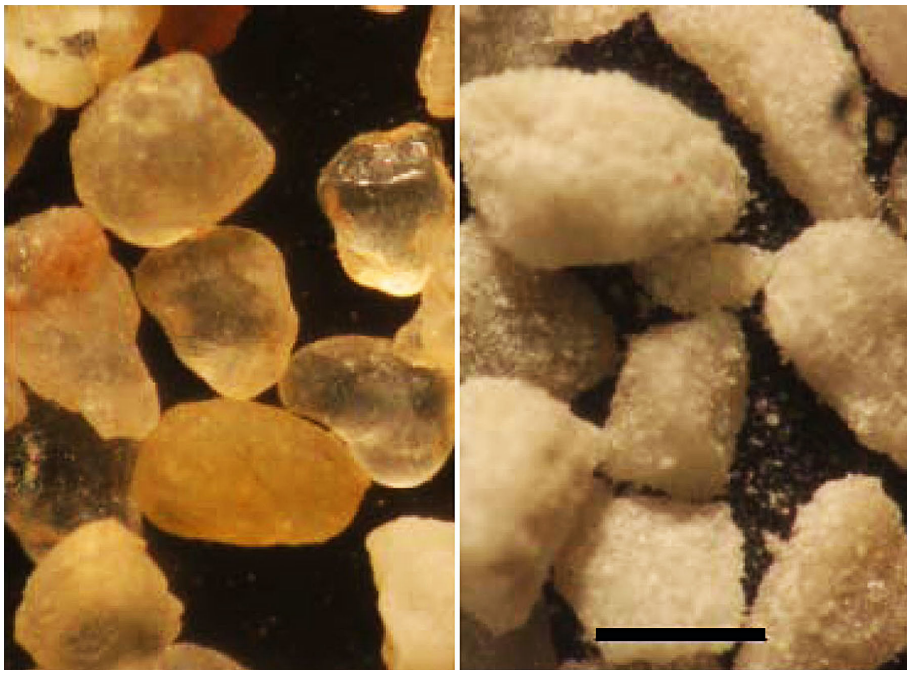
A major byproduct of the extensive crushed rock industry is called screenings, a fine material often considered waste, which presents storage and disposal problems for the industry. In this report, researchers at **Embry-Riddle Aeronautical University** investigated whether screenings are suitable substitute for sand in Portland cement concrete (PCC) or mortar.



This image, adapted from the report, shows natural sand (left) and screenings (right) of comparable size. The physical shape and chemical properties of these materials determine whether they will make good Portland cement concrete or mortar. The bar at lower right is one half millimeter.

Researchers studied the properties of screenings from several Florida mines and their effects on the quality of mortar and PCC made with them. A comprehensive study of these properties and formulations was related to compressive strength through mathematical models.

Studies of mortar showed that mortar flow is a function of angularity, fineness modulus, sand-to-cement ratio, water-to-cement ratio, and the presence of fly ash. Screenings caused a slight reduction in the 28-day compressive strength of mortar cubes.

Studies of PCC examined the influence of the angularity of fine aggregate, blends of screenings and silica sand, cement content, water-to-cement ratio, sand-to-total-aggregate ratio, and fly ash, based on a control mix of FDOT Class IV concrete.

Researchers found that screenings can be an acceptable substitute for natural sand in PCC. The screenings used in this study can replace up to 50 percent of natural sand in PCC for structural concrete, especially when durability is not a primary concern.

For nonstructural elements, a 100 percent replacement is possible.

These findings will benefit FDOT by making available a new material that has cost advantages over natural sand in many cases. The environment will benefit because less sand will be required for construction sites and fewer disposal sites will be needed for screenings. Rock industries will benefit through finding a major new market for their stockpiles of this material.

FDOT Contact: John Shoucair, State Materials Office
PI: Ashok Gurjar, Embry-Riddle Aeronautical University
For more information, visit http://www.dot.state.fl.us/research-center