Florida Department of Transportation Research

Field Study of Recycled Concrete Aggregate in French Drain

June 2019

Project Number
BDV24-977-19

Project Manager
John Shoucair
FDOT Materials Office

Principal Investigator
Boo Hyun Nam
University of Central Florida

Current Situation

Construction and maintenance of Florida roads and transportation structures produce significant amounts of used asphalt concrete and portland cement concrete. Efforts to find ways to recycle and use these materials are ongoing. Existing concrete is crushed and, for each use, it must be determined whether the recycled material will perform as desired in the long term and that it is environmentally friendly. Using discarded construction materials in new projects can reduce economic and environmental costs by reducing the need for virgin materials and reducing the amount of construction waste that must be placed in landfills.

Geotextile wraps around a French drain.

Research Objectives

University of Central Florida researchers studied the use of recycled concrete aggregate (RCA) as a backfill material in French drains.

Project Activities

A French drain consists of a pipe with holes in it, buried in a trench filled with specified-size rock, enclosed by a filter fabric. Water from a roadway flows into the pipe, and the perforations allow the water to flow through the rock and fabric away from the site. French drains are used wherever excess surface or groundwater is undesirable. To perform its function, the rock must not contain fine material that tends to block the holes in the fabric. RCA must not contain fines that can build up in the trench or cause recementation and calcite precipitation in the trench and fabric that could reduce or block water flow.

The researchers conducted a full-scale study of recycled concrete aggregate (RCA) in French drains. They designed procedures to measure the drainage performance of the French drains they constructed. They monitored the performance of the drains over an 18-month period, including buildups that might clog the drains. They also evaluated long-term chemical reactions, such as calcite precipitation or recementation of the aggregate, as potential sources of clogging.

Four full-scale French drains were constructed in trenches lined with a geotextile. One drain was backfilled with limestone as a control. The other three were backfilled with RCA: in the first, the RCA was as supplied, without any treatment; in the second, the RCA contained 2% fine material; and in the third, the RCA contained 4% fine material.

Flow rates over 18-months indicated that soil conditions surrounding the drains were more influential on drain efficiency than any of the material-backfill options. Camera inspection showed no aggregate or precipitate buildup in the drain pipes. Recementation and calcite precipitation were not significant. Post-excavation examination of the geotextile indicated that it was clogged more with the RCA with 4% fines than other materials. However, the researchers concluded that RCA did not cause an unacceptable or noticeable reduction in the drainage performance of French drains, compared to limestone.

Project Benefits

Demonstrating a new application for RCA adds to the economic and environmental benefits of the RCA recycling program.

For more information, please see www.fdot.gov/research/.