Florida Department of Transportation Research

Evaluate the Use of Reclaimed Concrete Aggregate in French Drain Applications
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Recycled concrete aggregate (RCA) is often used as a replacement of virgin aggregate in road foundations (base course), embankments, hot-mix asphalt, and Portland cement concrete. However, the use of RCA in exfiltration drainage systems, such as French drains, is currently prohibited in many states in the U.S. The French drain system collects water runoff from the road pavement and transfers it to slotted pipes underground and then filters it through coarse aggregate and geotextile filter fabric. The Florida Department of Transportation (FDOT) requires No. 4 size aggregate for French drain applications. The primary concerns with using RCA as a drainage medium are the fines content and precipitation of calcium carbonate, which can reduce filter fabric permittivity. Additional concerns include the potential for re-cementation of RCA fines.

RCA is rarely used as as a drainage material becuase its performance as a drainage material has been evaluated by few researchers. In this project, University of Central Florida researchers sought to improve the state of knowledge about RCA. They reviewed the available information related to RCA as drainage material. They conducted a survey of departments of transportation across the nation regarding use of RCA, particularly in French drains. Some state highway agencies reported use of RCA as base course; however, no state reported use of RCA in exfiltration drainage systems.

THe researchers investigated the performance of RCA as backfill material in French drains. RCA was tested for its physical properties, including specific gravity, unit weight, percent voids, absorption, and abrasion resistance. RCA cleaning/washing methods were also applied to evaluate the fines removal process. The potential for RCA re-cementation was evaluated by means of heat of hydration, pH, compressive strength, and setting time. Permeameter tests to measure the flow rate of water through RCA were conducted using

RCA before (left) and after (right) standard abrasion testing. The rounding and general loss of size shows significant susceptibility to abrasion.

the No. 4 aggregate. Long-term flow rate was monitored to evaluate the tendency for geotextile clogging from RCA fines. Calcium carbonate precipitation was also evaluated, and a procedure to accelerate the precipitation process was developed.

Study results showed that RCA has a high abrasion value, that is, it is very susceptible to breakdown from abrasion during aggregate handling such as transportation, stockpiling, or placing. The most effective cleaning method was found to be pressure washing with agitation. RCA did not demonstrate the tendency to rehydrate and harden when mixed with water. The permeameter test results showed that the No. 4 gradation did not restrict the flow of water; flow rate was highly dependent on the permeameter system (e.g., tube size and head); however, excessive fines were able to cause large reductions in flow rate over time. Based on these studies, the researchers determined that No. 4 gradation of RCA can provide a suitable drainage medium if the RCA is properly washed to remove excess fines before use.

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