Research Project 34

Beneficial Use of Fine Recycled Material Aggregates

Recycled Materials Resource Center

University of New Hampshire

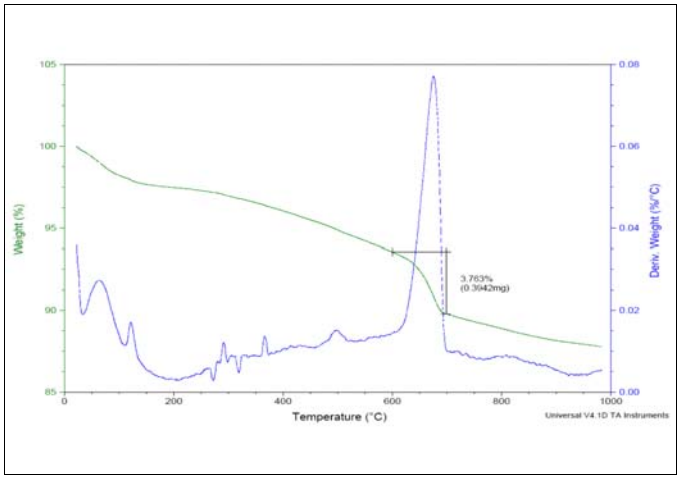
Federal Highway Administration

Project Objectives

There is growing interest in using recycled, secondary use and industrial byproduct materials as fine aggregate in beneficial use applications. Potential high volume applications include use as fine aggregate in flowable fill or as a component in manufactured aggregates. However, there is much research needed in this area because there is limited data on the mechanical and environmental properties of mine tailings, crusher fines and similar materials. The objectives of this project are to synthesize existing data on the beneficial reuse of fine recycled materials and to begin testing different materials for their environmental and mechanical properties. This will be done in conjunction with RMRC Projects 40 and 42.

Project Description

The use of fine recycled material aggregates in flowable fill or other applications is desirable because the aggregate requirements are generally less stringent than for portland cement concrete or hot mix asphalt, which allows for incorporation of lower grade material while at the same time avoiding issues associated with fine material in unbound applications (frost heaving, dust, excessive deformation, etc.). These applications may also help mitigate potential environmental concerns. For example, flowable fill may have the added benefit of solidifying materials with potential leaching problems. Work conducted over the last year has focused on carbonation to create new materials out of fine aggregates and soil. The basic idea is to mix moist soil or aggregates with cement in a CO_2 enriched atmosphere so that the cement reacts with the CO_2 to form $CaCO_3$ rather than hydrating. Solidification is achieved by creating an aggregate/ $CaCO_3$ matrix. This approach is based on work done in England to develop a beneficial use for poor quality soils. Preliminary results have shown that contaminant leaching from carbonated materials is significantly less than from the untreated material, and is sometimes better than the leaching from cement stabilized material. These results suggest stabilization/carbonation may be viable technique for preparing mildly contaminated materials for beneficial reuse. Current research is focusing on identifying the water and cement contents that optimize the carbonation reaction for different materials.



Thermogravimetric analysis of silty clay sample mixed with 20% portland cement by mass and carbonated for 1 hour. Almost 4% by mass of the mixture was converted to calcium carbonate.

End Products

This project will result in guidance for State DOTs regarding the beneficial use of fine recycled materials as aggregate or as fill.

Further Information

The Recycled Materials Resource Center (RMRC), a cooperative agreement between the University of New Hampshire and the Federal Highway Administration, is a national center that promotes the appropriate use of recycled materials in the highway environment. Its focus is on the long-term performance and environmental implications of using recycled materials.

For detailed quarterly progress reports for Project 34, as well as all RMRC-funded research projects, please see: http://www.rmrc.unh.edu/Research/researchlevel2.asp.

Project Principal Investigator
Jeffrey S. Melton, Ph.D.
Dept. of Civil Engineering
University of New Hampshire
Gregg Hall, 35 Colovos Road
Durham, NH 03824
Tel: (603) 862-2107
Fax: (603) 862-3957
Email: jeffrey.melton@unh.edu

RMRC
Gregg Hall, 35 Colovos Road
Durham, NH 03824
Tel: (603) 862-4704
Fax: (603) 862-3957
http://www.rmrc.unh.edu