Research Project 19

Synthetic Light Weight Aggregate (SLA) from Fly Ash and Waste Plastic

COMPLETE!

Recycled Materials Resource Center

University of New Hampshire

Federal Highway Administration

The final report for Project 19 is available on-line at:
http://www.rmrc.unh.edu/Research/Rprojects/project19/p19finalreport.asp.

Project Objectives

- Develop synthetic aggregates using fly ash and waste plastics of various characteristics.
- Evaluate the mechanical properties and long term durability of products made with the developed aggregate.
- Evaluate the potential for use of the developed aggregates in various construction materials such as lightweight: i) concrete for bridge decks; ii) precast concrete elements; and iii) geotechnical fill.

Project Progress

The objective of this study was to develop a new product, Synthetic Lightweight Aggregate (SLA), from two materials, waste plastics, and fly ash, currently sent to the disposal facilities. SLA is being developed and evaluated for use in construction applications such as geotechnical lightweight fill, concrete masonry blocks, and lightweight concrete structures. SLA is produced by melt compounding high concentrations of fly ash from coal with various thermoplastics.

In this study, a series of lightweight aggregate samples were produced using several different thermoplastics as binders at several fly ash-to-binder ratios. The SLA samples were produced using flexible thermoplastics, rigid thermoplastics, and mixed thermoplastics as binder. The fly ash used as filler contained various levels of carbon content ranging from less than 4% to more than 30%.

The results of the study show that the SLA properties are influenced by both the fly ash concentration and the thermoplastic binder composition. However, as the fly ash concentration increases, the physical properties of the SLA become less dependent on the thermoplastic binder's properties. At fly ash concentrations of 80%, the physical properties of the SLA are fairly insensitive to the composition of the thermoplastic binder. Concrete made with SLA exhibited a lower compressive strength as compared with the control material. As fly ash contents of the SLA increased, all properties of the SLA concrete were improved. SLA concrete can satisfy the minimum strength of 170 kPa (2500 psi) required for structural lightweight concrete and non-load-bearing concrete masonry units. The SLA concrete samples tested for compressive strength exhibited a low elastic modulus and a unique post cracking ductile behavior. The concrete samples made with the SLA that contained the maximum amount of fly ash 80% showed an excellent freeze-thaw salt scaling resistance, surpassing concrete made with both natural and lightweight aggregate. This project was completed in July 2001.

Extrudates on the left and granulated SLA on the right.

Project Partners

- Tufts University
- University of Massachusetts at Lowell
- Rhode Island DOT

End Products

SLA will undergo testing as an aggregate for asphaltic concrete with demonstrations planned in Massachusetts. This will be funded by the Chelsea Center.

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. Please visit http://www.rmrc.unh.edu.

Investigating Institution
GEI Consultants, Inc.
Winchester, MA

Principal Investigator's Current Contact Information
Mohsen G. Kashi, Ph.D.
DMJM & Harris
66 Long Wharf
Boston, MA 02110
Tel: (617) 994-6200
Email: mkashi@dmjmharris.com

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