

# Sustainable Highways Through the Use of Carbon Sequestering Construction Materials



Recycled  
Materials  
Resource  
Center



University of New Hampshire



Federal Highway Administration

**Project Principal Investigator**

Kevin Gardner, Ph.D., P.E.  
Dept. of Civil Engineering  
University of New Hampshire  
Gregg Hall, 35 Colovos Road  
Durham, NH 03824  
Tel: (603) 862-4334  
Fax: (603) 862-3957  
Email: kevin.gardner@unh.edu

**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>

## Project Description

Recent exploratory research at UNH has demonstrated that spontaneous reactions between carbon dioxide and alkaline recycled materials have significant potential to permanently sequester atmospheric CO<sub>2</sub>. Materials routinely used in roadway construction as embankments, base, and subbase materials (such as class C coal fly ash, crushed concrete, and steel slag) have significant added value as CO<sub>2</sub> sinks, have the potential to change the image of roadway construction and can make a significant impact on the CO<sub>2</sub> budget of the United States. Furthermore, carbonation can significantly reduce leaching from recycled materials, which can change estimates of groundwater impact from recycled materials use. Further research is required to deliver a marketable technology and to understand the life-cycle impact of the CO<sub>2</sub> sequestration and reduced leachability on producing more sustainable highways. The first objective of this research is to investigate the parameters that will determine the feasibility of the technology implementation options, including permeability to air in an optimally-compacted structure, reaction kinetics as a function of temperature, gas stream humidity, particle size, and gas stream CO<sub>2</sub> concentration, and the engineering and environmental properties of carbonated materials.

In the fall of 2005 the RMRC constructed a pilot scale facility to investigate CO<sub>2</sub> sequestration by recycled concrete in an embankment. This facility

is investigating passive and active methods for drawing atmospheric gases through the embankments, while measuring CO<sub>2</sub> concentration, moisture content, gas humidity, and temperature in the embankment. The embankment material is periodically sampled to analyze sequestered carbon in the laboratory. This pilot facility will continue operation through the year, and it is expected that additional embankments will be constructed of materials with significant carbon sequestration capacity over the next year.



RMRC researcher Scott Greenwood collecting data from instrumented piles of recycled concrete material behind UNH's Gregg Hall.

## End Products

Fundamental knowledge about the reaction processes as well as a conceptual design for the suggested implementation or embodiment of this CO<sub>2</sub> sequestration technology in roadways.

## 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 35, as well as all RMRC-funded research projects, please see: <http://www.rmrc.unh.edu/Research/researchlevel2.asp>.