

## Research Project 23

# A Life-Cycle Analysis Model and Decision-Support Tool for Selecting Recycled Versus Virgin Materials for Highway Applications



COMPLETE!

Recycled  
Materials  
Resource  
Center

The final report for Project 23 is available on-line at:

<http://www.rmrc.unh.edu/Research/Rprojects/Project23/P23finalreport.asp>

### Project Objectives

The objective of this project is to develop a life-cycle analysis (LCA) model and computer-based tool that uses environmental and economic parameters to assist decision-makers in evaluating the use of recycled materials in highway construction applications. The tool will allow the direct comparison of secondary (recycled) materials to traditional materials in bound applications and unbound applications.

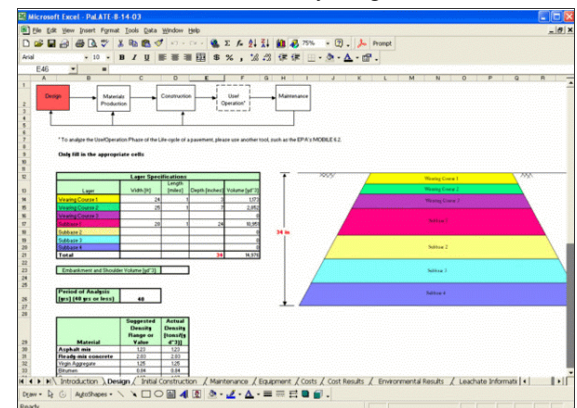
The model is unique in that it combines traditional economics-based tools with tools to quantify environmental effects. Managers and designers using the tool will be able to make fast, informed decisions about which material is most appropriate for a given situation.

### Project Progress

This project came about because even though the success of the RMRC shows support for recycled materials, significant barriers to recycled materials use in the highway environment still exist. One such barrier is a lack of data and guidance about determining the true costs associated with using recycled or even virgin materials. When considering recycled materials, designers and managers must often choose materials from a long list of candidates and then compare the economic, environmental, and engineering behavior of recycled versus virgin materials. This selection process can be very confusing and time consuming. In response to this need, Dr. Horvath developed a life-cycle cost analysis (LCCA) and computer-based decision tool that uses environmental parameters to assist decision-makers in evaluating the use of recycled materials. This software, named PaLATE, is unique in that it combines traditional economics based tools with tools to quantify short and long term physical and environmental effects as well. Applications considered in the model include bound applications such as Portland cement concrete pavements, asphalt concrete pavements, stabilized base, flowable fill, and unbound applications such as base course and structural fill. Recycled materials included in the tool are recycled aggregates from concrete and asphalt, coal combustion byproducts

(fly ash, bottom ash, bottom slag), crumb rubber from tires, blast furnace slag, and glass cullet. Managers and designers using PaLATE will be able to make fast, informed decisions about which material is most appropriate for a given application.

The final version of PaLATE, news about updates, and other information can be found on-line at ([www.ce.berkeley.edu/~horvath/palate.html](http://www.ce.berkeley.edu/~horvath/palate.html)). In addition, the tool and manual can be found on the RMRC website, and both have been added to the new RMRC Partners in Recycling CD.



PaLATE Design Worksheet.



University of New Hampshire



Federal Highway Administration

### Project Partners

- FHWA
- Washington DOT
- U.S. EPA
- Western Pavement Research Center

### End Products

Enhanced Interactive LCA model and decision tool for State DOTs and State EPAs, as well as a website devoted to the model and tool.

### 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.

#### Project Principal Investigator

Arpad Horvath, Ph.D.  
215 McLaughlin Hall  
University of California, Berkeley  
Berkeley, CA 94720-1712  
Tel: (510) 642-7300  
Fax: (510) 643-8919  
Email: [horvath@ce.berkeley.edu](mailto:horvath@ce.berkeley.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>