

RMRC



Recycled Materials Resource Center



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WISCONSIN
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Research Project 69

Statewide Materials Use Study

Project Objectives

- Quantitatively analyze and report the environmental and life cycle benefits of using recycled materials in highway construction
- Develop a tool by which the state system-wide material use can be used to calculate the life cycle benefits from the incorporation of these recycled materials in highway construction

Project Summary

The Recycled Materials Resource Center located at the University of Wisconsin-Madison, and many governmental agencies have developed fact sheets on various recycled materials and industrial byproducts for their use in highway construction applications. These fact sheets typically have addressed the engineering properties and environmental suitability issues relevant to various applications, and in some cases have incorporated design guidelines and construction specifications. However, direct information on sustainability assessment characteristics, i.e., greenhouse gas (GHG) emissions, energy and water consumption, and life cycle cost benefits is not yet readily available. Agencies may track systemwide use of quantities for major recycled materials such as fly ash in concrete, recycled asphalt pavement, recycled concrete aggregate, etc., but they have not yet calculated the benefits accrued by substitution of these materials. Project by project tracking of recycled materials use post-bid award has been a challenge as well. Although state DOTs have been in the forefront of introducing recycled materials, they have not been able to clearly convey the benefits in a quantitative and easily understood manner.

The first step in developing a quantitative benefit assessment tool was to examine existing publicly available pavement life cycle assessment (LCA) tools. An LCA can assist in a better understanding of the environmental impacts of products throughout their life cycle, and provide relevant data to make informed decisions. The International Organization for Standardization 14040 series provides general principles and a framework for an LCA study, detailing four phases of an LCA: (i) definition of goals and scope, (ii) inventory analysis, (iii) impact assessment, and (iv) interpretation. In general, LCAs should have defined system boundaries, functioning units, and inputs/outputs. For most pavement LCAs, the defined system boundaries are materials, construction, use, maintenance, and end-of life. For this study, we examined four existing publicly available LCA tools, focusing on the scope of each tool, including the system boundaries and environmental impacts.

The four LCA tools researched for this project all had unique advantages and disadvantages. The vast number of materials, equipment, and environmental outputs in the PaLATE database led to it being the LCA tool to be used and further developed in this study.

Project Partners

Departments of Transportation from the following States: Minnesota, Wisconsin, Georgia, Pennsylvania, Illinois, Virginia

End Products

Using the life cycle assessment tool PaLATE, this study has established the quantitative environmental benefits of using major recycled materials. The impact parameters of energy, water consumption, CO2 emissions, and RCRA hazardous waste show a large increase in environmental benefits. Quantifying these benefits serve as motivation for DOTs to track recycled materials in highway applications

Further Information

The Recycled Materials Resource Center (RMRC) is a national center that promotes the appropriate use of recycled materials in the highway environment. It focuses on the long-term performance and environmental implications of using recycled materials