New Technologies for Producing Asphalt Pavement Mixes

Problem

This project will study the relevance and applications of Economic Input-Output Life Cycle Assessment (EIO-LCA) and Life Cycle Costing methods in computing the environmental and economic impacts of Warm Mix Asphalt (WMA). Specifically, we will investigate the life cycle cost analysis using EIO-LCA in order to recommend the most beneficial pavement construction processes and designs in an environmentally challenged world.

Global environmental awareness has increased rapidly in recent years and extensive measures like air pollution reduction targets set by the EU under the Kyoto Protocol have encouraged efforts to reduce greenhouse gas emissions. Large quantities of greenhouse gas are emitted by the asphalt industry when it heats aggregate during the mixing process. The asphalt industry is concerned about energy savings as well as environmental benefits in the production of cold or warm asphalt. Warm mix asphalt (WMA), a new paving technology that originated in Europe, appears to allow a reduction in the temperature at which asphalt mixes are produced, and is a promising alternative to Hot Mix Asphalt (HMA). However, some information about WMA is missing, such as a complete life cycle cost analysis, and a better understanding of its environmental impact. Such information will help to ensure that WMA is produced economically and safely.

Research Objectives

Select the most sustainable pavement process and design from HMA and WMA based on EIO-LCA and LCCA.

Methodology

This research will be conducted using the following methodologies:

- Perform literature reviews to investigate the use of EIO-LCA in different sectors and study its applicability to material/acquisition, construction, maintenance phases.
- Create an inventory for material/acquisition and construction processes.
- Create a life cycle inventory for use and maintenance phases.
- Evaluate the environmental impact using EIO-LCA based on the available information.
- Evaluate the economical impact using the Michigan Engineer’s Resource Library (MERL).
- Using the Life Cycle Cost Analysis (LCCA) to estimate the net present value of the HMA and WMA.
Project Summary

Future Work

Future work will focus on collecting material and equipment inventory data from actual highway construction project scenarios, and further calibrating the proposed decision-making framework to reflect expected and actual long term pavement performance metrics.

Research Findings

The anticipated research finding will include the following deliverables:

- Comparative analysis of life cycle performance of WMA and HMA
- Decision-making framework for choosing pavement technologies (HMA and WMA)
- Recommendations for both HMA and WMA processes to different stakeholders (such as University Transportation Center, government, engineers, and contractors)

Anticipated Implementation

A recommendation report will be submitted to stakeholders so they have a better understanding of the life cycle costs and the life cycle assessment of WMA and HMA. This will also help researchers and engineers to identify problems in the life cycle of WMA and HMA, thus improving the sustainability of pavement construction and maintenance.

Related Publications


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