RESEARCH
PROJECT CAPSULE [17-3P]
October 2016
TECHNOLOGY TRANSFER PROGRAM

A Decision-Making Tool for Incorporating Sustainability Measures into Pavement Design

JUST THE FACTS:

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24 months

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

PROBLEM

While Life-Cycle Assessment (LCA) is a promising tool for evaluating materials' sustainability from cradle to grave, LCA is time-consuming and the data used can be outdated and/or inaccurate. Therefore, a more efficient tool is needed for sustainability performance assessment. The aim of this research is to provide the Louisiana Department of Transportation and Development (DOTD) with a user-friendly decision-making tool for quantifying the sustainability of pavement designs based on a cradle-to-grave analysis. To ensure accuracy and consistent inventory data, the proposed tool will incorporate life cycle environmental impact data available in Environmental Product Declarations (EPDs) to cover raw materials acquisition and manufacturing phases. The tool will also supply inventory data for transportation to construction sites allowing DOTD to assess the "design phase" sustainability. The developed tool will be incorporated within the new Pavement ME design software for easy integration with current and future pavement design methods.

OBJECTIVE

The objective of the proposed study is to conceive and develop a decision-making tool for evaluating sustainability of pavement designs based on a cradle-to-grave analysis. This tool will utilize EPDs to enhance the reliability of the assessment data and will be integrated within state-of-the-art pavement design methods such as Pavement ME. The proposed tool will be easy to use by pavement designers and decision makers and will also allow for evaluating alternative designs.

METHODOLOGY

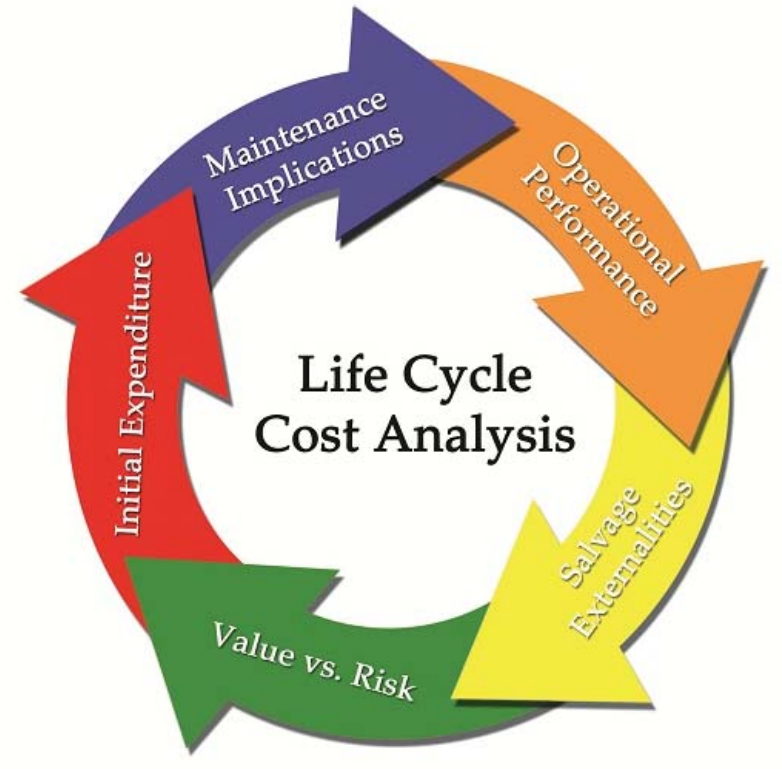
After collecting and reviewing pertinent literature that describes current state practices and studies that evaluate pavement sustainability quantification methods, the research team will design a database that compiles EPDs for concrete and asphalt pavement projects. EPDs are dependent on their associated Product Category Rules (PCRs), which report the content of EPDs and their limitations. The PCRs will be linked to the EPDs to inform the user of the quality of information extracted.

The developed database will be integrated into the Pavement ME design framework. The new tool will add a sustainability factor as an input for the materials used. Trial designs can then be assessed for performance, environmental, and economic criteria. When the criteria are not satisfied, redesign will be performed.

Demonstration of the developed tool will be performed for different design cases including rigid and flexible pavements. Projects will be selected in coordination with DOTD. The optimum design will be selected based on performance, environmental, and economic factors. A sensitivity analysis will be performed to see how the environmental criteria affect performance and economics.

IMPLEMENTATION POTENTIAL

The research team will develop an implementation plan that presents a strategy for using the developed tool. Designers will be able to compare alternative pavement designs that satisfy performance criteria from an environmental and economic perspective.



The life cycle of a cost analysis