NCHRP Project 20-05

Synthesis Topic 46-15
Life Cycle Cost Analysis for Management of Highway Assets

AEM studied the current state-of-the-practice of Life Cycle Cost Analysis and risk-based analyses among U.S. state highway agencies.
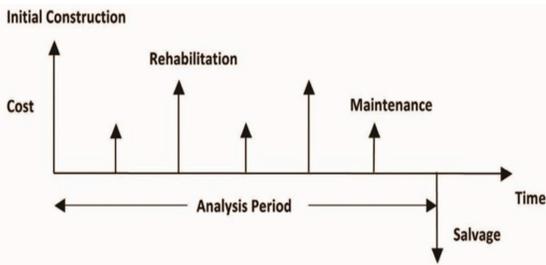
THE CHALLENGE

MAP-21 (Moving Ahead for Progress in the 21st Century Act) requires agencies to incorporate Life Cycle Cost Analysis (LCCA) and risk-based analyses into their asset management plans for pavements and bridges and encourages similar active management of other transportation assets. This study was conducted to provide insight as to the state-of-the-practice of LCCA amongst U.S. state highway agencies. One of the biggest challenges in LCCA is the availability and reliability of data to perform these analyses.

PROJECT GOALS

The objective of this project was to document the use of LCCA by state agencies and the challenges faced by these agencies when applying LCCA. To meet this objective, AEM conducted a literature review, administered a nationwide survey of state highway agencies, and developed case studies that documented current LCCA applications.
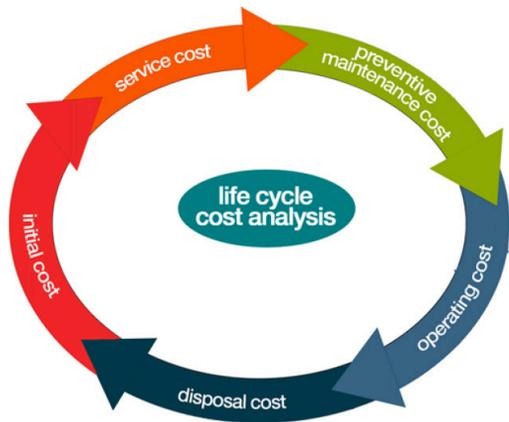
LCCA APPLICATIONS

LCCA can be used by agencies for a number of purposes:

- Helping to select the best alternative to meet a project objective, such as replacing a bridge
- Evaluating a design requirement within a specified project, such as pavement types
- Comparing overall costs between different types of projects to help prioritize limited funding in an agency wide program
- Calculating the most cost effective approaches to project implementation

STATE OF THE PRACTICE

Literature Review

In order to capture the state of practice of tools and models for LCCA, AEM developed a literature review to assess the typical elements of LCCA and the challenges associated with each. The literature review:

- Provided an overview of the costs typically associated with LCCA
- Highlighted some of the uncertainties associated with costs associated with LCCA (including unclear defini-tions and lack of reliable or consistently collected data)

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- Reviewed tools and models to support the application of LCCA to highway assets
- Utilized international studies to reveal a similar focus of LCCA for pavement and bridges

Survey Design

To better understand the needs and challenges of applying LCCA, AEM designed and administered a survey to all state transportation agencies in the spring of 2015. The survey was developed to better understand the challenges of applying LCCA with a series of questions related to software, data, and model needs of state agencies to support LCCA The goals of this survey were to:

- Better understand the challenges of applying LCCA
- Collect basic information on the use of LCCA
- Identify agencies to highlight through case studies
- Offer insight into which states are utilizing LCCA in their decision making and management of highway assets

Survey Analysis:

AEM conducted analysis on survey results:

- Provided basic knowledge on how states are currently using LCCA in their decision making and management of highway assets
- Specified which state agencies are applying LCCA at the asset-level, project-level, and network/program-level
- Identified which state agencies are using LCCA for decision making to analyze design alternatives for capital investments and maintenance treatment selection
- Detailed tools and software that are currently being used by survey respondents to conduct LCCA
- Specified factors and data used in LCCA applications by asset type, application level, and which factors and data state agencies noted they lacked information to fully employ LCCA

Case Studies

Five case studies were developed to document LCCA efforts and methods by four state agencies and one P3 concessionaire.

- The Florida DOT case study documented efforts made to calibrate deterioration curves to better align with field conditions and performance of bridges.
- The Utah DOT case study documented UDOT's pavement management program.
- The Washington State DOT case study documented efforts made to develop an owner's manual maintenance schedule concept to help improve maintenance completion rates.
- The Minnesota DOT case study documented development of a robust inventory and condition rating system for culverts.
- The P3 Concessionaire case study documented a holistic system approach to LCCA.

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TRANSPORTATION