CONSTRUCTION MANAGEMENT AND TECHNOLOGY

Asset Management Program Enhancement Plan: Baseline Assessment Phases I and II

tech transfer summary

The social return on investment methodology can help justify funding allocations for often overlooked low-volume bridge assets, reversing the significant negative economic impact for Iowa.

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RESEARCH PROJECT TITLE
Asset Management Program Enhancement Plan: Baseline Assessment Phases I and II

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Background and Problem Statement

The 2012 Moving Ahead for Progress in the 21st Century Act (MAP-21) transforms the framework for capital investments to guide the growth and development of the country's vital transportation infrastructure. To support regional economic growth, MAP-21 requires each state to develop a Transportation Asset Management (TAM) plan.

The Iowa Department of Transportation (DOT) therefore needs to develop a plan to enhance its current asset management program by increasing the synergy between the various Iowa DOT technical groups and implementing the newly published American Association of State Highway and Transportation Officials (AASHTO) Transportation Asset Management Guide.

Typically, engineers gather a range of key performance indicators (KPIs) to decide on resource allocation for construction and maintenance projects. However, relying too heavily on condition- and traffic-based metrics results in an asset management program that prioritizes projects by "worst first" and "most traffic."

Rural Iowa farm-to-market road that has concrete bridge deck in fair condition with numerous pits and popouts, spalled and crumbling fascia, and steel girders in satisfactory condition (Image: Bridge Engineering Center)

This approach essentially ignores the socioeconomic contribution that low-volume farm-to-market roads make to the economy of agricultural states like Iowa. For example, a passenger car carrying one commuter to work is assigned the same socioeconomic value as a truck hauling cargo or produce to market.

To measure the social, economic, and environmental impacts of transportation projects, methodologies such as social return on investment (SROI) have been developed to allow for a cost-benefit analysis. SROI is used by international institutions such as the World Bank to quantify justifications for funding improvements on low-volume assets such as rural bridges.

Objective

The objective of this research was to develop a TAM framework for the Iowa DOT to help prioritize and allocate resources such that the state's local agricultural economies are supported.

Research Description

This research focused on low-volume bridges located in Iowa's agricultural counties because recent research has shown that these counties have the greatest percentage of structurally deficient bridges in the nation. Many of the same counties also have the highest crop yields in the state, creating a situation where detours caused by deficient bridges on farm-to-market roads increase the cost of crop production and to transport crops.

The research included two phases: a discovery phase and a phase for developing and helping implement an SROI framework for bridge assets. Phase I involved the following tasks:

- Inventory all current Iowa DOT systems and processes that contribute to the existing asset management program
- Identify district-level programs used to make asset management decisions and evaluate their efficacy and potential for contributing to an enhanced asset management program
- Complete a gap analysis on the current Iowa DOT asset management program
- Develop a high-level asset management framework through which the program can be implemented in Iowa
- Document and publicize the findings from Phase I

In Phase II, the most promising findings from Phase I were applied to Iowa's 2014 local bridge program to allow a direct comparison of the actual asset management funding decisions to the hypothetical decisions that would have been made if the Iowa DOT had used the SROI methodology. Tasks included the following:

- Develop and present an SROI workshop for Iowa DOT upper management and selected personnel and develop an SROI presentation to be given to special interest groups and legislators
- Develop the SROI framework and integrate it into the existing TAM program framework for the bridge asset class methodology
- Develop an Iowa DOT asset maintenance and replacement decision-making methodology that integrates SROI into the current Iowa DOT decision-making process
- Develop an SROI guidebook for making TAM decisions at the local level

The proposed TAM framework is the result of a comprehensive literature review, a case study analysis, and several outreach efforts and informal interviews with stakeholders that provided the tools to help identify the user impact as well as to determine a flexible methodology that could easily be adapted to the current practices and policies of the Iowa DOT.

Key Findings

- Because common asset prioritization methodologies are primarily based on traffic volume and asset condition, low-volume assets are at disadvantage. High economic impact activities (HEIAs), such as those of the agricultural industry located near low-volume assets, are neglected.
- Integrating socioeconomic impacts into the evaluation of infrastructure projects is a current need that can impact different areas of the decision-making process for funding allocation.
- Testing the proposed SROI methodology revealed that higher annual average daily traffic (AADT) did not necessarily represent a higher impact on road users.
- Combining SROI with current asset management metrics like average daily traffic (ADT) makes it possible to prioritize bridges in such a way that the limited resources are allocated in a manner that promotes a more equitable distribution and that directly benefits the user, in this case Iowa farmers.

Implementation Benefits

- The resulting system more closely aligns itself with the spirit of MAP-21, in that infrastructure investments are used to facilitate economic growth for Iowa's agricultural economy.
- Adding SROI to the TAM plan as a KPI adds new value to the body of knowledge, justifies the allocation of resources to low-volume assets that service HEIAs, improves communication and transparency, and enhances the credibility of decision-makers and legislation.
- Not only does SROI ensure that current tax dollars are spent cost-effectively, but it also ensures a socially responsible and sustainable infrastructure network.
- If the 2014 annual budget for candidate bridges had been allocated using SROI, the impact generated would have been increased by 24%. Moreover, allocating resources using SROI would have reduced the percentage of structurally deficient local bridges from 52% to 32%.
- A key question in project evaluation is whether the developers have considered the needs of the surrounding community. SROI provides the tools for developers to answer this question and for engineers to design and build infrastructure projects that respond to social, economic, and environmental needs.

Implementation Readiness

- The negative impact of detouring bridge traffic to adjacent roads/bridges and the closure's impact on the community were not calculated. Better decision-making would require comparing the point where positive impacts outweigh negative impacts.
- A better understanding of the bridges' life cycles and the way different maintenance treatments could extend bridge lives or reduce maintenance costs would allow this variable to be included in the decision-making process.
- To calculate the net present value for the bridges' life cycle costs and benefits, this study used 4% as the discount rate based on recommendations from the Federal Highway Administration. However, studying the sensitivity of this rate and the reason behind it would be important. Different methods could also be analyzed in the selection of the discount rate.
- Similar SROI research needs to be conducted for the remaining Iowa DOT asset classes.
- The SROI methodology should be considered dynamic, not static. The proposed TAM framework can be updated annually based on a given year's final performance report or changing inputs from stakeholders. This would permit the agency to reevaluate stakeholder needs and changing economic interests.
- Eventually, the SROI methodology could be applied to other geographic zones and assets. However, this study was completed based on the needs and requirements of Iowa, the Iowa DOT, and the users; therefore, the implementation of this methodology in a different context would require a calibration of the system based on the specific requirements of the region and stakeholders.