Another Bridge Life-Cycle Cost Analysis Tool for MAP-21

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This article is a follow-up to the articles titled "Map-21 and Bridge Life-Cycle Cost Analysis" and "Using Bridge Life-Cycle Cost Analysis Tools for MAP-21" published in the Summer 2013 and Fall 2013 issues of *ASPIRE*,™ respectively. This article describes the National Bridge Investment Analysis System (NBIAS) for network level life-cycle analysis for making program investments to help meet certain performance targets, or for meeting MAP-21 requirements. Examples on the use of NBIAS are given in this article.

The Moving Ahead for Progress in the 21st Century Act (MAP-21) builds on the network management practices in its requirements for Asset Management Plans and Transportation Performance Management Plans. It provides the basis for examining a mixture of investment strategies to make progress toward achieving state-specified performance targets. MAP-21 requires that the deck area on national highway system (NHS) bridges classified as structurally deficient in the state not exceed 10% of the total deck area of all NHS bridges in the state.

National Bridge Investment Analysis System

To analyze network level strategies, states can use the NBIAS software. It uses state collected National Bridge Inventory (NBI) data to deteriorate all the bridges on a state's network using algorithms for each element on the bridge. It then assigns financial resources to cost-beneficial corrective actions. The software includes cost tables and adjustment factors for different states and climate zones.

Scott McClure, chief of the New Mexico Department of Transportation's Research Bureau says, "It is really a quite impressive application and seems to be a very powerful analytical tool." The analyst simply uploads their state's data and enters information such as annual budgets, performance targets, and benefit-cost ratio (BCR). The BCR identifies the threshold for an acceptable investment. Data can be aggregated to various levels, such as county or state.

The NBIAS output reflects a program of investments, covering a time horizon, that could support progress in achieving performance targets or meeting MAP-21 requirements. Users can generate reports describing over 200 performance measures such as "percent of deficient bridges by deck area" or identify the additional costs of postponed investments resulting from various budget scenarios. A risk-based plan or program reflecting various budgeting scenarios can be explored using NBIAS. Annual recommended actions for each bridge on the network can also be displayed in the results.

Examples

Figure 1 depicts an example analysis of the impact of different budgets that a state may face in moving its bridge network to the MAP-21 minimum threshold of no more than 10% of the total deck area of bridges in the state located on structurally deficient bridges. It presents four annual funding scenarios, an unconstrained/unlimited budget, a $202-million budget including 3% annual increase, a $305-million budget, and a $240-million budget with an influx of $600 million in year one, possibly from a one-time revenue measure. NBIAS identifies the most efficient types of investments under each budget scenario and assigns financial resources to those investments. Under the unconstrained/unlimited budget scenario, the state can achieve the target in the first year. Under the $202-million budget including 3% annual increase, which represents current trends for this example state, the target would not be met within the timeframe of the analysis. The $305-million budget scenario and the $240-million budget with an influx of $600 million in year one both trend toward the target similarly. With this information, a state bridge engineer would be strategically equipped to advise senior management on how the budgets will affect the state bridge network.

Figure 2 identifies the maintenance needs from various annual budgets. The four budgets represented in the graph are $27 million, $32 million, $35 million, and $50 million. The costs of all maintenance needs for all network bridges are depicted on the vertical axis. We can derive from the graph that a $15 million reduction from $50 million to $35 million in funding for bridges would cost the state approximately $163 million in additional maintenance needs over the 10-year analysis period. "The ability to identify the increased long-term costs due to budget cuts makes NBIAS a powerful tool for assessing our programs as well as communicating to senior management and law makers," says Scott A. Hill, Connecticut State Manager of Bridges and Facilities.

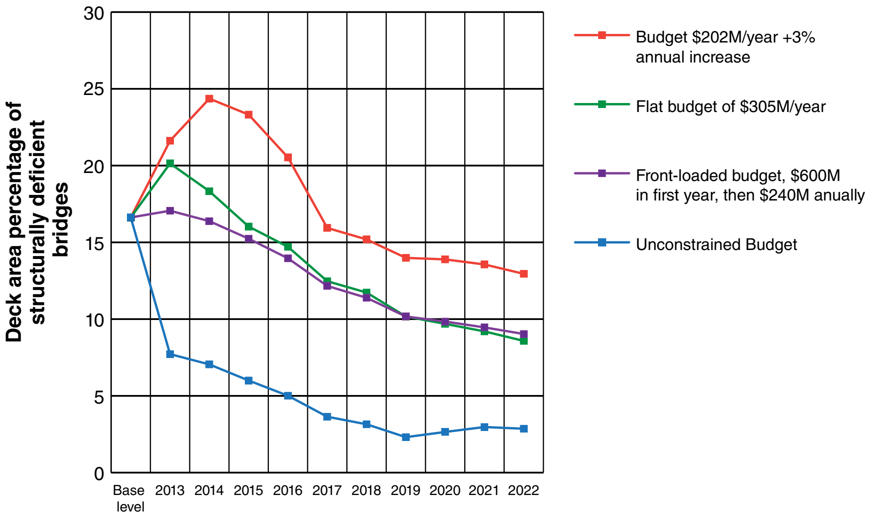

Figure 1: Example of a risk-based plan from the National Bridge Investment Analysis System software. All figures: Federal Highway Administration.

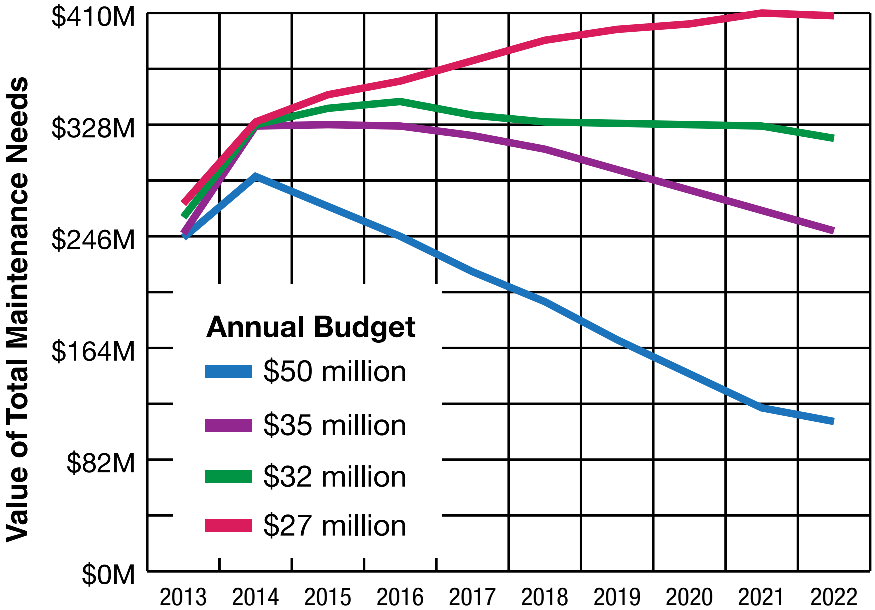

Figure 2: Example of impacts of annual budgets on the maintenance needs from National Bridge Investment Analysis System software.

Closing Remarks

NBIAS is most effective for exploring the network outcomes of various funding and investment scenarios and developing a risk-based plan. Output from a bridge management system along with output from NBIAS can be used as an analysis of efficient bridge investments. The results of an NBIAS analysis can also provide insight on which project level investments best support progress toward the state targets in meeting the MAP-21 requirement that the deck area on NHS bridges classified as structurally deficient not exceed 10% of the total deck area.

Please visit FHWA's economic resources internet web page at http://www.fhwa.dot.gov/infrastructure/asstmgmt/invest.cfm or contact Nathaniel Coley at 202-366-2171 or ncoley@dot.gov to request additional information about the free NBIAS software and workshop.