

JOINT TRANSPORTATION RESEARCH PROGRAM

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An Economic Analysis Methodology for Project Evaluation and Programming

Introduction

The basic concept and methodology of economic analysis were developed at the beginning of 20th century and were applied in different industries. Economic analysis is now commonly applied in the evaluation of the cost efficiency of various types of projects, including highway and bridge projects. Economic analysis is a critical component of a comprehensive project or program evaluation methodology that considers all key quantitative and qualitative impacts of highway investments. It allows highway agencies to identify, quantify, and value the economic benefits and costs of highway projects and programs over a multiyear timeframe. With this information, highway agencies are better able to target scarce resources to their best uses in terms of maximizing benefits to the public. It is important in the transportation development process that each transportation alternative is properly evaluated for its costs and benefits during its entire life-cycle. Highway agencies make use of measures such as the net present value of costs and benefits, benefit-cost ratio, and the internal rate of return to compare different competing alternatives. The alternative that gives the highest net present value, benefit-cost ratio, or return on investment is selected and placed to be funded, programmed, and eventually implemented. Cost items in the economic analysis include capital, operating, maintenance, and preservation costs, while the considered benefits are travel time savings, reduction in vehicle operating costs, and safety benefits. While INDOT recognizes the importance of economic analysis in an objective evaluation and selection of transportation projects, there were no uniform guidelines throughout the agency detailing how the analyses have to be performed, or what items should be considered when performing these analyses.

This research was conducted to develop a uniform tool for evaluating life-cycle benefits and costs of highway projects.

Economic analysis is a critical component of a comprehensive project or program evaluation methodology that considers all key quantitative and qualitative impacts of highway investments. It allows highway agencies to identify and quantify the benefits and costs of highway projects and programs over a multiyear timeframe. The results of economic analysis enable highway engineers and planners to systematically and rationally prioritize highway projects in terms of expected benefits and costs. Consequently, the limited highway funds and resources can be allocated in such a manner that maximum benefit will be achieved. Life-Cycle Cost Analysis (LCCA) and Benefit Cost Analysis (BCA) are the two most commonly applied economic analysis methods for determining whether the proposed highway projects are worth undertaking. LCCA is used to evaluate the total cost differences within a facility's life-cycle among several proposed alternative projects. It does not, however, consider the benefits because the assumption is that the resulting benefits are identical among project candidates. By contrast, BCA not only considers the costs, but also the benefits incurred in the future. Thus, LCCA is usually considered a cost subset of BCA. The general research approach of this study was to review the current and past methods and practices of economic analysis of highway projects in Indiana and in other state highway agencies, identify the cost and benefit items in economic analysis, develop a uniform algorithm for the economic computation, create the database that is necessary for the proposed model, and finally develop an Excel-based software for the economic analysis—the Indiana Highway Economic Evaluation Model (IHEEM).

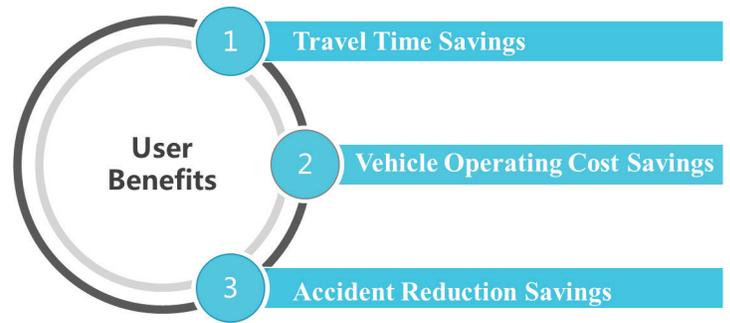
Findings

The following tasks were completed during the course of this study:

- Reviewed the current methods and practices of economic analysis of highway projects in the state highway agencies as well as in other countries. The methods and practices utilized by the state highway agencies and other countries provide useful information on the strength and weakness of various methods. The major software packages for highway economic analyses were examined and compared in detail.
- Developed a consistent cost and benefit evaluation methodology. As the existing methods and the cost and benefit items were reviewed and identified, a uniform economic analysis methodology was then developed and the cost and benefit items for the economic analysis were determined.
- Developed an Excel-based software for the economic analysis methodology. The Excel-based software enables INDOT staff to conduct economic analysis with the recommended cost and benefit items. A probabilistic economic analysis approach was included as a possible option.

Implementation

The IHEEM system includes a large number of default values for traffic volumes, agency costs, user benefits and costs, pavement conditions, and bridge conditions. These values are obtained either through data analysis in this study or adoption of previous study results of recognized national or statewide representative values. Efforts were made to use the Indiana-established values or to develop the necessary default values with Indiana data. Only if it was impossible to obtain these values pertinent to Indiana were the national values selected to be included in IHEEM. The software provides flexibility for users to overwrite any default values if project-specific data are available. The output of



User benefits in IHEEM.

the economic evaluation is presented as user-friendly tables and graphs.

The software can be used by INDOT to conduct economic analysis for highway and bridge projects. The input requirements indicate that it is essential to obtain accurate information on traffic volumes and vehicle speeds, agency costs, maintenance costs, and future rehabilitation costs. Although many default values are provided in the computer program, it is desirable to have project-specific information in order to produce accurate and meaningful economic evaluation results.

It is believed that this software will be a powerful and convenient tool for INDOT to evaluate highway and bridge improvement projects.

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