JOINT TRANSPORTATION RESEARCH PROGRAM

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A Methodology for Highway Asset Valuation in Indiana

Introduction

As recognized by the American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA), a key element of highway asset management is the determination of the total value of the existing stock of assets. Highway agencies require knowledge of the total value of their assets for a variety of reasons, including financing, investment evaluation using asset value instead of multiple criteria that have different units, and proper management of infrastructure by monitoring and focusing on value-added investments while minimizing value loss. Other rationales for asset valuation include guidance in measuring the accountability of a highway agency, not only in its disbursements but also in assessment of funding needs, and using asset value as a basis of support for requests for increased funding to maintain or improve current infrastructure. The need for correctly valuing highway infrastructure also stems from the Government Accounting Standards Board (GASB) Statement No. 34, which requires all government transportation agencies, such as the Indiana Department of Transportation (INDOT), to report their tangible capital assets. Thus, INDOT requires a robust and comprehensive method that yields a value of its assets at any year, as that would play many roles in highway management.

This research report provides explicit rationales for conducting asset valuation in the state of Indiana and discusses the role of asset value in INDOT's business processes. During the study, existing literature on the current valuation practices was reviewed and the general approaches and the methods associated with each approach were discussed. Research was then carried out to develop and demonstrate proposed valuation methods that address the limitations of traditional valuation practices. Values of the different asset types on the Indiana state highway network were determined, and the study went further to estimate the total value of highway assets in the United States.

Findings

This study found that the current valuation methods tend to underestimate asset value due to their monolithic consideration of the physical asset structure. In addressing this limitation, the first proposed method for asset valuation, the elemental decomposition and multi-criteria (EDMC) method, calculates the contribution of each component to the asset value. Also, the EDMC method incorporates both the condition and the remaining service life of an asset. The second proposed method incorporates replacement, downtime (user) cost, and recycling benefits or disposal costs and is aptly named the replacement-downtime-salvage (RDS) method; this method recognizes that recycling or disposal costs are associated with the end-of-life of an existing asset, and user costs during asset replacement can significantly influence the value of an asset and thus should be duly considered in asset valuation. Admittedly, the inclusion of user costs in asset valuation can be a controversial issue because they tend to exceed, by far, the agency costs, and also they are not borne directly by the agency. However, this component of the RDS method, hopefully, can spark a conversation on the larger issue of the role of user costs in asset management decision making in general. Decommission and re-use (D&R), third proposed method of valuation, assumes that assets can be valued on the basis of the land they occupy, particularly in high-density urban areas where land is very expensive and where there exist opportunities for relocation elsewhere. This method appears to be suitable only where the land value is very high. The fourth proposed method, the duration-cost method, uses probabilistic duration models to predict the probability of asset survival until the end of its typical service life, and calculates the product of the survival probability and the asset replacement cost to determine the asset value. For a given replacement cost, a lower asset value reflects an asset with low probability of surviving to the end of its service life, while a higher value reflects a higher probability of surviving to the end of its service life.

In this study each of the proposed methods yielded asset values that differed due to their different mathematical formulations. Nevertheless, they all contribute additional information to the conversation of asset valuation and thus yield results that can help achieve the goals of asset valuation. Ultimately, the EDMC method is recommended for adoption by INDOT for valuation of their assets.

The total value of Indiana's state highway assets was determined in this study using the traditional and proposed methods. Using the EDMC, this was estimated at approximately \$45 billion. The value of pavements and bridges were \$37.38B and \$3.404B, respectively; together, these "large assets" constituted approximately 90% of total asset value. The total value of smaller assets was approximately \$1.2B, constituting approximately 3% of the total value of assets; the breakdown was as follows: guardrails, \$0.318B; underdrains, \$0.007B; culverts, \$0.850B; and road signs, \$0.035B. The total value of the right-of-way was \$2.840B.

Using the most common method used by other agencies, namely, the straight line depreciation (SLD) method, INDOT's pavement and bridge values were determined as \$32.6 billion and \$3.76 billion, respectively. It is seen that the EDMC yields values that are significantly different than those from the traditional methods, which could be due to the former explicitly considering the asset as an assemblage of components and thus carrying out valuation for each component rather than considering the structure as a monolithic entity.

Also, using the unit value of highway bridge and pavement assets in Indiana, a total value for bridge and pavement assets in the United States was determined. The total value of state-owned highway pavements and bridges in the country was determined as \$3.4 trillion using the EDBC method and \$2.9 trillion using SLD method, respectively; for pavements and bridges on all highways in the country, the EDBC and SLD methods yielded \$16.2 trillion and \$13.8 trillion, respectively.

Implementation

This study can be used by personnel at a number of divisions, offices, program areas, and units at INDOT to assess the value of a specific highway asset or a collection of assets in a given jurisdiction or functional class for input in a variety of agency business processes. Specifically, knowledge of asset value not only can enhance financing opportunities, but also can facilitate the evaluation of investments that improve the nation's highway infrastructure. Past research has demonstrated that appropriate valuation of highway assets permits proper management of infrastructure by monitoring

and minimizing the value loss through physical deterioration, congestion, underutilization, and safety hazard. Furthermore, the increase in total highway asset value from year to year can serve as a performance indicator for measuring the accountability of a highway agency in its disbursements and also for assessing funding needs. Thus, asset valuation can provide a link between investment planning and financial accountability. Ultimately, asset valuation can enable highway administrators to build a more formidable case when they petition the legislature and general public for increased funding to maintain or improve current infrastructure. The need for correctly valuing highway infrastructure also stems from GASB Statement No. 34, which requires all government transportation agencies, such as INDOT, to report their tangible capital assets. Higher asset values generally reflect satisfactory stewardship of assets that fall under a highway agency's jurisdiction. Thus, by presenting the year-to-year reduction in the value of assets within its jurisdiction, an agency can show the extent to which its assets are in need of repair or replacement and also can enable oversight of organizations to ascertain whether an agency is properly maintaining its highway assets.

A core group of five persons at INDOT under advisement of FHWA can further define and select implementation strategies relative to agency practices. The principal mission of this implementing panel could be to advance and institutionalize the most practicable methods outlined in this research report.

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