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Multipurpose Asset Valuation for Civil Infrastructure

Aligning Valuation Approaches with Asset Management Objectives and Stakeholder Interests

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Valuation is a critical component of asset management for civil infrastructure because it provides a means for evaluating facilities whose value is to be preserved or enhanced. Although the basic concept of valuation is generic, there are various quantitative approaches for valuing assets. These approaches can be classified to provide guidance for selecting the right valuation approach to accomplish different asset management objectives. Various approaches are examined for valuing assets in transportation corridor, financial, and corporate real estate asset management from the viewpoint of the purpose of valuation. How different valuation approaches support different purposes is shown, and the importance of selecting appropriate valuation methods to achieve different objectives is discussed. On this basis, some of the critical issues are identified for developing useful valuation classification frameworks to relate valuation approaches with an agency's asset management objectives and the scope and emphases of stakeholder interests. Building on the purposes of valuation associated with the Governmental Accounting Standards Board Statement 34 requirements, a prototype framework is developed for classifying valuation approaches, and emerging opportunities to expand the scope of valuation tools for multipurpose infrastructure valuation are discussed. The results should be useful to agency staff interested in understanding how various valuation tools can help them to accomplish different asset management objectives as they upgrade their infrastructure management systems to asset management systems.

Although there are various definitions of asset management, most if not all of them capture the core principle of valuing assets in order to preserve or enhance their value (*1–3*). To evaluate or place a value on something is to determine its significance, worth, or condition, usually by careful appraisal and study (*4*). Value, then, is a subjective concept because it always occurs within a predefined context. As Smith and Parr acknowledge: "Value does not exist in the abstract and must be addressed within the context of time, place, potential owners and potential users" (*5*). It is not surprising, therefore, that there are several quantitative approaches for valuing assets and that these approaches can result in significantly different values for the same asset at the same point in time.

Valuation approaches that take a retrospective view of the asset, for example, the book value method (historical costs less depreciation), are likely to produce a different value for an asset than approaches that focus on the future earning potential of the same asset, for example, the productivity realized value (net present value of the benefit stream of the asset for its remaining service life). Similarly, for the same asset, valuation approaches that focus solely on costs are likely to produce different results from those that focus exclusively on benefits. Because different valuation approaches result in different values for the same asset, it is important to understand what purposes are best served by using various approaches to manage an asset. The purpose here is to explore the intent of various valuation methods, analyze why certain approaches are more effective than others for accomplishing various asset management objectives, and identify critical issues for choosing appropriate valuation methods based on the purposes of valuation. Why is this an important and pertinent issue?

In 1999 the Governmental Accounting Standards Board (GASB) introduced a financial reporting requirement for civil infrastructure for local and state governments (*6*). The GASB guidelines require governments to report the book value of their assets. Governments are also allowed to use a modified approach to report their total infrastructure-related expenditures without depreciation as long as it can be demonstrated that their infrastructure is being maintained at some minimum condition level using an asset management system. Reporting the accumulated historical costs less depreciation could be useful for various objectives. For example, historical costs and accumulated depreciation of water and sewer systems are used to estimate the age of assets and to consider a government's need to replace or rehabilitate these systems. Also, such information could serve as an indicator of a government's overall fiscal health for public borrowing (*7*). Although the results of book valuation are useful in these contexts, they may be less useful, for example, for optimizing or enhancing the future value of assets, which is arguably one of the main objectives of asset valuation. Thus, for example, if an agency were to choose a more efficient construction process that resulted in capital cost savings, that agency would end up with a relatively lower book value for its assets than otherwise, all else being equal. A valuation approach that more explicitly reflects the value added in construction efficiency would be more useful for an agency whose objectives included increasing the value of its assets while simultaneously adopting more efficient construction and maintenance practices. Such an agency could adopt multiple valuation approaches to accomplish several asset management objectives.

The issue of choosing an appropriate method of valuation relative to the intent of valuation is addressed here. First, valuation approaches used in transportation corridor, financial, and corporate real estate asset management are reviewed and analyzed to show how different valuation approaches are used to accomplish different objectives

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and to highlight the importance of selecting the right valuation approach for a given purpose. With insights gained from this exercise, critical issues are identified in the development of useful valuation classification frameworks to provide guidance for choosing appropriate valuation approaches for various asset management objectives and stakeholder interests. Finally, emerging opportunities are discussed for broadening the scope of asset management tools and databases to support multipurpose valuation of civil infrastructure assets.

EXAMPLES OF ASSET VALUATION APPROACHES

The following three examples of asset valuation for transportation corridors and financial and corporate real estate assets clearly illustrate the following key points in asset valuation: valuation is context dependent; the valuation approach used must reflect the intent of the valuation, which is usually linked to stakeholder interests; not all valuation approaches are designed to expressly assist asset managers with decision making to enhance the value of their assets; multiple valuation approaches can be used to accomplish various objectives; and agencies interested in using valuation techniques to accomplish multiple objectives will benefit from a better understanding of the scope and appropriate applications of existing valuation methods.

Transportation Corridor Valuation

A review of traditional methods for valuing railway and other transportation corridors indicates that before a corridor is valued, one must first determine what type of value will be appraised (*8, 9*). Subsequently, several methodologies may be used in the valuation. Possible appraisal values include the value in use, which represents the total value for assembling the corridor; the going-concern value, which is the value encountered when right-of-way is transferred from one railroad to another; the alternative right-of-way use, which is the value of the best alternative use of a corridor; and the salvage value, which is the value gained from breaking the right-of-way up into logical pieces and selling them individually.

In determining value in use, the cost-of-assembly approach is used. This approach develops a cost estimate for the actual assembly of the corridor from its various components and assigns this estimate as the value of the asset. Two approaches may be used to determine the going-concern value: the first is the income approach, which is used to assign a value on the basis of ability to generate future income using projected expenses and revenue to determine the net income obtainable from the corridor. The second is the cost approach, which assigns value on the basis of either original cost or current costs less depreciation. The current-cost-less-depreciation approach is most commonly used, including deterioration and obsolescence in depreciation. In determining the alternative right-of-way value, the income approach and cost approach cannot be used because the manner of use is expected to change and these approaches are only applicable for consistent use; the comparative methodology is more appropriate in this case. Comparative methodology uses comparisons based on the value attached to similar property in the surrounding area, determined by input from local real estate agents or from past right-of-way land sales, to assign value to abandoned railroad rights-of-way. The salvage value represents the lower limit of alternative use and is therefore also determined by comparative analysis.

From the 1970s to the 1990s, the scope of transportation corridor valuation techniques grew to capture different types of asset value, as is indicated by Valentine (*10*), who identifies the following as key factors for appraising a transportation corridor: (*a*) understanding definitions of certain fundamental terminology, (*b*) being aware of potential corridor uses, (*c*) knowing which interest is to be appraised, (*d*) determining the purpose of the appraisal, (*e*) defining the subject area, (*f*) arriving at its highest and best use, and (*g*) understanding the applications and methods of appraisal. The third, fourth, and seventh factors are of particular interest in this discussion. The valuation objective is closely associated with stakeholder perspectives. Thus, for instance, the book value method may be appropriate for demonstrating fiscal health but perhaps less useful for prioritizing investments to enhance the overall value of a portfolio of civil infrastructure assets. In some cases, it may be important to use multiple valuation methods to accomplish different objectives. In such cases, it will be important to align valuation objectives and methods in a meaningful way. Table 1 shows the six methods that Valentine discusses for

TABLE 1 Transportation Corridor Appraisal Methods [Adapted from Valentine (*10*)]

Method	Description
Across the Fence Value (ATF)	Based on the concept of alternative use assignable to land segments within the overall corridor: segments are divided down the centerline; each half is joined to the adjacent parcel, and the highest and best use and unit value of the adjacent property are used to estimate the value of each segment.
Net Liquidation Value (NLV)	Present value of the net amount the owner would realize if the corridor was sold piecemeal over a reasonable time period: determined by deducting administrative, marketing and cleanup/demolition costs and real estate taxes from the gross revenues and adding the salvage value.
Going Concern Value (GCV)	Based on proven property/business operations, calculated as expected future profits discounted to the present at a rate reflecting the quantity, quality and durability of income.
Sales Comparison Approach	Based on comparison with similar sales in subject's market area.
Corridor Value (CV)	Based on the value of a corridor as a function of the social and economic benefits generated by connecting its two end points.
Replacement Cost New Less Depreciation (RCNLD)	Based on the costs to assemble corridor from scratch, including costs of portions taken, appraisal costs, project management cost and building acquisition and demolition costs.

appraising transportation corridors, highlighting the linkages between valuation purpose and approach.

These valuation methods can be classified according to their level of appropriateness for various asset management objectives, which are also related to stakeholder objectives. For example, the NLV approach (Table 1) would be more appropriate for an abandoned corridor with no immediate prospects than it would be for a corridor with multiple and competing potential buyers, in which case the sales comparison approach would be more appropriate. The broader scope of methods described in the 1990s in comparison with those presented in the 1970s may be viewed as a reflection of the growth in the different types of value associated with transportation corridors, corresponding to a growing number of uses and hence stakeholder interests in transportation corridors.

Financial Asset Valuation

The linkages between the objectives and methods of valuation in the case of railway corridor valuation are also evident in the case of financial asset management. As discussed by Damodaran, financial assets such as stocks, bonds, and other investment instruments are acquired for the cash flows expected from owning them (*2*). Consequently the price that is paid for any asset ought to reflect the cash flows it is expected to generate. On the basis of the ultimate objective of the owners (stakeholders) of financial assets, which is to maximize their economic payoff, it is not surprising that the financial models of valuation described by Damodaran are all future-based rather than historical and all benefits-based rather than cost-related. These models attempt to relate the value of an asset to the level and expected growth of the cash flows that the asset is expected to generate. For example, the discounted cash-flow valuation approach relates the value of an asset to the present value of the expected future cash flows on that asset. The relative valuation approach estimates the value of an asset by looking at the pricing of "comparable assets" standardized using a common variable such as earnings, cash flows, book value, or sales. And the contingent claim valuation approach uses option-pricing models to measure the value of assets that share option characteristics. A contingent claim or option is an asset that pays off only under certain contingencies, and option pricing models have been developed to value assets that have optionlike features. In all three cases, there is an attempt to value the growth and risk of the company and pass on this value to the stakeholders of the company, that is, the shareholders or owners of the equity or stock of the company.

Real Estate Asset Management

The linkages between valuation objectives and methods are also evident in corporate real estate asset management. Corporate real estate asset management is the acquisition, management, and redeployment of real property to implement user objectives. A real estate investor seeks opportunities in real estate to maximize his or her wealth. In corporate real estate asset management, these opportunities are controlled by and must conform to the business of the corporation. Thus, the real estate will be acquired, managed, and disposed of to increase the value of the main business or businesses of the corporation (*3*). In this context, Levy and Matz distinguish between facility management and asset management in corporate real estate management (*11*). Asset management is described as an active process that searches for ways to increase the value of real estate to the firm and to increase shareholder value, whereas facility management is described as real estate management that is passive to requests from the rest of the firm and more facility-oriented than stakeholder-focused (i.e., focused on enhancing the related value to stakeholders). According to Levy and Matz, asset managers interact more with executives in the rest of the firm to assist in molding real estate decisions to improve them for the corporation. When the objective of managing a facility moves beyond ensuring that its physical condition and functionality are adequate to include strategies for enhancing the value of the facility for its stakeholders, it would make sense that the objectives of the stakeholders are taken into consideration in the valuation method. To relate real estate decisions to shareholder value, Nourse (*3*) presents the following valuation model that links real estate decisions to the cash flows of the corporation:

$$NPV = -O + ATCF_1/(1+i) + ATCF_2/(1+i)^2 + \cdots + ATCF_n/(1+i)^n$$

where

NPV = net present value,
O = initial outlay,
$ATCF$ = net after-tax cash flows from operation in each year ($ATCF$ in year n includes net proceeds from sale of asset), and
i = alternative yield on corporate assets minus weighted average cost of capital.

CONSIDERATIONS FOR VALUING TRANSPORTATION INFRASTRUCTURE

Multiple Measures of Value and Stakeholder Interests

Given that there are various stakeholders for the facilities that constitute a transportation system in a community (city, state, or nation), it is expected that there can be multiple considerations for valuing a community's transportation assets. The purposes of valuation for each stakeholder group can be inferred from the scope of stakeholder interests in the transportation system. For example, as the financiers of transportation infrastructure projects, the general public may have an interest in the overall fiscal health of transportation agencies. Table 2 shows some examples of measures of value for the transportation system from various stakeholder viewpoints. These examples are provided to highlight some of the different emphases in stakeholder values rather than to suggest a comprehensive typology for measures of value in transportation.

Growing Importance of Accountability

Recommended by the GASB 34 infrastructure reporting requirements, the book value method for valuing civil infrastructure facilities may provide useful information for infrastructure financiers, who are interested in the overall fiscal health and accountability of the borrowing agency. The GASB 34 requirement captures the increased importance of government accountability to the general public, a prevalent theme in the 1990s reflected in such legislation as the Government Performance and Results Act (GPRA) of 1993 (*12*), which requires that federal agencies establish long-term strategic goals as well as annual goals linked to them, measure their perfor-

TABLE 2 Value Measures for Transportation Facilities by Stakeholder Interests

Stakeholders	Measures or Indicators of Value
Users – General Public	Mobility/Accessibility, Safety, Durability, Environmental Quality, Functional Obsolescence
Financiers/Owners – General Public	Accountability and fiscal health of transportation agencies
Engineering and Construction Professionals	User Objectives, Infrastructure Improvement Opportunities
System Managers – Operation & Maintenance	Economic Efficiency, User Objectives
Investment Decision/Policy-Makers	Overall condition and level of service of the system
Community – General Public	Physical functionality, economic impact, environmental impact, social impact
Marginal Populations, e.g., low income, racial minority and elderly communities	Equity in benefits and burdens of transportation improvements

mance against these goals, and report publicly on their progress toward these goals. The GASB-modified reporting approach also provides public works agencies with information on the relative health of their facilities as well as their relative efficiency in maintaining these facilities above a minimum acceptable condition level, information that is also relevant to financiers.

Value-Based Infrastructure Management

The scope of valuation approaches for infrastructure asset management could be extended to include other important considerations for investing in the civil infrastructure. An important set of considerations in infrastructure investment relate to increasing the asset value over time. This idea is synonymous with the concept of value-based management (also known as value management or engineering). Value-based management assumes that value creation is a primary consideration in managerial decision making. It refers to a systematic approach for analyzing and improving the value in a product, facility design, system, or service, a set of approaches designed to improve performance and quality requirements while reducing costs. By enhancing value characteristics, value management is meant to increase customer satisfaction, and thus has a direct relation to stakeholder interests in a product, design, system, or service (*13, 14*). Value management of civil infrastructure assets would entail defining the pertinent stakeholder interests, identifying associated indicators of value, developing approaches to quantitatively assess this value, and proposing strategies to enhance this value. According to Esty (*14*), it requires a knowledge of what creates value and why as well as the ability to measure value accurately.

Evolving Measures of Value in Transportation Infrastructure Investment

Traditional methods for evaluating infrastructure performance focused first on the functional (physical) and then the economic performance of facilities. For example, the national highway investment analysis model, first known as the Highway Performance Monitoring System-Analytical Process (HPMS-AP) and later as the Highway Economic Requirements System (HERS), was originally designed to evaluate several measures of functionality of the nation's highway system, such as the surface roughness of pavements. Subsequently the investment analysis tool was upgraded to prioritize improvements using incremental benefit–cost analysis, thus incorporating economic considerations for selecting project improvements (*15, 16*). Like other infrastructure investment analysis tools, HERS was subsequently upgraded to address environmental impacts of highway investments, for example, vehicle emissions (*17*).

Beginning in the 1990s, several projects were initiated to upgrade transportation planning and investment tools to address the equity impacts of transportation investments (*18–21*) in response to regulations requiring that agencies address the environmental justice impacts of federally funded projects (*22*). Several analysis tools seek to address not only the functional, economic, and environmental impacts of transportation investments but the social impacts as well, for example, the impacts of proposed improvements on the mobility of marginal populations. This evolution in the scope of formal considerations that are incorporated into transportation investment analysis could be viewed as a progressive attempt to formally address the evolving values of stakeholders in transportation, not dissimilar to the broadening scope of transportation corridor valuation approaches between the 1970s and the 1990s.

With multiple considerations and approaches for valuation, agencies may find valuation classification frameworks useful for identifying appropriate approaches for different objectives. In the remaining sections, critical questions are identified that must be addressed to develop useful frameworks for classifying valuation tools, and emerging opportunities to expand the scope of infrastructure investment analysis tools for multipurpose valuation of transportation infrastructure are discussed.

CLASSIFYING INFRASTRUCTURE VALUATION APPROACHES

Relevant Questions for Valuing Infrastructure

In the context of multiple agency objectives, stakeholders, and other considerations for transportation infrastructure investment, some of the relevant questions for valuing transportation assets are as follows:

- Which valuation methods should be used to value transportation infrastructure, when should they be used, and why?
- Considering the methods currently available for asset valuation, is the scope of valuation methods and data sufficient to address the multiple considerations in contemporary transportation investment decision making, or is there potential value in expanding the scope of valuation approaches to support multiple investment considerations?

• Are there existing opportunities that can be leveraged to advance valuation tools and databases for transportation and other civil infrastructure asset management?

Prototype Framework for Classifying Valuation Approaches

Civil infrastructure facilities may be valued by using various valuation approaches, as described in Table 3. A review of these and the other methods of valuation presented for transportation corridors, corporate real estate, and financial assets reveals that there are at least four common dimensions under which valuation methods can be classified for infrastructure valuation:

1. They may be either future based or historically based;
2. They may be either costs based or benefits based, or both;
3. They may have different sets of value indicators in the valuation function; and
4. They may or may not characterize the risks of investment.

Figure 1 shows multidimensional asset valuation as a function of the types of value parameters used, whether they are benefits or costs or located in the past or the future. Using this framework to align stakeholder interests with asset management objectives and valuation methods, several pertinent questions become apparent:

1. When is it appropriate to treat past costs as sunken costs?
2. When is it relevant to use future-based versus historical costs?
3. When does it make sense to use benefits instead of costs for valuing assets?
4. When does it make sense to use both costs and benefits to value assets?
5. What are the appropriate measures, attributes, or indicators for valuing an asset and why?
6. How can asset valuation approaches be integrated meaningfully within legacy management systems?

These are all examples of important questions that must be addressed when a valuation approach is chosen. For example, in contemplating these questions, it is clear that valuation approaches

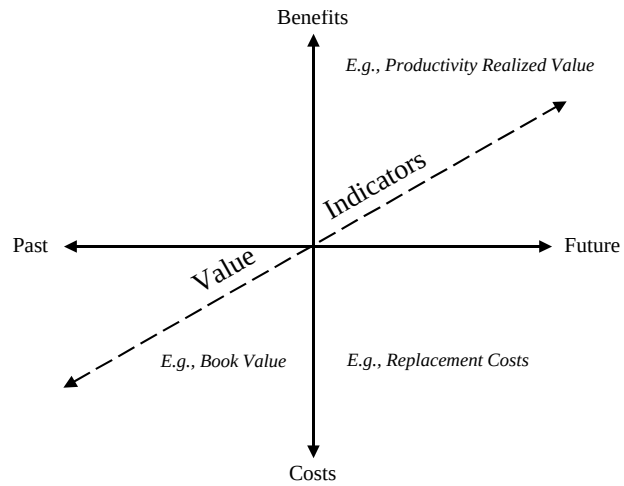

FIGURE 1 Multidimensional valuation chart for civil infrastructure assets.

that support value-based management of infrastructure necessarily need to capture the future value of infrastructure as well as the benefits to be derived from the infrastructure by its stakeholders. These approaches will most likely lie in the top right quadrant of the multidimensional valuation chart shown in Figure 1.

There are also important considerations related to data availability and the accuracy of the results of the valuation. Because more specific data exist on past costs associated with civil infrastructure, valuations that require a higher level of accuracy will more likely fall in the bottom left quadrant of the valuation chart. For example, if an agency were interested in benchmarking various facilities by the relative amount of expenditures made on the facilities in the past, standardized by some measure such as facility usage, valuation techniques that capture past costs are likely to provide more reliable information. Such a benchmark could be useful for demonstrating equitable investments in various voting districts within a jurisdiction, for example.

In Table 4, this framework is used to classify existing valuation approaches and illustrate the potential uses of different valuation methods for an agency. Frameworks such as those discussed above

TABLE 3 Description of Valuation Approaches [Adapted from Haas and Raymond (*23*), Valentine (*10*), and Damodaran (*2*)]

Valuation Approach	Description
Book Value	Present worth of capital and subsequent costs of asset depreciated to the present
Equivalent Present Worth in Place	Represents worth "as is." Based on historic costs adjusted for inflation, depreciation, depletion and wear
Productivity Realized Value	Represents value of asset in use. Present worth of future benefits for the remaining service life of the facility
Written Down Replacement Costs	Uses current market prices to determine costs to rebuild or replace facility in its current condition
Market Value	Price that buyer is willing to pay
Net Liquidation Value	Present worth of amount obtainable from selling off the components of the asset over a reasonable period of time
Salvage Value	Present worth of the amount obtainable from disposing or recycling facility
Option Value	Value of asset in specific circumstances

TABLE 4 Example of Valuation Classification for Civil Infrastructure

Category of Approach	Examples of Approaches	Uses	Data Availability/ Accuracy
PV of Past Costs	Book Value Equivalent Present Worth in Place	• Indicator of health of infrastructure agency • Public accountability Benchmark of relative condition level of assets	Data readily available/ Relatively higher accuracy
PV of Future Benefits	Productivity Realized Value or Income Capitalized Value	• More easily applicable to income-generating facilities such as toll road	Little data available/ Relatively lower accuracy level
NPV of Past Costs and Benefits	--	• Benchmarking facilities by relative utility/obsolescence • Assessing agencies' investment efficiency	Data readily available/ Relatively higher accuracy
NPV of Future Costs and Benefits	Net Present Value	• Value-based asset management	Little data available/ Relatively lower accuracy level
Market (Relative)	Written Down Replacement Costs Market Value	• Asset sales	Relatively little data available only where facilities have been traded on the market
Income Retrievable from Components	Net Liquidation Value Salvage Value	• Facility recycling or disposal	Data from similar facilities recycled/ Relatively higher accuracy
Option Value	--	• Can be used as a decision-making tool for unusual circumstances; e.g., valuation of a highway being converted into a congestion pricing facility	Data from new traffic volumes, toll revenues etc./ Relatively higher accuracy

provide guidance for selecting appropriate valuation tools for different objectives. They may also point to areas in which new or modified tools could be useful, for example, capturing value added as a function of the environmental, social, and equity impacts of investments.

There are a number of ongoing research initiatives that would support an endeavor to advance valuation methods for transportation asset management. Next several opportunities for developing multipurpose tools for transportation asset valuation are discussed.

OPPORTUNITIES FOR DEVELOPING MULTIPURPOSE VALUATION TOOLS

There are several ongoing research initiatives that make this an opportune time for research to advance valuation techniques and effectively integrate these techniques with existing decision support tools for transportation infrastructure asset management. These research activities, initiated in the 1990s and more recently, seek to integrate a scope of stakeholder values into a common framework for evaluating and managing transportation infrastructure and could provide useful resources for a multipurpose valuation toolkit.

The integration of stakeholder values into a common evaluation framework for sustainable transportation planning is a widespread effort that is related to multipurpose asset valuation for transportation infrastructure. The United Nations World Commission on Environment and Development defines sustainable development as "development that meets the needs of present without compromising the ability of future generations to meet their own needs" (*24*). A sustainable process or condition is one that can be maintained indefinitely without progressive diminution of valued qualities inside or outside the system in which the process operates or the condition prevails (*25*, pp. 3–14). Sustainable development is now a stated policy objective for many nations (*26*). Several countries and various cities around the world have initiated activities to develop sustainable transportation plans. For example, the city of San Francisco, Canada, the United Kingdom, the Baltic Region, and New Zealand are noted for their work to incorporate sustainability into long-range transportation planning (*27*). Many of these research initiatives include projects to develop indicators of transportation sustainability followed by the collection of data and the development of analysis tools for assessing the sustainability of transportation systems and projects. This research is a potentially useful data source for advancing valuation approaches for transportation asset management.

Another, related effort is the initiative to incorporate the environmental considerations in infrastructure development at the

systems level of planning rather than at the project development stages. There are several ongoing research initiatives in this area in the United States (*28–30*). Referred to as Strategic Environmental Assessment (SEA) in the European Union, environmental planning for infrastructure systems has had several more years of development in Europe. SEA is the consideration and analysis of the potential environmental effects of strategic decisions concerning policies, plans, and programs rather than projects (*31*). Research and other activities in this area could provide useful resources for integrating environmental considerations into the overall value of civil infrastructure.

Another growing initiative is related to the development of databases and tools for transportation equity analysis (*18–21, 32, 33*). This research will identify and develop relevant databases for characterizing the impacts of transportation investments on marginal populations and hence will most likely broaden the indicator set for traditional transportation planning. It will also develop tools for characterizing the benefits and burdens of transportation investments as a function of various demographic and socioeconomic variables. It could provide useful resources for integrating the social impacts of transportation investments into the overall value of civil infrastructure.

Collectively, these initiatives have the potential to generate a wealth of data and ideas that can be leveraged for transportation infrastructure valuation based on multiple considerations and from multiple stakeholder perspectives and capturing multiple dimensions of value. These initiatives are likely to provide data on nontraditional dimensions of value in transportation, thus extending the indicator set for valuing transportation investments. Simultaneous initiatives to develop multipurpose valuation techniques can leverage these resources and also create synergies that advance the aforementioned research activities. Initiatives to develop multipurpose valuation approaches could also leverage the development and upgrading of databases by various transportation agencies to meet the GASB 34 requirements while contributing useful information and guidance to integrate valuation tools with legacy infrastructure management systems.

SUMMARY AND CONCLUSIONS

A case is made for multipurpose valuation of transportation assets, which involves aligning an agency's asset management objectives and stakeholder interests with the appropriate valuation methods. By use of examples from railway corridor, financial, and real estate asset management, it is demonstrated how the objectives of valuation, systematically linked with stakeholder interests, are reflected in the approaches used for valuing assets. Then multiple considerations are presented for valuing transportation infrastructure for different asset management objectives and from various stakeholder viewpoints. Some critical questions are identified for choosing a valuation method for transportation infrastructure, and a framework is developed that classifies valuation approaches by the value parameters used in the valuation function, whether they are benefits or costs and whether they are future based or historically based. The authors explain how this framework could be used to identify appropriate valuation techniques for different situations. It is concluded that this is an appropriate time to advance the scope of valuation tools to reflect multiple considerations in modern transportation planning, especially in the context of active research on sustainable transportation planning, strategic environmental assessment, equity evaluation for transportation system investments, and state and local activities driven by the GASB 34 requirements.

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