TCI
SCOPING
PAPER
SERIES

BENEFITS OF INVESTMENT

Prepared for the Georgetown Climate Center and the Transportation and Climate Initiative

Rutgers University
Environmental Analysis Communications Group

Introduction

There are a variety of outcomes that could be deemed "benefits" of transportation investment. Indeed, the purpose of specifying and monitoring indicators in the Transportation and Climate Initiative (TCI) context is to explicitly quantify the benefits of actions taken in conjunction with the Initiative, which include:

The purpose of specifying and monitoring indicators in the TCI context is to explicitly quantify the benefits of actions taken in conjunction with the Initiative.

- reductions in energy consumed and greenhouse gas emissions,
- changes in travel mode share that reflect the increasing popularity of transit and other non-single occupancy vehicle options,
- increases in sustainable development and infrastructure investments,
- the protection of green and open spaces,
- enhanced accessibility of transit and other amenities,
- and improvements in people's health.

Although numerous and varied in focus, there are other types of benefits that can be derived as a result of investments in transportation infrastructure, which are not captured by the TCI-specified metrics. The quantification of such benefits is consistent with increasingly inclusive federal funding approaches that seek to utilize standardized methods in accounting for community benefits to help prioritize capital program and funding decisions (Norboge, 2012). The following pages provide an overview of the types of economic effects that can result from expenditures in the area of transportation and the methods utilized to quantify the benefits of such projects. For those interested in monitoring the benefits of investments in conjunction with their participation in TCI, a summary of recommendations is then provided.

Overview of the Economic Impacts of Transportation Investments and Initiatives

In order to communicate the benefits of investment to political leaders and citizens, TCI communities must be able to demonstrate the financial, environmental, and qualitative impacts of those investments. Accrual of benefits from transportation projects and spending can be both direct and indirect. Direct impacts include job creation directly related to the project and improvements to mobility, accessibility and ease of travel. Indirect impacts include multiplier effects related to jobs created (e.g., consumer spending by those employed, income tax revenue, and additional jobs and money spent through the materials supply chain), as well as new economic activity associated with improved accessibility. However, according to a GAO survey (2010) only 11 of 52 states and territories reported that the results of such economic impact analyses were of great or very great importance. Nevertheless, US Department of Transportation (DOT) has since continued to take steps to encourage states to conduct economic analyses, including benefit-cost analysis, to plan for new transportation investments through the Transportation Investment Generating Economic Recovery (TIGER) grant program and other federal funding measures (GAO, 2010). Should these trends continue, it may become increasingly important for state departments of transportation and metropolitan planning organizations to be able to quantify the benefits of project investments using a method of economic analysis.

Methods and models for estimating the economic impacts of transportation investments have advanced and improved significantly and many jurisdictions have developed expertise in the area. Economic considerations related to transportation decision-making and investments are not restricted to how agencies spend funds and what kind of return on investment is derived. More broadly, investment decisions can affect the costs borne by individual travelers in order to

meet their mobility needs. In many jurisdictions, there is growing recognition that the combined costs of housing and transportation can be burdensome to many families, reduce economic growth potential and creates other societal costs.

There are two types of analyses that are used to estimate benefits of transportation projects; Economic Impact Analysis (EIA) and Benefit Cost Analysis (BCA). The BCA is used to determine the return on investment of a project over a given time frame and focuses on the net changes attributable to the project or program (i.e. the differences between an improvement case and a base case). The EIA assesses impacts, regardless of whether they are a transfer or net incremental change (Horst and Carini, 2011). In conducting the BCA, gains in employment, tax increases and other benefits present in an EIA are considered transfer payments. For example, jobs represent both a cost to the employer (paying a wage) and a benefit to the employee (receiving a wage); it is a transfer payment, rather than a net benefit. A Cambridge Systematics (2008) report also suggests that conducting a cost-benefit analysis is almost synonymous with calculating the Return on Investment (ROI) of a transportation project. Readers should investigate their audience and types of decisions that need to be made in order to understand the appropriateness of each analysis.

Types of Economic Benefits

Table 1 displays a summary of benefits and their inclusion in either of the analyses described beforehand (Horst and Carini, 2011). The benefits structure utilized consists of user, non-user, community, and broad regional benefits. User benefits are those transportation benefits that are experienced by people using the new project, as opposed to non-user benefits experienced on parallel facilities (Horst and Carini, 2011). Community benefits are experienced by the entire community within the project area, such as environmental impacts, resulting from

secondary outcomes or byproducts of transportation investment. Lastly, wider economic impacts include agglomeration impacts related to productivity, land price affects and other impacts that are more generally related to increases in accessibility (Horst and Carini, 2011).

Table 1: Benefit and Impact Types included in Economic Impact Analysis and Cost Benefit Analysis

Benefit / Impact Type	Included in Economic Impact Analysis	Included in Benefit Cost Analysis	Quantifiable Measures
User Benefits or Impacts			
Travel Time Savings	Y	Y	Time Saved; $
Travel Cost Savings	Y	Y	Reduced VMT, $
Value of Accidents Avoided	Y	Y	Reduced VMT, $
Non-User Benefits or Impacts			
Travel Time Savings	Y	Y	
Value of Accidents Avoided	Y	Y	Reduced VMT, $
Community Benefits or Impacts			
Value of Emissions Avoided	Y	Y	Reduced short-tons and VMT, $
Environmental (e.g. air quality, water quality, noise)	Y	Y	dB/other unit; Qualitative
Walkability	Y	Y	Qualitative
Greater Access for Transportation Dependent Populations	Y	Y	Time Saved; Qualitative
Recreational Benefits	Y	Y	Qualitative
Jobs/Earnings Associated with Construction	Y	N	Number of Jobs and $ of Earnings
Jobs/Earnings Associated with Construction Activity to Build New Project Area Development	Y	N	Number of Jobs and $ of Earnings
Jobs/Earnings Directly Associated with Operation	Y	N	Number of Jobs and $ of Earnings
Jobs/Earnings Project Area Development (net new; not transfers)	Y	N	Number of Jobs and $ of Earnings
Tax Base Impacts Associated with Acquisition of Private Land and Transfer of Non-Taxed Public Use	Y	N	$ of Property Value Lost
Wider Economic Benefits or Impacts			
Land Premium	Y	Y	$
Labor Productivity	Y	Y	$
Option Value	Y	N	$ or Qualitative
Residual Value of the Improvement's Assets	Y	Y	$
Value of Investments Avoided	Y	Y	$

Source: Adapted from (Horst and Carini, 2011)

In addition to addressing the scope of benefits described above, analyses must also consider that different benefits may accrue during different periods of time. One-time benefits derive from expenditures on the materials and labor needed throughout the project design and construction phases. Not only do these dollars represent a direct influx into the economy, the business revenues and personal income they create are spent, resulting in further effects. However great, these benefits cease once a given project is completed, hence the use of the term "one-time benefits" (Seneca et al., 2009).

The reduction in transportation costs resulting from system improvements also produces "recurring benefits," that is, benefits that accrue more or less continually throughout the lifetime of the investment. Savings of this type are realized through reductions in congestion and accident rates, lowered vehicle operating expenses, and diminished highway maintenance expenditures. Avoided environmental costs, such as air and noise pollution, are also among the typical recurring benefits of transportation investments (Seneca et al., 2009).

Given the focus of TCI, we will further focus on selected user, non-user, community and wider economic impacts from transportation investment; however, readers may refer to the references to gain a better understanding of all of the potential inclusions for both economic impact and benefit cost analyses.

User and Non-User Benefits

User benefits are those transportation benefits that are experienced by people using the new project. These benefits are often communicated in terms of direct reduction in travel time for passengers, reduction of travel cost across a transportation system, or other benefits experienced by the system users. User benefits are included in both economic impact analyses and benefit cost analyses. These reductions are subsequently quantified using a variety of

methods related to adjustment in the travel demand or forecasting analysis performed by Metropolitan Planning Organizations. The user benefits are ultimately, "a quantification of the transportation travel impacts associated with each decision made about the construction and operation of the project or program," (Horst and Carini, 2011).

Non-user benefits include the similar transportation benefit types as user benefits—travel time and accident reduction savings. However, the difference lies in who experiences these benefits. Non-user benefits are those transportation benefits that are experienced by people who are not using the new transportation investment(s) directly. For example, if a proposed project improves transit service to the region and people divert to use the service, it is likely that those who continue to drive may experience benefits from reduced congestions or other improvements. Non-user benefits are often included in both economic impact analyses and benefit cost analyses, as seen in Table 1 above. The methods utilized for understanding non-user benefits are similar to those utilized for understanding the direct user benefits, with non-users seeing benefits from changes to travel efficiency based on modal diversion and other impacts. These reductions are subsequently quantified using a variety of methods related to adjustments in the travel demand or forecasting analysis performed by Metropolitan Planning Organizations and/or State Departments of Transportation (Horst and Carini, 2011).

As an example, Michigan analyzed gains in travel efficiencies as a direct user benefit for understanding the economic impact of FY 2011-2015 Five-Year Highway & Bridge Program. These efficiencies included travel time savings, accident cost savings, and vehicle cost savings as a result of reductions in congestion on roadways and other increased efficiencies. The economic impact measures are contingent upon the availability of other metrics and measures to be used as inputs, including assumptions on the value of time for system users, and vehicle miles traveled

(VMT) / vehicle hours traveled (VHT) reduction calculated using the statewide Travel Demand Model (TDM). The other benefits are made up of community impacts and wider economic benefits, which are discussed hereafter (MDOT, 2011).

Community Impacts

Community benefits are experienced by the entire community within the project area, such as environmental impacts, resulting from secondary outcomes or byproducts of transportation investment. Community benefits are one of a number of benefit types. Many of these impacts are not quantifiable and must be discussed qualitatively (e.g. livability), stating what the benefits are and who the beneficiary groups are.

Emissions avoidance and/or reduction is one of the more common metrics utilized to communicate community impacts that is quantifiable. These benefits are often quantified by understanding the potential reduction in VMT and subsequent emission rates and costs related to the reduction in VMT. There are also qualitative methods that exist to understand community impacts that may apply when analysts are not comfortable in quantifying such measures. Accessibility and walkability are examples of community impacts that are often communicated through qualitative means, although some quantitative measures and calculations exist.

The main difference observed in benefit cost and economic impact analyses is seen when estimating the community level impacts of jobs and earnings related to the project. Impacts are positive and/or negative outcomes experienced as a result of the program or project without regard to their net effect. The BCA does not include multiplier effects because the multipliers describe the aggregate outcome of a series of transactions across the economy. For example, contracting services for the project (i.e. payment of wages) is a benefit to the worker, but a cost to the employer. Though each of these entities experiences a positive economic impact from an

EIA perspective, the net gain for the BCA would be zero. Such situations are classified as transfers and excluded from the BCA in most cases.

Using the Michigan FY 2011 – 2015 plan again as an example, several regional direct impacts were analyzed by their modeling approach. These community impacts included employment gains, and emissions cost savings along with a host of other impacts that could be considered either community impacts or wider economic benefits depending on the scope of the project (MDOT, 2011). The Southern California Association of Governments (SCAG) performed an economic impact analysis of greenhouse gas emission reduction strategies and policies through its Climate and Economic Development Project (CEDP). The analysis required the use of both macro and microeconomic modeling strategies and software to delineate benefits among the user/non-user groups (micro) and the community (and wider economy) benefits. The combination of modeling approaches and sensitivity analyses has been cited as a leading innovative approach, however the process of convening stakeholder groups, hiring consultants and researchers, acquiring data, and other activities inherent in conducting such a robust study should be noted by other stakeholders seeking to conduct such an analysis for transportation planning purposes (The Center for Climate Strategies, 2012).

Wider Economic Benefits or Impacts

Wider economic benefits are a relatively new addition to the accepted scope of an EIA or BCA. These benefits often include increasing property values, gains from agglomeration productivity, and other benefits more generally related to increases in accessibility. However, there is no broadly accepted standard methodology for most of these wider benefits, in addition to considerable variations in findings from existing methods and the resulting potential for

misunderstanding the results of such analyses because of the lack of an accepted set of methods (Horst and Carini, 2011).

As such, the impacts of transportation investments in these areas have garnered considerable attention for research. For example, a study by Prud'homme and Lee (1999) on labor accessibility found that improvements to a city's transportation network that reduce travel time by 10 percent can boost the size of the labor market by between 15 and 18 percent. An increase in available employees of just 10 percent, in turn, has been found to raise output and productivity by some 2.4 percent. The benefits of living close to public transit may also be capitalized into home prices, creating a housing market in which residences located close to well-served transit stops sell for more than comparable units lacking this amenity (Landis, et al, 1994).

However, the Center for Transportation Oriented Development also suggests that capturing the value for these projects is dependent on the tools, timing, and motivations of property owners and developers. Many value capture strategies will involve a mix of tools, such as special districts, development fees, and others that can be complex to value and administer. As previously discussed, the likelihood to which these benefits can be transparently evaluated and captured should guide analysts in determining their inclusion in either an economic impact analysis or a benefit cost analysis (CTOD 2008).

> The ability to access a broad labor force is critical, and the quality of the transportation network is an important determinant of worker availability.

Recommendations

As stated in the introduction, all of the TCI indicators are intended to demonstrate benefits of agency actions and investments. Many of these indicators (e.g. VMT, Accessibility, etc.) are critical to the development of economic impact analyses and benefit cost analyses. The completion of an EIA or BCA allows for communications with stakeholders and the public in terms of quantifiable and relatable benefits such as increased income, job growth, reduced travel and other metrics. This document has summarized the types of one-time and recurring economic effects realizable through agencies' investments in transportation, which range from an influx of dollars throughout the construction phase, to the continual cost savings realized by area businesses as a result of reduced congestion. Examples of how these techniques are utilized were provided, though the reader is encouraged to further review analyses conducted in their locale to place the techniques and benefits in their own context for better understanding.

The nature and magnitude of the economic effects of transportation improvements will vary according to the type of project undertaken, the area in which it occurs, the types of industries impacted, and myriad other factors. Analyses are complicated and often conducted by trained economists and modelers, with the assistance of specialized software packages, data sources and discussions with many stakeholders and decision makers. The cost of obtaining such analytical results may be prohibitive, or at the very least, sufficiently high so as to cause debate around maintaining an ongoing "economic benefits of transportation investments" indicator for use in the TCI context. However, it is also true that significant efforts are underway in the public and private sector to make these metrics more accessible and affordable to monitor.

It is therefore recommended that efforts to monitor the benefits of investments rely on one or more of the other TCI-specified indicators, with economic assessments representing a

valuable tool for determining the potential or realized impacts on the economy of a particular project.

References

1. Cambridge Systematics. 2008. Best Practice Methodology for Calculating Return on Investment for Transportation Programs and Projects. NCHRP Report 8-36. Available at: http://144.171.11.40/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=1276

2. The Center for Climate Strategies (December 2012) *Microeconomic and Macroeconomic Impact Analysis of Greenhouse Gas Mitigation Policy Options for the Southern California Climate and Economic Development Project (CEDP)*. Available at: www.climatestrategies.us/library/library/download/1053

3. Horst, Toni and Carini, Sara (November 2011). *Understanding How to Develop and Apply Economic Analyses: Guidance for Transportation Planners Final Guidebook.* Arlington, Virginia: National Cooperative Highway Research Program. Available at: http://onlinepubs.trb.org/onlinepubs/nchrp/docs/nchrp08-36%28101%29_FR.pdf

4. Landis, J., S. Guhathakaruta, and M. Zhang. 1994. *Capitalization of transit investments into single-family home prices: A comparative analysis of five california rail transit systems.* Berkely, CA: Transportation Review Board, 00711318. Available at: http://www.uctc.net/papers/246.pdf

5. Litman, T. 2004. *Rail transit in America: A comprehensive evaluation of benefits.* Victoria, British Columbia: Transportation Research Board, 00981868. Available at: http://www.vtpi.org/railbensum.pdf

6. Michigan Department of Transportation (March 2011) *Economic Benefits of the Michigan Department of Transportation's FY 2011-2015 Highway Program*. Available at: http://www.michigan.gov/documents/mdot/MDOT_EcnBen_2011-2015_363646_7.pdf

7. Nadirir, I., and T. P. Mamuneas. 1998. *Contribution of highway capital to industry and national productivity growth.* Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration. Available at: http://www.fhwa.dot.gov/policy/gro98cvr.htm

8. Norboge, Nicolas. June 2012. *Better Use of Public Dollars: Economic Impact Analysis in Transportation Decision Making*. Eno Center for Transportation. Washington, DC. Available at: http://www.enotrans.org/wp-content/uploads/wpsc/downloadables/Public-Dollars.pdf

9. Prud'homme, R., and C. W. Lee. 1999. Size, sprawl, and the efficiency of cities. *Urban Studies* 36 (11): 1849-1858.

10. U.S. Government Accountability Office (GAO), "Statewide Transportation Planning: Opportunities Exist to Transition to Performance-Based Planning and Federal Oversight," GAO-11-77, December 15, 2010. Available at: http://www.gao.gov/assets/320/314004.pdf