

A GUIDE TO STATE DOT CONSIDERATION OF ECONOMIC DEVELOPMENT POTENTIAL IN PLANNING

FINAL REPORT

Requested by:

American Association of State Highway
and Transportation Officials (AASHTO)

Standing Committee on Planning

Prepared by:

ICF International

March 14, 2007

The information contained in this report was prepared as part of NCHRP Project 08-36, Task 60, National Cooperative Highway Research Program, Transportation Research Board.

Acknowledgements

This study was requested by the American Association of State Highway and Transportation Officials (AASHTO) and conducted as part of National Cooperative Highway Research Program (NCHRP) Project 8-36. The NCHRP is supported by annual voluntary contributions from the state Departments of Transportation. Project 8-36 is intended to fund quick response studies on behalf of the AASHTO Standing Committee on Planning. The report was prepared by ICF International. The study Principal Investigator was Jeffrey Ang-Olson. The work was guided by a task group chaired by Mary Lynn Tischer of the Virginia Department of Transportation. The project was managed by Ronald D. McCready, NCHRP Senior Program Officer.

Disclaimer

The opinions and conclusions expressed or implied are those of the research agency that performed the research and are not necessarily those of the Transportation Research Board or its sponsors. This report has not been reviewed or accepted by the Transportation Research Board's Executive Committee or the Governing Board of the National Research Council.

CONTENTS

1	ECONOMIC DEVELOPMENT TERMS AND CONCEPTS.....	1
1.1	Introduction	1
1.2	Economic Development Concepts.....	2
	Economic Development Goals	2
	Productivity	3
	Generative and Distributive Impacts	3
1.3	Indicators of Economic Development.....	3
1.4	How Transportation Investment Relates to Economic Development.....	4
	User Impacts (Primary Impacts)	5
	Economic Benefits (Secondary Impacts).....	7
	Categorizing Economic Impacts.....	9
	Tertiary Impacts: Increasing a Region’s Competitiveness.....	10
1.5	Research on Economic Impacts of Highway Improvements	11
2	HOW GOVERNMENT AGENCIES PROMOTE ECONOMIC DEVELOPMENT.....	14
2.1	Role of Non-Transportation Agencies	14
	Economic Development Strategies	14
	State Level Agencies	15
	Regional and Local Level Agencies	15
2.2	Role of State DOTs.....	17
	DOT Coordination with External Economic Development Efforts	19
	Using Economic Development Criteria in the Project Selection Process.....	20
	Establishing Economic Development Funding Programs.....	22
	Analyzing Economic Development Impacts of Transportation Projects	23
3	EVALUATING ECONOMIC DEVELOPMENT IMPACTS	25
3.1	Introduction	25
3.2	Background.....	25
	Reasons for Project Evaluation.....	25
	Quantitative Assessment Frameworks.....	26
	Types of Economic Impacts	26

3.3	Measurement Procedures and Techniques	27
	Defining the Project.....	27
	Analytical Scope and Definition.....	28
	Impacts and Indicators.....	29
	Simple Analysis Methods	30
	Input-Output Models	32
	Dynamic Economic Models.....	33
	Plugging Outputs into a Quantitative Framework	34
	Summary of Evaluation Process	34
3.4	Post-Project Evaluations.....	35
	Considerations	35
	Framework and Methods for Post-Project Evaluations	36
	Evaluations of Economic Contribution.....	38
	REFERENCES	40

1 ECONOMIC DEVELOPMENT TERMS AND CONCEPTS

1.1 Introduction

Transportation investments can be a powerful tool for promoting economic development. Transportation infrastructure allows the movement of goods and people to and from places of production and consumption. Improvements to the transportation system can promote economic development by making transportation quicker, more reliable, safer, and less costly. For example, highway improvements can enhance the competitive position of a region, making it a more favorable location for new businesses and residents. For existing businesses, transportation improvements can allow access to a broader set of suppliers, customers, and workers. When a transportation investment leads to an increase in through traffic, it can generate the development of establishments that provide the goods and services demanded by travelers. And transportation investments can allow a region to take greater advantage of tourism opportunities by improving accessibility.

Many state DOTs include the promotion of economic development among their explicit planning goals. In recognition of this goal, state DOTs carry out a variety of activities to promote economic development. Some states, for example, use economic development potential as one of the formal criteria for prioritizing candidate projects. At least 20 state DOTs administer funding programs specifically for projects intended to promote economic development. State DOTs can offer flexibility to areas of the state in greatest need of economic development, such as waiving local matching requirements or advancing projects in the STIP. And some DOTs have formal procedures in place to coordinate with the state's economic development agency and its regional counterparts.

Despite these activities, state DOT efforts to promote economic development often do not reach their full potential. DOT planners are sometimes not sufficiently aware of the activities of economic development organizations to support their efforts. When transportation agencies do consider economic development plans, they often do so too late in the planning process to meaningfully affect the outcome. Many state DOTs do not sufficiently analyze potential economic benefits of transportation investments. While project proponents often use economic development to make the case for highway investments in rural areas, most state DOTs make little attempt to assess these claims. In fact, a variety of tools and techniques are available to forecast regional economic impacts. Many state DOTs do not take advantage of these tools and techniques because they do not understand them, they do not have the resources to use them, or they do not have the procedures in place to integrate economic analysis into the planning process. According to a 2000 study of current practice, many transportation agencies reported a need for more understandable analysis tools, better staff training, and more consistency in methods for evaluating and measuring economic development impacts of individual transportation projects.¹

This guide seeks to address these problems by assisting state DOTs in understanding the relevance of economic development in relation to their planning activities and assessing the potential economic development benefits of their actions. The guide explains economic development concepts as they relate to transportation improvements. It also describes the promotion of economic development as a public policy goal and summarizes the current state of involvement of state DOTs in economic development. Because the intended audience is state DOTs, this document focuses primarily on highway improvements, although many of the concepts and techniques apply to other modes as well.

¹ Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

There are many other guidance documents available to state DOTs that address economic impact analyses and transportation investments, although none of these are comprehensive. This document synthesizes and references many of the other resources, and thereby provides a clear starting point for transportation professionals. By advancing the general understanding of economic development issues in state DOTs as well as providing guidelines for specific analysis techniques, this guide aims to improve the integration of economic development considerations in the transportation planning process.

This guide is organized into three chapters. Chapter 1 provides a primer on economic development concepts, specifically as they relate to transportation improvements. Chapter 2 outlines the current role of government agencies in promoting economic development, including both non-transportation agencies and state DOTs. Chapter 3 describes the requirements and techniques for analyzing the economic development impacts of transportation investments.

1.2 Economic Development Concepts

There is no single definition of “economic development.” The term is best explained by what it attempts to accomplish. The process of economic development aims to enhance the wealth of residents, business owners, and the community in general by expanding the level of economic activity. One goal of economic development is to create more and better jobs for residents. Another goal is to increase local wealth by expanding the diversity of business activities to include all members of the community. Economic development is intended to create long-term, broad-based improvements instead of one-time, targeted growth. By increasing a region’s tax base and improving quality of life on a continuing rather than temporary basis, economic development is a crucial contributor to a region’s lasting success.

Economic Development Goals

The specific goals of economic development efforts may vary depending on the needs of a region. Most economic development initiatives seek to improve one or more of the following factors:²

- *Income* – Increased income is a measure of the improved economic well-being of residents; it represents their increased spending power and role in the economy. It also indicates the wealth of the region.
- *Employment/Job choice* – Increased employment options and job choice are measures of improved opportunity for income, job satisfaction, and upward occupational mobility. They also can represent an expansion of the types of jobs available in the local economy and therefore its regional strength.
- *Activity choice* – Increased activity choice is an indicator of improved quality of life through the expansion of local opportunities for shopping, social, and entertainment activities in an area. More opportunities mean a more vibrant local economy and increased tax base.
- *Stability and Diversification* – Increased stability of jobs and income in an area through diversification is important to economic development because it reduces the reliance on declining industries and those subject to significant business cycle fluctuation.

² Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

Productivity

Productivity is a key concept in economic development. Simply defined, productivity is a measure of the efficiency of production. It can be expressed as a ratio of output (or gross regional product) to the cost of an input (labor, capital, land, transportation) involved in production. An increase in productivity reflects more efficient use of the labor, capital, and materials that are available to society at any given time. Production can always be increased if more resources can be found, but the supply of resources at any particular time is always limited. Productivity gains allow a region to enjoy more or better goods and services with the available resources. Increased personal income, property value, business output, and tax revenue are all consequences of increased productivity.

The real impact of economic development is realized in the relationship between agglomeration and productivity. Economic development often has a catalytic effect on the wider economy. Growth begets growth and, where spatial concentration of activity exists, even greater efficiency is reached. Reduction in communication barriers and transportation distance creates a tighter, more efficient market. This concept of agglomeration advantage is the premise of cluster theory. Industry cluster theory explains the competitive advantage of a close-knit web of companies that have similar inputs and share a distribution network. The economies of scale account for only a portion of the advantage; in today's economy it is the knowledge sharing and specialized networks that make up the majority of the benefit. At root, access is the key component of this economic advantage. And thus, a key component in creating economic development is capturing the efficiency of agglomeration.

Generative and Distributive Impacts

An important distinction in economic development is that between “generative” impacts and “distributive” impacts. Generative impacts involve the creation of new economic activity or wealth in a region; distributive impacts shift economic activity or wealth from one region to another. Many times, economic development involves both types of impacts. Generative economic growth can result from an increase in productivity – more output from existing resources due to increased capacity, new technologies, investments in education and training, etc. It is usually the preferred avenue to economic development because it does not create any “losers”.

Redistribution of some economic activity from areas of existing success to one that is underperforming may also be an acceptable outcome when promoting economic development. Even without net gains in output, such redistribution may increase national or regional welfare if social goals are achieved (e.g., reduced racial or geographic disparities in employment). Transportation investment has the ability to channel growth to regions that have been isolated or disadvantaged, spatially and economically. New opportunities in employment and subsequent raises in personal income and consumer spending create increased regional and sectoral output. Such distributive growth has the potential to create its own momentum, possibly stimulating productivity improvements and further growth.

1.3 Indicators of Economic Development

A variety of indicators are used to measure the success in achieving economic development goals. The most commonly used indicators are described below.³

³ Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

- *Regional Output* is the combined measure of all business sales in a region, including raw materials, intermediary inputs, and final products. This indicator offers a straightforward measurement that businesses often find most useful.
- *Gross Regional Product (GRP) or Value Added* is a measurement of the value of all goods and services produced in a region less those sold within the region as intermediary inputs. This indicator is favored by economists because it can effectively measure the change in a regional economy.
- *Wages* are the compensation paid to workers for their services. Wages are the best representation of personal income (which also includes self-employment and investment income). Not surprisingly, wages/personal income is the measurement that is best understood by local residents.
- *Employment* is the number of jobs in a region. Along with wages, this measurement is easily understood and favored by local residents. Employment is also one of the easiest indicators to measure.

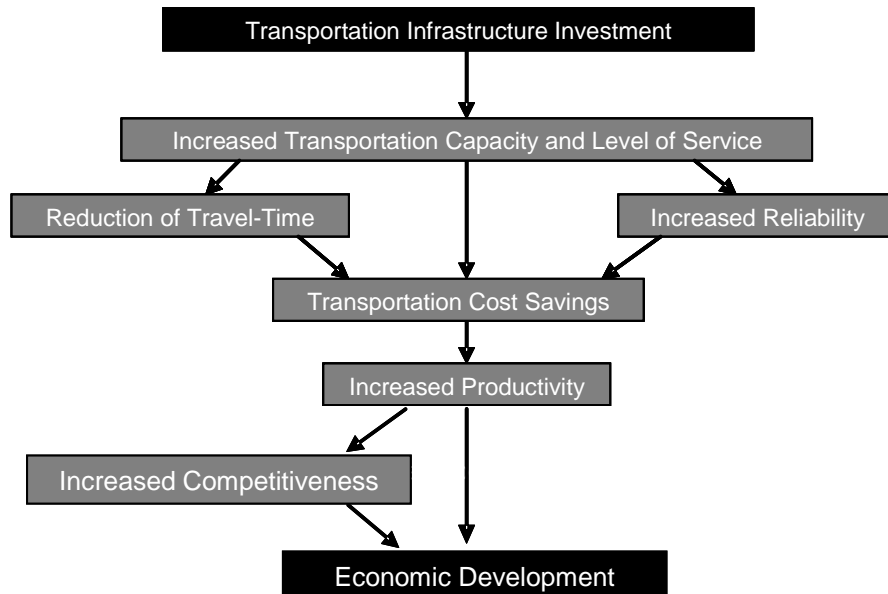
There are other common indicators of economic development that focus more narrowly on one aspect of economic growth. These include the following:

- *Capital Investment* is the money put into land improvements, building construction, or equipment to improve a region's productivity.
- *Property Values* are indicative of the demand for local property. Rising property values mark an increase in population, income, or business activity.
- *Tax Revenue* is the income gained by the government from when it taxes income, property, and other wealth. Rising tax revenue is indicative of greater personal wealth or business activity and thus a marker of a more robust economy.⁴

1.4 How Transportation Investment Relates to Economic Development

Transportation investments can play a key role in catalyzing economic development when they result in an improvement in productivity and regional competitiveness. The specific mechanism for improving productivity and competitiveness depends on the nature of the investment and the nature of the system users. As illustrated in Figure 1, the three most common mechanisms are a reduction in travel time, an improvement in travel time reliability, and a reduction in transportation costs.

⁴ Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

Figure 1: Transportation Investment and Economic Development

It is important to note that transportation investment does not always generate economic development. A project that does not significantly improve travel times, improve reliability, or otherwise reduce transportation costs will have little effect on the broader economy. Of course, a transportation project will bring with it construction and maintenance jobs as well as an increased flow of capital to the site, but these are temporary effects. Economic development depends on an improvement in productivity or a permanent redistribution of economic activity that results in broader, long-term effects.

There are several schemes for categorizing the economic impacts of transportation improvements. Much of the literature classifies economic impacts as *direct*, *indirect*, and *induced*. However, the distinction between indirect and induced impacts is sometime blurred, and the application of these terms can vary.⁵ Transportation practitioners are often most familiar with system user impacts, which are not, strictly speaking, economic impacts. There are also environmental and social impacts, which are generally unrelated to economic development, such as impacts on air quality, noise, aesthetics, and other quality of life factors. Below we describe the major types of impacts relevant to economic development.

User Impacts (Primary Impacts)

Investments in the transportation system do not, in and of themselves, produce permanent economic development benefits. Rather, transportation investments can improve the efficiency, reliability, and safety of the transportation system, which results in economic benefits. Thus, the primary impacts of a transportation improvement are those experienced by users of the system. The four most common user impacts are changes in travel time, reliability, operating cost, and safety. When a transportation investment results in improvements to one or more of these measures, it can generate economic benefits and, ultimately, improve regional competitiveness and create economic development.

⁵ Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

Average Travel Time

Transportation improvements can reduce average travel times when they reduce roadway congestion, facilitate higher speeds, or shorten travel distances. Travel time savings will be experienced by both passenger vehicles (private travel) and trucks (commercial freight movement). For passenger vehicles, a reduction in travel time can mean a shorter commute to work and less time spent driving to shopping, recreation, and education destinations. Households benefit from a reduction in travel time because it can reduce their out-of-pocket expenses, increase time for other activities, and allow them to access a wider range of destinations (jobs, retail, etc.). Businesses benefit because they have access to a wider set of potential employees or potential shoppers within a regional market. Travel time improvements can also lead to an increase in pass-through traffic (benefiting traveler-serving businesses) and an increase in tourist traffic (benefiting local tourism businesses).

The value of travel time savings can be calculated by applying the time savings to a monetary estimate of the traveler's value of time. Personal travel is valued as a percentage of average personal wage or what commuters are willing to pay to reduce travel time; a value of 50 percent of the average wage is typical.⁶ For commercial vehicles (primarily freight trucks), a reduction in average travel time means a lower cost for transporting goods. Business-related travel is typically valued at the traveler's hourly wage plus overhead. Estimates of truckers' value of time vary widely, and for-hire carriers generally have higher value of time than do private carriers. Recent estimates of truckers value of time range from \$25 to \$49 per hour.^{7 8 9 10}

Travel Time Reliability

Separate from an improvement in *average* travel times, private and commercial travelers benefit from an improvement in travel time *reliability*. Reliability refers to the variance in travel time. While average travel time is affected by recurrent traffic delay (which occurs when traffic volume exceeds capacity on a regular basis), travel time reliability is affected by non-recurrent delay caused by traffic incidents – vehicle crashes or breakdowns, weather events, special events, roadway work zones, etc.

To the freight sector, travel time reliability can be even more important as average travel time. Freight shippers have become used to receiving a high level of highway-freight service, and can demand schedule reliability such that deliveries consistently arrive in time windows of 15 or fewer minutes, even on runs of ten hours or longer. Whole systems of inventory control and supply-chain management have been built around the expectation that this kind of reliability is a

Resource

For a discussion of the benefits of reliability improvements to the freight sector, see *Economic Effects of Transportation: The Freight Story*, prepared for the Federal Highway Administration by ICF Consulting and HLB Decision-Economics.

⁶ Economic Analysis Primer, US Department of Transportation. Federal Highway Administration. Washington DC. August 2003

⁷ Kawamura, Kazuya, "Commercial vehicle value of time and perceived benefit of congestion pricing." Doctoral dissertation, University of California at Berkeley, 1999.

⁸ Smalkowski, Brian, Value of Time for Commercial Vehicle Operators in Minnesota, University of Minnesota, 2003.

⁹ Federal Highway Administration, *HERS-ST V2.0, Technical Report*, v 3.54, 2002.

¹⁰ Ohio DOT, *Northern Ohio Freight Strategy: Recommendations to Improve Traffic Safety and Congestion*, October 11, 2004.

permanent feature of freight service. As a consequence, carriers can be crippled by unexpected delays. As congestion grows and a larger portion of roadway capacity is being used, highways are increasingly susceptible to unexpected delay, with potentially serious implications for the freight sector.

Quantifying an improvement in travel time reliability is difficult, and the value of such improvements to businesses is the subject of on-going research. Several studies have suggested that the freight sector values a reduction in travel time variance at three to four times the value of a reduction in average travel time. However, the value placed on reliability improvements depends heavily on the nature of the business and the products being shipped. Reliability matters much more to those involved in transporting relatively high-value, time-sensitive goods.

Vehicle Operating Costs

Vehicle operating costs include repair and routine maintenance expenditures, fuel costs, and out-of-pocket costs for tolls. For most highway projects, the magnitude of any potential vehicle operating cost savings is relatively small, unless a project involves repairs to a roadway with serious deterioration or paving of an unpaved road. One study suggests pavement surface improvements can reduce vehicle operating costs from 30.1 cents to 24.2 cents per mile.¹¹

Highway speed and traffic congestion can also affect operating costs. In heavily congested conditions, vehicles may experience additional wear and tear as well as higher fuel consumption. Fuel economy also declines as speeds rise above approximately 50 miles per hour. Thus, in some cases, a highway improvement that allows higher speeds will reduce fuel economy and increase vehicle operating costs. These higher costs may be offset by reduced vehicle wear as a result of pavement surface improvements.

Safety Impacts

Investments in transportation infrastructure often improve roadway safety by reducing the number and severity of crashes. Because roadway crashes impose economic losses to households and businesses, a safer transportation system results in monetary benefits. Safety cost components include the cost of fatalities, injuries, and vehicle damage. Typically a “willingness to pay” approach is used to determine the dollar value of these benefits. There also may be benefits associated with perceptions of security and piece of mind for travelers.¹²

Economic Benefits (Secondary Impacts)

When transportation investments reduce travel time, improve reliability, reduce operating costs, or improve safety they can create a variety of economic benefits. These benefits can be considered secondary impacts in that they result from system user (primary) impacts. Three major types of benefits are business productivity benefits, household welfare benefits, and tourism benefits.¹³

¹¹ “Economic Benefits of Transportation Investment,” Working Paper 1, Prepared for NCHRP Project 8-36 Task 22, Demonstrating Positive Benefits of Transportation Investment, Cambridge Systematics, January 2002.

¹² Economic Analysis Primer, US Department of Transportation. Federal Highway Administration. Washington DC. August 2003.

¹³ “Economic Benefits of Transportation Investment,” Working Paper 1, Prepared for NCHRP Project 8-36 Task 22, Demonstrating Positive Benefits of Transportation Investment, Cambridge Systematics, January 2002.

Business Productivity Benefits

Improvements to roadway systems can reduce costs for delivery of goods and services by reducing travel time and vehicle operating costs. These, in turn, reduce the costs of collecting inputs and delivering products to markets in several ways:

- Less driver time on the road and therefore lower labor costs
- Increased trip miles per time period per vehicle and thus smaller vehicle fleet needed for the same amount of work (“freight efficiency”)
- Lower vehicle repair and fuel costs

These factors can directly reduce total production costs for businesses. Improvements in transportation reliability can also lower production costs by enabling reductions in inventories of inputs, spare parts, and/or finished goods.

All these cost reductions will enhance the competitive position of businesses with access to the improved highway network. In turn, this can stimulate increased trade domestically and/or internationally, resulting in improved trade balances. Moreover, expanded demand can generate economies of scale and improved productivity as enterprises take advantage of these market opportunities—thus inducing another round of cost reduction.¹⁴

Resource

For an extensive discussion of seven types of economic benefits of transportation investment, see “Economic Benefits of Transportation Investment,” Working Paper 1, Prepared for NCHRP Project 8-36 Task 22 by Cambridge Systematics, January 2002.

Household Welfare Benefits

Transportation investments can improve household welfare in a number of ways. U.S. households spend, on average, more than \$1,600 on transportation fuel and more than \$600 on vehicle repairs annually.¹⁵ A reduction in vehicle operating costs directly reduces these expenditures. By allowing higher travel speeds, workers have access to a wider choice of jobs, allowing them to better match their skills with available positions. If a transportation improvement leads to a reduction in travel time, households benefit from an increase in discretionary time. Transportation improvements that reduce commute times can also benefit households by boosting home values.¹⁶

Tourism Benefits

Transportation projects that improve accessibility to a region can allow the region to take advantage of increased tourism opportunities, assuming that supportive infrastructure is in place. Factors such as traffic congestion, construction delays, poor roadway conditions, absent or confusing signage, inadequate parking facilities, and lack of public transportation can diminish the drawing power of a tourist attraction.¹⁷ Then a transportation investment addresses such deficiencies, the result can be an increase in

¹⁴ *Economic Effects of Transportation: The Freight Story*, Prepared for the Federal Highway Administration, Prepared by ICF Consulting and HLB Decision Economics, 2002.

¹⁵ 2004 Consumer Expenditure Survey, Bureau of Labor Statistics.

¹⁶ “Economic Benefits of Transportation Investment,” Working Paper 1, Prepared for NCHRP Project 8-36 Task 22, Demonstrating Positive Benefits of Transportation Investment, Cambridge Systematics, January 2002.

¹⁷ “Economic Benefits of Transportation Investment,” Working Paper 1, Prepared for NCHRP Project 8-36 Task 22, Demonstrating Positive Benefits of Transportation Investment, Cambridge Systematics, January 2002.

tourist volumes, lengths of stay, and spending per visitor-day. This in turn can stimulate investment in additional tourist facilities.

Transportation improvements can also stimulate an increase in pass-through traffic, which benefits establishments that provide the goods and services demanded by travelers. Existing traveler-serving businesses might expand, and new businesses might open in the area.

Categorizing Economic Impacts

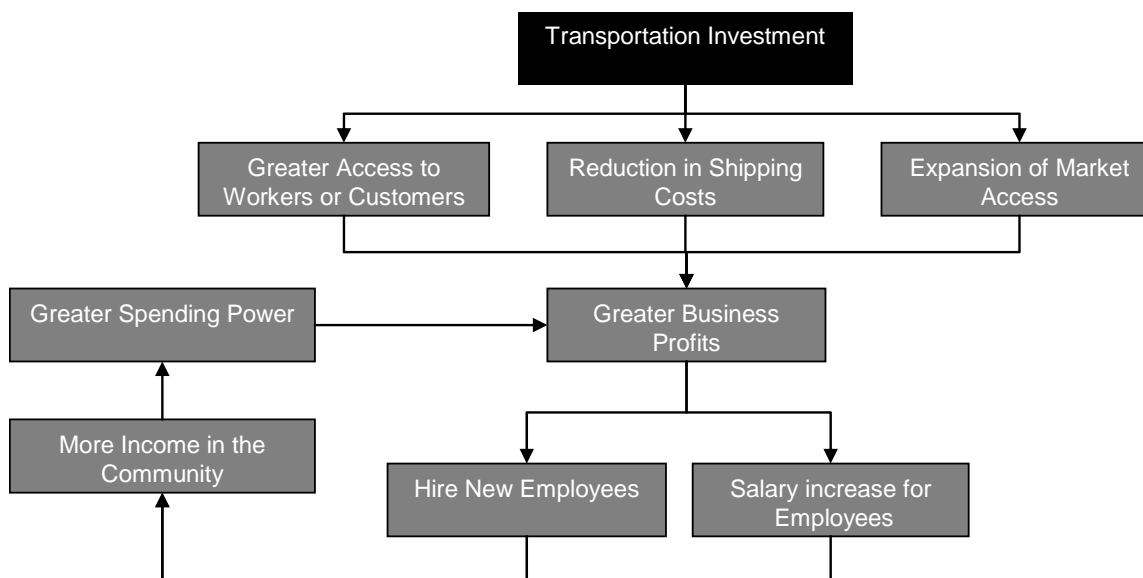
The economic benefits described above are generally “direct” economic impacts, meaning they result directly from the user benefits of the transportation improvement. Such direct impacts can stimulate additional economic activity among other businesses, including both “indirect” and “induced” economic impacts. Most literature employs this scheme to categorize economic impacts, summarized as follows:

- **Direct economic impacts** are direct consequences of an improvement in travel time, safety, or vehicle operating costs. For example, a reduction in average travel time creates a direct cost savings for a manufacturer shipping parts to an assembly plant. A reduction in vehicle operating costs equates to lower out-of-pocket expense for households and businesses. Direct economic impacts also include the temporary effects associated with construction, such as the employment of labor and purchasing of goods and services during the project.
- **Indirect economic impacts** derive primarily from economic activities removed from the immediate area of improvement and are often associated with intermediate goods and services purchased by those companies experiencing direct economic benefits. For example, a manufacturer that benefits directly from a reduction in travel time may use some of its cost savings to purchase more inputs from suppliers. The increased activity of this supplier is an indirect economic impact.
- **Induced economic impacts** are created by the re-spending of additional worker income. For example, businesses experiencing direct and indirect impacts will hire more workers or raise salaries. As this additional income is spent at local retail and service businesses, it generates induced impacts.

The combined effect of indirect and induced economic impacts is sometimes referred to as “multiplier” effects. The concept is that a dollar in direct benefits ripples through the regional economy and multiplies the original direct effect. Thus, the economic multiplier is the ratio of total benefit to direct benefit.¹⁸

Figure 2 illustrates the potential reinforcing nature of these economic impacts. When a transportation improvement allows businesses to reduce their shipping costs, access a larger market, or draw from a larger pool of workers or customers, they become more profitable. They may use these profits to hire more employees or may pay higher wages. This increases disposable income in the community, benefiting other local businesses which themselves become more profitable, and the cycle continues.

¹⁸ Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

Figure 2: Secondary Impacts of Transportation Investment

Tertiary Impacts: Increasing a Region's Competitiveness

As explained in the previous sections, transportation investments can generate direct, indirect, and induced economic benefits. Improvements in transportation efficiency can lead to an increase in overall productivity. This boost in productivity, on its own, generates economic growth in the region by reducing the “friction” in the economic system, allowing more resources to be devoted to directly productive activity. At the same time, however, increases in productivity can enhance regional competitiveness, and in the process stimulate further rounds of economic growth.

The economic structure of all regions in a modern economy is conditioned by its trading relationships, and competitiveness is a vital concept in understanding regional trade. When a region becomes more competitive in a given industry or sector, it expands its exports and overall production, receives more export income from outside the region, and draws in and mobilizes more capital investment and labor resources. These direct effects associated with enhanced competitiveness trigger secondary spillover effects, just like the internal productivity benefits just discussed.

Several characteristics of today's economy reinforce the importance of efficient and reliable transportation. These include:

- Just-in-time production
- The dominance of the globally traded goods and services
- The importance of attractive locations in draw and retaining skilled workers.

Just-in-time (JIT) inventory practices have become the norm not only in the U.S. but globally. JIT inventory means that raw materials, parts, or other manufacturing inputs do not arrive at a production plant until immediately before they are needed for assembling the final product. It allows the product to be highly specialized and the manufacturing process to be extremely flexible. However, it intensifies the dependence on an efficient and reliable transportation system because of the immediacy of the production cycle. Just-in-time production relies on speed and reliability as well as coordination between various modes of transportation. What this means for competitiveness is that regions with the transportation and logistics infrastructure that can support JIT production tend to be more competitive in manufacturing than

those that do not. In this case, the economic impact of transportation projects does not simply reduce to a simple matter of travel time and reliability, but the ability to orchestrate a complex, often global, value chain spanning multiple transportation modes and production stages.

Increasingly, local and regional economies are forced to compete on a global scale. In order to survive, businesses must be able to access global markets and expand beyond immediate customers. With greater market access and therefore distance between producer, supplier, and consumer, transportation system efficiency and reliability have become increasingly important drivers of firm and hence regional competitiveness. The increasing importance of international trade, to the U.S. and its regional economies, places a premium on international seaport and airport infrastructure and the roadway connections to these facilities. The development of this infrastructure will have a disproportionate economic impact on the region because of how its capacity to support global business enhances regional competitiveness.

Lastly, due to rising regional competition, quality of life factors have become increasingly important in attracting talented employees and visitors. In today's highly mobile, knowledge-driven economy, a location's attractiveness is a key component in its ability to draw and retain a skilled and productive workforce. Tourism remains a dominant industry segment bringing not only holiday travelers but industry and academic conventions as well. It is increasingly recognized that specific types of transportation investment – light rail transit, a well-connected bicycle and pedestrian network, attractive arterial streets, etc. – are associated with dense, vibrant urban areas that attract talented workers. Quite apart from this infrastructure's ability to raise productivity by limiting travel time and increasing system reliability, it can enhance regional competitiveness through its contribution to creative place-making.

1.5 Research on Economic Impacts of Highway Improvements

While transportation improvements have the potential to generate the primary, secondary, and tertiary benefits described above, not all transportation improvements will necessarily produce such benefits. Transportation investments that do not significantly reduce travel time, improve reliability, or reduce vehicle operating or accident costs will create little lasting economic development benefit. The uncertainty regarding economic development impacts is reflected in the research literature. Despite substantial research into the economic effects of highway investments, there continues to be substantial disagreement as to the extent and nature of regional economic development impacts.

Some studies have shown that new highways create broad economic growth and development along highway routes. This argument draws on studies such as those that analyzed impacts of the Appalachian Development Highway System (ADHS). A 1981 survey of state highway departments that was designed to determine the importance of highways for businesses located in Appalachia found that the ADHS has broadly aided employment, industrial growth, and provision of services in the region, and as such, advocated the need for continued funding of the highway system.¹⁹ In 1998, an evaluation of the ADHS found that it has created more than 16,000 jobs, led to increased production valued at \$6.9 billion, and made travel in Appalachia easier and more cost-effective.²⁰

Wisconsin DOT conducted a detailed retrospective study of the economic development benefits of a project that converted State Highway 29 from two to four lanes.²¹ The study found that the rate of growth was higher in the Highway 29 corridor than a parallel "control" corridor in terms of tourism expenditure,

¹⁹ *Appalachia*, "Appalachian Highways are Catalysts of Change," Vol. 15, Nos 2/3, pp.8-17, 1982.

²⁰ Wilbur Smith Associates, "Appalachian Development Highways Economic Impact Studies." Prepared for the Appalachian Regional Commission, 1998.

²¹ *Economic and Land Use Impacts of Wisconsin State Trunk Highway 29*, Final Report, Wisconsin DOT, July 2004.

per capita income, population, number of businesses, traffic counts, and property values. Information from interviews reinforced the hypothesis that economic growth along Highway 29 was linked to the higher level of service. The survey also projected total economic growth related to the project up to 2020 and found that future growth was likely to be much higher than that predicted in the pre-project evaluation study.

Other studies argue that highways are “necessary but not sufficient” for economic growth and development.²² Good access alone will not ensure economic development, absent other necessary factors including availability of competitively priced land, labor, capital, and supporting infrastructure. One study found that although highways may be an important factor in explaining rural development, distance to an urban area is often a more important determinant of non-metro growth than the presence of highways.²³ Another study also supported this conclusion, finding that the beneficiaries of Interstate highway access in terms of economic growth have been Interstate counties in close proximity to large cities or having some degree of prior urbanization, such as cities with 25,000 or more residents.²⁴ Rural Interstate and off-Interstate counties were found to have benefited little from highway investment. A third study used regression analysis to find that although access to Interstate highway interchanges contributed to 0.42 percent additional income growth in rural communities, this was much less than other factors that the authors investigated, such as the presence of an airport with scheduled passenger service within 50 miles.²⁵

Studies have also found that highway improvements have limited impact on business location decisions and economic development, particularly in rural areas. One study examined the degree to which investments in high capacity highways are likely to influence business location decisions.²⁶ After surveying Iowa businesses, the authors found that proximity to markets and materials is more important than access to transportation facilities, a finding that is consistent with previous research. The study suggests that other factors, such as quality and cost of labor, are likely to play larger roles in location decision than transportation. Because of the mature state of the nation’s rural highway system, the authors conclude that:

- Access to highways has become a less important factor over time,
- Location poses few problems on an uncongested, well-maintained rural highway, and
- Maintenance and relatively minor improvements are likely to be more cost-effective economic development strategies than expensive highway construction projects.

The question of to what extent transportation investments can promote economic development will probably never be answered conclusively because the answer depends so heavily on the local context. The only definitive conclusion to be drawn from the research is that some transportation projects have had

²² Forkenbrock, David J, Thomas Pogue, David Finnegan, and Norman Foster, “Transportation Investment to Promote Economic Development” in *Infrastructure Investment and Economic Development: Rural Strategies for the 1990s*. December 1990.

²³ Harris, Curtis C., “New Developments and Extensions of the Multiregional, Multi-Industry Forecasting Model,” *Journal of the Regional Science*, Vol. 20, No. 2, pp 159-71, 1980.

²⁴ Rephann, Terance J., and Andrew M. Isserman, “New Highways as Economic Development Tools: An Evaluation Using Quasi-Experimental Matching Methods,” *Regional Science and Urban Economics*, Vol. 24, No. 6, 1994.

²⁵ Aldrich, Lorna and Lorin Kusmin, “Rural Economic Development: What Makes Rural Communities Grow?” *Agriculture Information Bulletin*. U.S. Department of Agriculture, Economic Research Service, Bulletin No. 737, September 1997.

²⁶ Study by Wilbur Smith Associates noted in Forkenbrock, David J and Norman S. J. Foster, “Highways and Business Location Decisions,” *Economic Development Quarterly*. Vol 10, No 3, 1996.

major economic development benefits while others have had little to none. Thus, it is all the more important that state DOT practitioners apply the concepts and techniques discussed in this document and related resources so that, when economic development is a desired outcome of a transportation investment, that outcome is achieved.

2 HOW GOVERNMENT AGENCIES PROMOTE ECONOMIC DEVELOPMENT

In order for state DOTs to more successfully promote economic development through their investment decisions, they need to have a better understanding of the roles and responsibilities of other government agencies related to economic development. Many state DOTs can also benefit from a better understanding of what peer DOTs are doing to promote economic development. This section reviews current government economic development activities, starting with non-transportation agencies and then covering state DOTs.

2.1 Role of Non-Transportation Agencies

A variety of agencies at the federal, state, regional, and local level are charged with implementing economic development strategies. Because regional and local organizations are in the best position to tailor their practices to the needs of their community, most of the hands-on economic development occurs at those levels. Economic development activity at the national and state level generally dictates funding availability and agency prevue and cooperation. States play an important role in assembling stakeholders around common interests and allocating funding.

Economic Development Strategies

Economic development is a broad term that means different things to different agencies. Strategies to promote economic development are similarly diverse. The most common goals and tactics used by economic development agencies fall under into three main arenas:

- Business retention/attraction strategies
- Workforce development
- Technical assistance programs

Business retention and attraction has become increasingly important in today's world of footloose companies. The most popular methods to attract and retain businesses involve financial or regulatory incentives. Financial incentives often include federal, state, or local-level loans or tax incentives. Often a state or region "targets" a particular industry (e.g., biotechnology) or type of businesses (e.g., local, small, minority-owned) and provides industry-specific tax incentives or grants that are tailored to the particular needs of those businesses. Utilizing discretionary or earmarked funds, states and local governments are able to provide a package of financial benefits to existing and incoming companies. Regulatory incentives often include expedited procedures for permits or zoning code exemptions. In this way, agencies seek to demonstrate to desired businesses that the state or city is "business friendly" and that government will go out of its way to ease the legal and procedural process.

Apart from direct incentives, agencies may seek to attract and retain businesses by providing procedural assistance, such as assistance in complying with federal or state legal procedures. Some agencies may also offer industry or location-specific training programs for employees and business owners. These programs are often carried out at the local or regional level because they are specific to the area's needs.

Workforce development includes the management and implementation of employment programs, the administration of unemployment insurance systems, and the facilitation of regional economic growth initiatives concerning skills-training. Funding for such programs is often mandated by the Federal

Workforce Investment Act and allocated by a State Workforce Investment Board. Most of the training and facilitation is carried out at the regional or local level. Employment services centers such as *one-stop career centers* provide resources to help individuals find employment and re-skill or up-skill. Other common local programs include *first-source hiring*, which requires or financially encourages the government and companies to hire locally, and *youth programs*, which target that portion of the population for employment assistance. Increasingly, industry-specific programs have been utilized to train residents and encourage employment in the region's fastest growing industries.

Technical assistance programs most often target small businesses and provide support skills in a variety of business-related needs. The funding and coordination for these programs usually comes from federal or state-level economic development agencies, but the majority of the technical assistance comes from providers at the local level. Most regional and state governments have a multitude of vendors that they rely on to supply specific training and continued support to small businesses. These providers are often coordinated by a city but work independently within their area of expertise. The diversity of programs offered ranges from tourism-specific promotional marketing to high-tech entrepreneur and venture capital advice.

State Level Agencies

Nearly every state has an Office of Economic Development or an Economic Development Department that is charged with improving the economic welfare of the state. Unlike the federal level, most states develop an economic development strategy to target specific regions, industries, or populations within the state while also working towards a comprehensive state-wide goal. These agencies are often located within a state Department of Commerce, though some report directly to the governor. Regardless of title or placement, the state office of economic development supports a number of programs and initiatives to facilitate business attraction/retention, work-force development, small business assistance, and other industry-specific services. In an attempt to improve the state's ability to attract, grow, and retain valuable economic activity, these agencies often provide expert advice in business tax and permitting procedures as well as demographic and market statistics to businesses and service providers. They have financing capacity to not only channel federal money but also pool state funds to support both state and regional projects.

In addition to the state office of economic development, there are numerous other public-private, non-profit, or purely private economic councils that work within a state to create economic development. These can include economic development councils, chambers of commerce, economic development associations, and business investment services.

The majority of state-level economic development work involves coordination. States also have a significant amount of power to dictate the actions of regional and city-wide agencies because they provide a large percentage of local funding. Most state-level economic development agencies aim to create long-term, broad-based economic development, and their programs typically strive not only to add new jobs but boost incomes and create *better* jobs. This strategy requires implementation of an over-arching policy as well as targeted assistance.

Regional and Local Level Agencies

There are countless regional, city, and neighborhood agencies that are involved in some aspect of economic development. Like their state-level counterparts, regional and local organizations may be industry or population specific, or they may be broader in scope depending on their funding source or constituency. Like the state-level agencies, there is often a city office of economic development within

the mayor's office. And there are a multitude of other bodies that combine counties and cities to create partnerships, many with specific industry or regional goals. In California, for example, there are more than 150 organizations beyond those in state, county, and city governments that engage in economic development activity.

The federal government is the main supporter of rural economic development even at the local level. The Economic Development Administration, a division of the U.S. Department of Commerce, provides grants for infrastructure development, local capacity building, reducing unemployment, as well as general support for local (and state) economic development planning. The Economic Development Administration funds Economic Development Districts (EDDs), which are regional economic development bodies responsible for regional collaboration and program planning/financing. There are approximately 325 EDDs in the nation. EDDs bring together the private and public sector to create the partnership necessary for coordinated strategy and ongoing development.

One of the principal activities of EDDs is the creation of a strategic plan, known as a Comprehensive Economic Development Strategy (CEDS). A CEDS is a regional economic development plan created from collaborative, broad-based planning processes. It is a key ingredient in effective design and implementation of a regional strategy and is also a prerequisite for communities to qualify for federal funding. Each CEDS is unique as it reflects the strengths, weaknesses, opportunities, and challenges for the region. However, most contain four common elements: analysis, vision, action plan, and evaluation. The CEDS should assess the region's economic stability internally as well as its ability to partner with allies. It should take note of the community's goals in relation to existing conditions and advantages and set a plan to realize such visions through specific implementation projects and or programs. Lastly, it is important that a CEDS evaluate its progress to allow for periodic updates and improvements.

Aside from EDDs, other common economic development agencies at the regional and local level include the following:

- *Workforce Investment Board (WIB)* – WIBs are regional entities created by and for the implementation of the Workforce Investment Act (WIA) of 1998. The main role of WIBs is to direct federal, state, and local funding for workforce-related programs. WIBs oversee One-Stop Career centers and connect job seekers to other local resources. They also conduct and publish research on various programs and the needs of the local job market.
- *Economic Development Corporation (EDC)* – EDCs are common at the state, regional, and local level. They are typically 501C3 non-profit organizations that promote economic development by compiling information on the local economy and coordinating with other organizations on workforce development and business retention and expansion efforts. EDCs are similar to and often work side-by-side with chambers of commerce. They act as the organizing agency to many targeted programs.
- *Chambers of Commerce* – A chamber of commerce is a private business network that meets to improve the economic climate. Chambers work primarily through lobbying and networking within the business community, although they sometimes partner with economic development corporations on large-scale initiatives.

Other organizations involved in regional economic development projects include community planning associations (CPAs), association of governments and regional councils, and metropolitan planning organizations (MPOs).

These organizations can be public, private, non-profit, or a combination. They generally rely on a mix of federal, state, local, and industry funds to carry out their work. Some have a specific focus (such as work-

force initiatives) or a particular industry, but these organizations typically take on a wide-range of economic development initiatives for a region.

2.2 Role of State DOTs

State DOTs can promote economic development through a variety of mechanisms. Each state is unique in terms of the structure of its agencies, its economic development needs, and the options available to the DOTs for promoting economic development. As such, it is clear that there is no “one size fits all” solution to promoting economic development at within the DOT. Actions generally fall into the following four categories:

- DOT coordination with external economic development efforts
- Using economic development criteria in the project selection process
- Administering economic development funding programs
- Analyzing economic development potential of transportation projects

Table 1 provides a summary of current activities by state DOTs, based on a survey conducted as part of this research project and a review of other literature. This compilation of information suggests the following snapshot of current state DOT activities:

- At least 17 DOTs coordinate activities with the state or regional economic development agencies. Most interaction with other state agencies is informal, however. Many DOTs rely on their routine interaction with MPOs and regional planning organizations to coordinate economic development-related actions.
- At least 11 DOTs use economic development as formal criteria in investment decisions. Economic development potential is often assessed qualitatively, although a few states use numeric scoring of economic development potential.
- At least 20 state DOTs dedicate funding to promote economic development.
- At least 8 state DOTs conduct quantitative evaluations of economic development potential of projects, and at least 5 states have conducted post-implementation evaluations of economic development impacts.

The remainder of this section discusses these state DOT activities in more detail, highlighting some best practices.

Table 1: Current State DOT Approaches to Promoting Economic Development (ED)

	DOT coordinates with external ED efforts?	ED goals as formal investment criteria?	Separate funding for ED projects?	Separate funding for ED areas?	ED evaluations for proposed projects?	Post-project evaluations of ED?
Alaska	-	yes	-	-	-	-
Alabama	-	-	yes	-	-	-
Arizona	yes	yes	yes	no	-	-
Colorado	no	no	no	no	no	no
Delaware	yes	yes	-	-	-	-
Florida	yes	yes	yes	yes	no	-
Idaho	-	yes	-	-	-	-
Indiana	-	yes	-	-	-	-
Iowa	yes	no	yes	no	no	yes
Illinois	-	-	yes	-	-	-
Kansas	yes	no	yes	no	no	no
Kentucky	yes	no	yes	no	no	no
Maine	no	yes	no	no	no	no
Maryland	yes	no	no	no	no	no
Michigan	yes	-	yes	no	yes	-
Missouri	yes	yes	yes	no	yes	yes
Montana	yes	no	no	-	yes	-
Nebraska	yes	no	no	no	no	no
New Jersey	no	no	no	no	no	no
New York	yes	no	yes	no	yes	yes
North Carolina	no	no	no	yes	no	no
Ohio	no	yes	no	yes	yes	no
Oklahoma	-	-	yes	-	-	-
Oregon	yes	yes	yes	no	yes	yes
Pennsylvania	yes	-	yes	-	-	-
South Carolina	yes	-	yes	-	-	-
South Dakota	-	-	yes	yes	-	-
Tennessee	-	-	yes	-	-	-
Utah	no	no	no	no	yes	no
Washington	yes	no	yes	-	-	-
West Virginia	-	-	yes	-	-	-
Wisconsin	yes	yes	yes	no	yes	yes
Wyoming	-	-	yes	-	-	-
Total data points	23	23	29	19	18	15
Total "yes"	17	11	20	4	8	5
<i>- denotes no information available</i>						

Source: Survey conducted as part of this project combined with results from other literature, most notably Weisbrod, Glen and Manisha Gupta, *Study of the National Scope and Potential for Improvement of State Economic Development Highway Programs: Overview of State Economic Development Highway Programs* (Task A-B Report), Prepared for the Federal Highway Administration, March 2005.

DOT Coordination with External Economic Development Efforts

It should go without saying that state DOTs will have more success promoting economic development when they work closely with other organizations that do the same. As discussed in Section 2.1, economic development efforts are conducted by a variety of state, regional, and local agencies and organizations. State DOTs interact with these agencies and organizations in a variety of ways.

Include as Stakeholders

At the most basic level, state DOTs should include economic development organizations as stakeholders in the planning process. Most DOTs do this informally as part of normal interagency cooperation and outreach efforts. By formalizing the role of these organizations, DOTs will help to ensure that economic development is given consistent and meaningful consideration in the planning process. Florida DOT, for example, has made a proactive attempt to incorporate economic development stakeholders in regional forums and steering committees that drive the planning process.

When state DOTs delegate more planning activities to the regional level, they often inherently strengthen ties to economic development objectives. Economic development is typically one of the primary functions of regional planning organizations (RPOs) in rural areas; by empowering RPOs with a greater role in transportation decision making, the linkages between economic development and transportation investments are most likely to occur naturally. In Missouri, for example, all of the state's 19 regional planning commissions are involved in economic development planning, and about half are federally-designated economic development districts (EDDs). Since 1995, Missouri DOT has empowered the commissions with responsibilities that include formation of a Transportation Advisory Committee and development and implementation of an annual transportation work program.

In some states, economic development agencies may have a formal process for identifying transportation needs, and the DOT can use the results of this process as an input to planning and programming. In Oregon, for example, the state's Economic and Community Development Department identifies transportation needs as part of the Needs and Issues Inventory process. This standardized process is an on-going collection and annual prioritization of local and regional infrastructure and community facility needs. City and county governments, tribes, ports, special districts, and economic and community development-related non-profit organizations participate in the process by submitting Project Notification Forms. Transportation needs identified through this process are then reviewed by Oregon DOT as part of the STIP process.

Use State Economic Development Agency to Evaluate Projects

When state DOTs evaluate projects for economic development potential, they should involve the state economic development agency. This agency is likely to be more familiar with the economic potential and needs of the various regions of the state, and thus in a better position to evaluate a proposed project. A number of states have formally established such a relationship. For example, when Florida DOT receives applications for the Economic Development Transportation Fund, it turns to the state's Office of Tourism, Trade and Economic Development to evaluate the merits of the project. In Ohio, the DOT and the Ohio Department of Development jointly score projects based on economic development factors under the TRAC process for prioritizing major projects.

State DOTs can also turn to economic development agencies for technical assistance. These agencies are often in the best position to provide economic data or to run economic models. In Missouri, for example, the Department of Economic Development maintains a REMI model and performs customized runs for MoDOT as needed to evaluate major transportation investments.

Collaborate on Economic Development Teams

There are a variety of ways that state DOTs can more proactively coordinate with external economic development efforts. One way is for the DOT to participate in multi-agency economic development “teams.” In Oregon, the state legislature has mandated the creation of an Economic Revitalization Team (ERT), which focuses on how state agencies can pro-actively support and facilitate local and statewide economic development. Oregon DOT is an active participant in the ERT process. The ERT aims to streamline permitting for business and industry, increase opportunities to link and leverage public and private investments, and provide greater local access to state resources and assistance. At the state level, the ERT comprises a seven-member team in the Governor’s Office, along with eight ERT state agency directors (including Oregon DOT). At the regional level, the ERT developed nine locally-based, multi-agency regional teams aimed at assisting local governments in promoting job creation. The existence of the ERT provides Oregon DOT with external partners statewide for addressing issues that have significant overlap between transportation and economic development. The ERTs also provide a statewide perspective that balances with and among local interests in economic development.

State DOTs should also ensure that, whenever possible, they provide input to economic development plans. In Florida, statewide economic development is led by a public-private partnership known as Enterprise Florida, Inc. Enterprise Florida develops an annual five-year strategic plan that, among other things, identifies tactics and responsibilities for developing infrastructure to support a competitive economy. This provides another opportunity for FDOT to coordinate economic development objectives and transportation investments.

Using Economic Development Criteria in the Project Selection Process

State DOTs can establish procedures to formally incorporate economic development potential into the project selection decisions. At least 11 states use economic development potential as a criterion for prioritizing projects, typically by assigning an economic development “score” to each project and then weighting the economic development factor relative to other planning objectives (safety, mobility, etc.). In some states, a project’s economic development score is largely a subjective assessment by DOT staff; in other cases, states have established detailed systems for serving projects that minimizes subjectivity.

Ohio offers a good example of this approach. Ohio relies on an independent council, the Transportation Review Advisory Council (TRAC), to review major new highway investments. TRAC’s methodology scores each major transportation improvement project relative to its effect on goals for safety, transportation efficiency, and economic development. Economic development accounts for 30 percent of the total TRAC project score. Economic development points are assessed on five factors, shown with

Economic Development Factors in Ohio’s TRAC Project Scoring System	
Factor	Max. Points
Job Creation: projected level of non-retail jobs created	10
Job Retention: evidence that the project will retain existing jobs	5
Economic Distress: region’s unemployment rate	5
Cost Effectiveness: ratio of project cost to job and economic benefits	5
Level of Investment: level of private-sector, non-retail capital attracted to Ohio	5
Maximum possible economic development points	30

their assigned weights in the box.²⁷ As noted above, Ohio DOT and the Ohio Department of Development jointly score projects based on these economic development factors.

Wisconsin DOT offers another example of use of economic development potential in prioritizing projects. WisDOT applies a scoring system for proposed projects with a total cost over \$5 million. As shown in the box below, economic considerations account for 40 percent of overall project scores. Components of the economic development score include: reductions in travel costs in relation to construction costs; businesses that will benefit; economic growth potential of the corridor; the ability of the project to attract new businesses; and location on Wisconsin’s Corridors 2020 or National Highway System networks. The evaluation often involves development of indices with which to compare and rank projects, and some aspects are conducted at the corridor level. WisDOT conducts economic analysis to support this scoring system using a REMI model and geographic economic data on existing businesses and industries.

WisDOT Scoring System of Major Highway Projects		
Measure	Component	Percent Weight
Economic	Reduction in travel cost vs. construction costs	15%
	Business that will benefit	5%
	Economic growth potential	5%
	Unique reasons why project will attract new businesses	5%
	Location on Wisconsin Corridors 2020 or National Highway System (NHS) Network	10%
Traffic Flow	Level of Service	20%
Safety	Crash rate; severity proportion; pedestrian and bicycle considerations	20%
Environmental	Natural, physical resources	5%
	Socio-economic, cultural resources	5%
Community Input	Public support or opposition	5%
	Relationship to adopted plans	5%

DOTs should also take steps to ensure that the focus areas of the state’s economic development agencies are aligned with the DOTs efforts. State economic development agencies may designate economically depressed areas of the state, for example, or identify particular industry sectors that will serve as economic growth engines. As one example, Missouri’s Department of Economic Development has

²⁷ TRAC Policies and Procedures Handbook, Ohio Department of Transportation, 2003. Available at <http://www.dot.state.oh.us/trac/PDFfiles/book2003.pdf>

identified a set of “Strategic Economic Corridors” in the state, and transportation projects located on such corridors receive more points in MoDOT’s scoring process than those that are not.

Establishing Economic Development Funding Programs

One of the most common ways for DOTs to promote economic development is to establish dedicated funding programs. At least 20 state DOTs administer funding programs specifically for transportation projects intended to promote economic development. Most of these programs fund transportation projects anywhere in the state; a few states also have funding programs specifically aimed at areas designated for economic development efforts. Many of the programs require a state or local sponsor to conduct evaluations on the economic development potential of projects. Some use a threshold for the minimum number of jobs that will be created (or retained) per dollar of transportation investment. While many of these DOT funding programs are intended to support highway improvements, some can be used for improvements to other modes, and a few are dedicated entirely to non-highway modes.

Florida DOT, for example, maintains several funding programs aimed at supporting economic development through transportation investments, some of which have their roots in state law. These programs have been shaped to respond to local perspectives and needs, rather than to rely on state-level analysis to prioritize projects. A common element in these programs is the solicitation of private-sector participation in funding as a way to involve external partners in transportation planning. The fund programs include the following:

- Economic Development Transportation Fund, with \$10 million available annually
- County Incentive Grant Program, with \$45.6 million available annually
- Small County Outreach Program, with \$11.4 million available annually
- Small County Road Assistance Program, with \$25 million available annually
- Transportation Outreach Program

Wisconsin DOT also maintains several transportation funding programs directed explicitly at supporting economic development, including the following:

- The Transportation Economic Assistance Program is intended to provide quick-response transportation funding to local agencies supporting jobs-focused initiatives. Projects are evaluated in a ranking system that considers the number of jobs to be created, amount of private investment, and passing a benefit-cost ratio analysis. To receive funding, anticipated jobs must be realized after three years from the start date of the project, and remain in the community for an additional four years. Grants of up to \$1 million are provided, but require a 50-percent match and a maximum ratio of \$5,000 per each new job created.
- The Harbor Assistance Program provides grants of up to 80 percent of total project cost for facility improvements to private and publicly owned harbors. Projects are evaluated based on the amount of

Florida’s Economic Development Transportation Fund

FDOT administers the Economic Development Transportation Fund (EDTF) through a not-for-profit partnership of government and business. The fund provides financing to local governments to help alleviate transportation problems affecting business location. Approximately \$10 million in funds are available annually from the State Transportation Trust Fund for improvements for projects that help to attract or retain a specific firm or industry that would provide or retain jobs.

Applications for EDTF funding are made by local governments on behalf of specific companies, and are required to include: the capital investment the company intends to make; the number of permanent full-time jobs to be created and/or retained; and the average hourly wage of these jobs.

Funding has been used for new roadway construction, traffic operations, widening/expansion, reconstruction public transportation, and resurfacing. Manufacturing companies are the dominant target businesses that EDTF projects have aimed to support.

monetary benefits accrued, after accounting for costs, over the facility’s 20-year useful life. Projects must demonstrate travel time and cost savings related to loading and unloading of waterborne freight; gains in employment and market share are also considered in the application process.

- The Freight Rail Infrastructure Improvement Program provides low- to no-interest loans for start-up or existing businesses expanding in the state. Projects must demonstrate the creation of positive economic benefits, possibly including highway maintenance cost savings, increases wages, employment, and private investment.

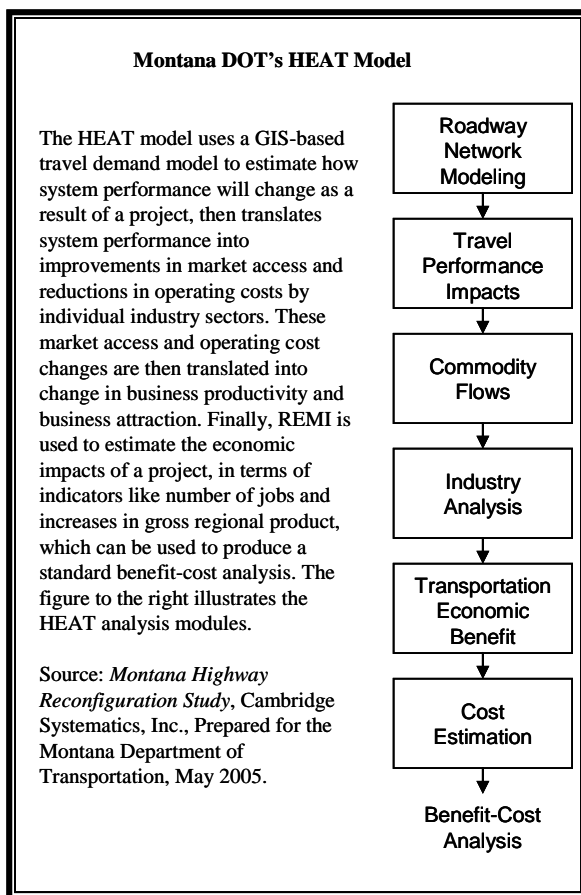
Unfortunately, there has been no attempt to rigorously assess how these programs have produced economic development benefits. Some states report estimates of program impacts, such as the number jobs created or retained. But these are typically based on the impacts estimated by the local sponsor and do not reflect a rigorous comparison of economic impacts with and without the project.

Analyzing Economic Development Impacts of Transportation Projects

Most state DOTs rarely conduct rigorous analyses of the potential economic development impacts of transportation projects, even for projects that are promoted primarily for their economic development benefits. This is partly because such analyses are often challenging and require specialized expertise that many DOTs lack. When an analysis of potential economic development benefits is performed, it is typically done to select among various project alternatives in a corridor, rather than to select regions and corridors in which to invest transportation funds.

Over the last decade, however, a small number state DOTs have devoted significant resources to analyze the economic development impacts of their investment decisions. These analyses have been enabled by significant improvements to economic models, which allows a more comprehensive and accurate estimation of potential benefits (see Section 3.3 for a description of these models). The Regional Economic Models, Incorporated (REMI) package remains the most common model choice.

One example is Montana DOT (MDT). MDT developed a software tool to evaluate the economic benefits and costs of proposed projects called the Highway Economic Analysis Tool (HEAT). A driving force behind the development of the model was the need for a way to objectively assess the economic impacts that might be expected from a transportation investment. In multiple locations across the state, external stakeholders have proposed transportation improvements, such as widening of two-lane roads into four-lane roads, and have identified economic development benefits as a central justification for the proposed public investments. At the same time, state legislation has mandated that MDT incorporate economic development criteria into its funding allocation process.



HEAT is a suite of analytical tools that predicts the economic impacts of transportation projects (see box). MDT intends to use HEAT to help guide transportation investment decisions in a number of ways. For instance, MDT intends to use HEAT in policy planning for corridor analysis, as a way to identify and prioritize corridors that are worthy of investment from an economic development perspective when compared against project costs. MDT also intends to use HEAT in the investment analysis step to compare the effects of different investment category allocations. While the use of HEAT would not change the responsibility of MDT's districts in nominating projects, it would allow MDT to understand the economic impact of allocating different amounts of funding to different general funding categories. MDT is also planning to use HEAT to analyze particular projects nominated by districts, especially in cases where potential economic benefit is the driver of a project proposal. Although HEAT was developed by a consultant, MDT is committed to maintaining HEAT internally and integrating it into the planning process as much as possible. The agency recently hired a full-time transportation economist to maintain and run the model.

There have been very few post-project studies that attempt to rigorously measure the impacts of transportation investments on economic development. One reason for this is the considerably difficulty in establishing causation, rather than just correlation, between the project and economic development for regional-scale transportation investments. Often the most informative analyses for determining causal relationships use both qualitative and quantitative data. Most DOTs find little reason to conduct a rigorous post-project evaluation of economic benefits, given that such a study could cast doubt on the purported benefits of the project. One noteworthy example is Wisconsin DOT's post-project evaluation of improvements to Highway 29 (see Section 3.4 for details).²⁸

²⁸ *Economic and Land Use Impacts of Wisconsin State Trunk Highway 29*, Final Report, Wisconsin DOT, July 2004.

3 EVALUATING ECONOMIC DEVELOPMENT IMPACTS

3.1 Introduction

Chapter 1 of this report explains how improvement to a highway or other transportation facility can significantly affect a local or regional economy. Transportation projects produce economic development when they induce permanent increases in employment, wages, and/or business output. When state DOTs seek to direct their investments toward projects that will promote economic development, it is critical that they properly evaluate the potential economic development impacts. Without such an evaluation, agencies risk squandering scarce resources on projects that do not yield their intended benefit. Note that an analysis of economic development impacts does not necessarily need to be complex or costly (although some will be); in many situations, relatively quick and simple methods can often provide at least a general sense of the economic development potential of alternative projects or corridors considered for investment.

This chapter provides an overview of the economic development evaluation process. It begins with background information on the reasons for conducting evaluations, some types of quantitative assessment frameworks, and categories of economic impacts. It then moves on to the design of an evaluation and the considerations necessary in that process, including project characteristics and analytical scope. The chapter then discusses major evaluative methods along with their inputs, outputs, advantages, and disadvantages. It concludes with a discussion of post-project evaluations of economic development impact.

Although this section is concerned with evaluating economic development, not simply economic impacts, the former must generally be assessed via the latter. Therefore the text of this chapter will often use the term economic impacts. As discussed in Chapter 1, these impacts are ultimately useful as indicators of economic development.

3.2 Background

Reasons for Project Evaluation

There are a number of reasons why a DOT might perform an economic development evaluation of a transportation investment, including:

- Forecasting of impacts to aid planning and programming
- Environmental regulatory review of proposed projects
- Public education
- Research to improve understanding or linkages between transportation and economic development

Forecasting of impacts for decision making often occurs in the system planning phases, when alternative projects and investment strategies are being compared. An evaluation of this type might determine which of two proposed projects is likely to bring greater economic benefits to a local or regional economy. In contrast, regulatory review of proposed projects occurs in the context of an Environmental Impact Statement (EIS) or other formal impact assessment, when projects are further along in the planning stages. This type of evaluation is usually required by a legal statute.

Evaluations for the purpose of public education attempt to demonstrate the importance to the economy of existing transportation facilities or modes. For example, such an evaluation might show the extent to

which jobs in an area are dependent upon the highway system. In contrast, a research application would involve an evaluation of actual economic changes linked to the construction of a recent transportation project.²⁹

Quantitative Assessment Frameworks

Economic development analyses sometimes turn to quantitative frameworks to ultimately determine whether a project is or was a good investment or to compare the impacts of one project to another. These frameworks distill aspects of an area's economic performance and the details of a project itself into a series of economic costs and benefits. Typical assessment frameworks include:

- Cost Effectiveness – the ratio of present value of cost per unit of (non-monetary) benefit
- Benefit/Cost (B/C) ratio – the ratio of the present value of total (monetary) benefits to the present value of total costs
- Net Benefit – the present value of total benefits minus the present value of totals costs.

These frameworks are applied as a final step in the analysis process, after the impacts of a project have been fully determined and quantified.

Resource

More detail on cost effectiveness, NPV, and B/C analysis can be found in Weisbrod, Glen and Burton Weisbrod, *Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project*, Transportation Research Circular, Number 477, October 1997.

Types of Economic Impacts

Chapter 1 discusses in detail the categories of economic impacts that can result from transportation projects. In summary, the economic impacts of transportation projects fall into three categories. In order of increasing complexity, they are:

- *Primary Impacts* – These are impacts on businesses as a direct result of their use, their employees' use, and their customers' use of the transportation system. For example, consider Business X, a manufacturer of tennis racquets. An improvement to a highway located near Business X makes it easier for workers to get to Business X. Therefore Business X can hire from a broader labor pool and save money on labor costs. The improvement also means that Business X can distribute its tennis racquets more cheaply. Distribution costs also fall. Both of these shifts are primary impacts on Business X.
- *Secondary Impacts* – These are impacts on businesses that result from changes in income flows from other businesses. As a result of greater profitability at Business X, it begins to produce and sell more tennis racquets. In order to increase production it must purchase more raw goods and hire more workers. The additional income flow to suppliers of the raw goods represents one type of secondary impact. The additional income flow to other area businesses as newly hired workers spend their wages represents another type of secondary impact.
- *Tertiary Impacts* – These are long-term shifts in an area's overall economic structure brought about by a combination of primary and secondary impacts. These impacts are, by nature, more complex and varied. Tertiary impacts have multiple levels of interaction and causation. Consider, for example, Business X again. As its output and the output of other businesses in the area grow, workers are

²⁹ Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

attracted to the increased employment opportunities. A population shift occurs as people move into the area. Some of them take up jobs at Business X and learn to make tennis racquets. Meanwhile, an employee of Business X decides to take advantage of the new labor pool and the flow of raw goods to the area by starting an operation that manufactures squash racquets. These impacts cycle back through income growth, spending, and business growth and increase an area's economic competitiveness versus other areas. Such tertiary impacts can be self-sustaining and generate economic development beyond that achievable through primary and secondary impacts.

The three categories of primary, secondary, and tertiary impacts provide a framework for understanding economic impacts that contribute to economic development. A later section will discuss how evaluation methods can assess these impacts in different ways and to different extents.

Two further categories of impacts are not economic per se but are relevant to economic development evaluations. User impacts, the direct effects of transportation system improvements, are important inputs in the evaluation of economic impacts. They include reductions in travel time and travel cost and increases in safety and reliability. The estimation of user impacts is often the first step in an economic development impact analysis. Societal impacts, as externalities, are not typically a part of economic development evaluations. Societal impacts include impacts on the environment, such as emissions of air pollutants, and impacts on quality of life, such as noise levels. Although they can be monetized, the relationship of these impacts to economic development is not well understood.

3.3 Measurement Procedures and Techniques

Regardless of its ultimate complexity, the quantification of economic development impacts from a transportation investment requires a number of steps. The first of these is the outlining of the characteristics of the project in terms of mode, type of project, scale, and purpose. The parameters of the analysis itself must also be defined. What will be assumed about alternatives to the project, and what are the relevant geographical areas and time periods for the analysis? Several different methods of analysis are available to assess the impacts of interest. Appropriate methods should be chosen based on their feasibility and effectiveness. If desired, the outputs of these assessment methods can be plugged into one of the quantitative frameworks discussed above.³⁰

Defining the Project

An important initial consideration in project evaluation is the definition of the project itself. The details of the project will affect all subsequent parts of the design and execution of the evaluation. Defining a project for analysis typically requires consideration of the following issues:

- Modes of Transportation Affected
 - Does the project affect road, rail, or other forms of transportation? Will it serve primarily passengers or freight? What types of vehicles will be affected? What types of infrastructure are included in the project? Does the project affect only the road itself, or does it affect other facilities as well?
 - These questions help to determine how various users of the transportation system will be affected by the project to different degrees. The impacts on users are the starting points for the economic development analysis.

³⁰ Weisbrod, Glen and Burton Weisbrod, *Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project*, Transportation Research Circular, Number 477, October 1997.

- Scale of the Transportation Project’s Service Area
 - How big is the project, and how large of an area will it serve? Will the project affect only a specific site, such as an interchange, or will it affect a corridor or an entire system?
 - The larger the area of immediate impact on the transportation system, the larger will be the area of interest for the impact study.
- Type of Transportation System Change
 - Is the project an expansion of existing capacity, such as the addition of lanes to a highway or the addition of new transportation services, or is it aimed at operational and safety improvements, such as resurfacing or realignment?
- Purpose of the Transportation Project
 - Is the project intended to relieve congestion? Is it intended to improve safety? Is it intended to spur economic development?
 - The purpose of the project provides some clues about what the impacts of the project are expected to be. It also may provide a yardstick against which to compare the eventual outputs of the analysis.

Analytical Scope and Definition

The analytical scope of the assessment includes the base case and alternatives, the geographic area of interest, and the time period of interest. The determination of analytical scope is crucial, because the same project may appear to have very different economic impacts under differently designed analyses. For example, the construction of a new local road may provide negligible economic benefits at the regional level, but significant benefits at the local level. Analytical scope can thus have a dramatic effect on the approval or rejection of projects. There are three primary considerations in designing the analysis, described below.

- Base Case and Alternatives
 - The selection of a proper base case is crucial to the “what if” nature of a pre-project evaluation. Assumptions regarding the base case will affect the magnitude of benefits associated with a project. Generally the base case will be a no-project alternative and will reflect current trends. If more than one alternative is to be used, each one should be defined according to the guidelines above.
- Geographic Study Area
 - The improper definition of study areas is one of the most common pitfalls in conducting economic impact analyses. A study area might be a neighborhood, a city, a county, a multi-county region, a state, or a multi-state region. Although the appropriate study area is related to the area of physical impact of the project, the study area can be much larger than the actual project area. Many users of transportation projects are not located in the immediate vicinity of the project.
 - The selection of a study area is particularly important to the distinction between generative and distributional effects. As discussed in Section 1.2, generative effects result in new business and job creation, whereas distributive effects result in business and job relocation. A highway bypass project that brings new business activity to a neighborhood produces positive impacts at the local level; but if that activity simply relocates from elsewhere within the city, impacts at the regional scale are neutral. While distributive effects can still be a viable form of economic development, it

Resource

A more detailed explanation of how to select a base case and alternatives can be found in Weisbrod, Glen and Burton Weisbrod, *Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project*, Transportation Research Circular, Number 477, October 1997.

is important to distinguish between the two types of impacts. In general, the evaluated impacts of a project will change depending on the study area chosen.

- DOTs should generally consider the following four factors in determining the appropriate study area for economic impact analyses:
 - The area of jurisdiction for the sponsoring agency
 - The area of direct project influence
 - Any areas or subareas on which socioeconomic impacts are of special interest
 - The level of interest in or necessity of considering impacts on neighboring jurisdictions
- Time Period for Study
 - The time period to be analyzed should reflect the timing of capital outlays, the period of construction, and ample post-construction time for the impacts of the project to become fully manifested. In the case of significant changes to transportation networks, decades may be necessary for the impacts of a project to fully play out. In general, a greater degree of change to the transportation system will require a longer study period. Longer study periods are more likely to fully capture the impacts of a project.

Resource

More detail on the selection of a geographic area can be found in Weisbrod, Glen and Burton Weisbrod, *Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project*, Transportation Research Circular, Number 477, October 1997.

Impacts and Indicators

Indicators of economic development are the discretely measurable variables and criteria that provide the quantitative basis for an economic development analysis. For the user and societal categories, impacts and indicators are largely equivalent. In the economic realm, indicators are distinguished from classes of impacts in that primary, secondary, and tertiary impacts can all influence the same indicators. Impacts are assessed by means of indicators. Common indicators are discussed in Chapter 1 and summarized below.

- User Impacts
 - Travel time savings
 - Travel cost savings
 - Crash reduction
 - Standard deviation of travel time
- Economic Impacts
 - Regional output
 - Gross regional product or value added
 - Personal Income (wages)
 - Employment
 - Property Value
 - Tax Revenue
 - Business Sales Volume
 - Business Profit

- Public Expenditures
- Societal Impacts
 - Air pollutant emissions
 - Pollutant concentrations in runoff
 - Noise levels

In assessing economic impacts, it is important to avoid double counting of indicators. Double counting occurs when the changes in two indicators that represent the same economic shift are summed together.³¹

Simple Analysis Methods

Simple analysis methods can provide estimates of economic development impacts with relatively little time and expenditure. They are often best suited to the assessment of small ranges of impacts, or to relatively small projects. Simple methods can also provide information that feeds into more comprehensive modeling exercises. Simple methods include:

- Interviews and Surveys
- Case Study Comparisons
- Simple Quantitative Methods

Interviews and Surveys

Interviews and surveys are an important initial step in many economic evaluations. Interviews may be held with planners, business owners, real estate agents, developers, or other individuals with knowledge of local economic development issues. Interviews provide valuable first-hand predictions of the effects of transportation improvement projects. They are particularly useful for broadly assessing what impacts might be associated with a project. For example, conversations with real estate agents can help to understand likely impacts on the property market. Interviews with business owners might help assess how a highway improvement would affect shipping costs and market reach. Conversations with local planners can help to judge how an area's share of regional economic activity might change, and therefore how local employment might increase.

Surveys are another simple method of collecting information. Data from surveys, whether they are surveys of local businesses, suppliers, or customers, are often inputs into other assessment methods. Surveys can include the collection of origin and destination data on trucks or shoppers, or windshield surveys of the types of businesses and business conditions along a corridor. Although this information does not immediately determine the impacts of a proposed project, it can serve as an input into subsequent quantitative analyses.

Case Studies

Case studies can sometimes be used where other methods are difficult to apply, such as in small areas where economic data are not readily available. Case studies can also provide more vivid evidence of positive economic impacts than do data and projections. The basic case study approach is to find similar

³¹ For further instruction on avoiding double counting, see: Weisbrod, Glen and Burton Weisbrod, *Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project*, Transportation Research Circular, Number 477, October 1997, pp14-15.

completed projects in other areas and examine the benefits that they provided to their respective communities. This type of analysis can provide a picture of the magnitude of expected benefits of a transportation project. Case studies can potentially provide information on primary, secondary, and tertiary impacts.

Simple Quantitative Methods

In addition to these qualitative methods, economic development analyses can also use simple quantitative methods to assess economic impacts. The first of these involves the use of traffic forecasting data to estimate the likely direct impacts on users of the transportation system. Simple traffic engineering relationships can be applied to project changes in travel cost, time, and safety resulting from a specific transportation project. The latter two of these user impacts can then be monetized based on the value of time and the cost of traffic accidents. Further calculations can provide evaluations of primary impacts, or the results can be input to an economic model. Traffic forecasts can also provide estimates of the externalities associated with a project, such as air quality impacts.

User impacts can be used to perform simple benefit-cost analysis. There are a number of software tools to assist in applying benefit-cost analysis to transportation projects. One such tool is StratBENCOST, a program developed for the Transportation Research Board to evaluate highway project alternatives. Based on data on the existing transportation network and details of the proposed projects, StratBENCOST calculates benefits from time savings, vehicle operating cost reductions, accident-cost reductions, and emissions reductions. Benefits are calculated year by year in dollars, discounted to present value and summed. Other such tools include MicroBENCOST, STEAM, and NET BC.³²

Resource

For a description and evaluation of benefit-cost analysis tools, see *Guidance on Using Existing Economic Analysis Tools for Evaluating Transportation Investments*, Final Report, NCHRP 2-19(2), Prepared by Hagler Bailly Services, 1999.

Another type of simple quantitative tool is the market study. Market studies generally look at the balance of supply and demand for some type of business activity and then forecast how that balance might change in response to changes in transportation infrastructure. Market studies include assessments of the office market, the tourism market, the real estate market, markets for industrial growth and relocation, and retail markets. Market studies can predict primary, secondary, or tertiary impacts. For example, a real estate market study might look at the demand for and supply of office space in a certain area. It would then predict how rents and total occupied space might change as a result of the proposed project. From the projection of occupied space, an estimate of jobs that would be added to the local economy can be made. Thus it would assess secondary and tertiary impacts. A retail market study, on the other hand, might project likely changes in sales volume due to changes in customer flows caused by a transportation project. Thus it would assess primary impacts. The survey methods mentioned above often feed into market studies. Market studies, in turn, can provide inputs to more complicated economic models.

These simple methods, both quantitative and qualitative, provide a first line of project analysis. When time and resources are scarce, when projects are small or uncontroversial, or when regulatory requirements do not call for further analysis, these methods may suffice. Simple methods may also represent the first step in a more comprehensive analytical process. Economic models will ultimately provide a more complete picture of economic impacts than qualitative methods, market studies, and transportation forecast tools alone.

³² *Guidance on Using Existing Economic Analysis Tools for Evaluating Transportation Investments*, Final Report, NCHRP 2-19(2), Prepared by Hagler Bailly Services, 1999.

Input-Output Models

Input-Output (I-O) models are one type of economic model. Although I-O models are limited in their ability to forecast long term economic development impacts, they have been widely used in the past to analyze transportation projects and are still used because of their relative simplicity and ability to capture inter-industry economic linkages. In addition, I-O models form an important component of the more comprehensive dynamic economic models. An I-O model is typically not a good stand-alone assessment method for a transportation project, but it can be quite useful in conjunction with other methods.

I-O models are made up of tables that trace the linkages of inter-industry sales and purchases within a given area (county, region, state, or country). They provide a framework within which industrial linkages and feedback systems between consumers and producers can be simulated. An I-O model produces multipliers that can be applied to the estimate of primary impacts to estimate the total impact on the economy.³³ Purchases for final use, broken down by industry and by geographical area, comprise the inputs to I-O models. For example, the construction of a new road for \$40 million would be input to the model as \$40 million in the construction industry. The output of the model is typically a table showing the total secondary effects by industry that result from that \$40 million expenditure.

Implan is one commercially available I-O model.³⁴ *Implan* consists of a software package and a database containing all the information necessary to build a model. The software package assists the user in constructing a custom I-O model based on selected geographical areas. The user can also modify the trade data and inter-industry relationships in a variety of ways. Expenditures are input to the model either in terms of dollar value or in terms of employment. *Implan* can then produce a wide variety of economic reports. Other available I-O models include RIMS II and PC I-O.

Resource

More information on the use of I-O models for transportation analysis can be found in Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

The primary shortcoming of the I-O models is that they are static economic models. That is, they have no time component. The traditional application of an I-O model is to the economic activity generated by the construction of a project. An I-O model can predict what the total economic activity caused by capital outlays and employment in the construction phase will be, but it falls short of predicting the long term effects of the operation of the transportation facility. This shortcoming is due to the fact that stand-alone I-O models do not account for the effects of business expansion and attraction. Therefore, while I-O models can assess some of the secondary effects from a project, they cannot account for tertiary impacts.

Some applications have successfully modified I-O models in order to account for tertiary impacts. The Regional Economic Impact Model for Highway Systems (REIMHS) is one such application. This model translates capital investment and user impacts into increases in income flows. An I-O model then calculates from that income the additional output, wages, and jobs. Thus, the model aims to assess long term business growth. Modifications such as this one essentially move the assessment tool closer to a dynamic economic model.

³³ Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

³⁴ Commercial Input-Output models are identified for information purposes only and no endorsement should be implied.

Dynamic Economic Models

Dynamic economic models account for changes over time. Unlike stand-alone I-O models, which account only for the effects of construction and operation spending on the economy, dynamic models can also account for the effects of changes in travel conditions. This capability makes for a far more comprehensive economic impact analysis. A typical dynamic economic model forecasts the effects of future changes in business costs, prices, wages, taxes, productivity and other aspects of business competitiveness, as well as shifts in population, employment, and housing values.

The best-known example of a dynamic economic model is the REMI model.³⁵ REMI includes base case forecasts and information on inter-industry (I-O) purchasing relationships. In addition, it contains modules to forecast how alternative project or policy scenarios would change economic and demographic patterns including business output and employment, wages, prices, business productivity, cost of living, and interregional migration of businesses and households. REMI is customizable by geographical area and by industry breakdown. It produces forecasts for a “base case” and “project alternative” scenario for each year up to 2035.³⁶

TranSight is a REMI model developed specifically to analyze transportation projects. TranSight incorporates transportation-planning and travel-demand models, usually provided by local planners. Based on changes to the transportation network input by the user, TranSight calculates changes in vehicle miles traveled (VMT), vehicle hours traveled (VHT), emissions, safety, and fuel demand. Effects on businesses are then calculated based on transportation cost, access to labor, and access to commodities. TranSight’s outputs include employment and output by industry, wage rates and personal income, population by demographic group, and gross regional product.

Another dynamic model is the Regional Dynamics (ReDyn) model. ReDyn works on the same principles as REMI, but is organized differently and includes different components. Unlike REMI, ReDyn is a web-based, modular application. Users can build their own models based on an array of components. ReDyn also includes a more detailed regional breakdown than does REMI, with about 3,100 regions versus about 80.

Like REMI’s TranSight, TREDIS (the Transportation Economic Development Impact System) is a dynamic economic model that specifically focuses on transportation projects. It relies on ReDyn to provide economic content. Like ReDyn, TREDIS is a web-based, modular tool. The user inputs details about the project, from which TREDIS calculates primary, secondary, and tertiary impacts. The final outputs of TREDIS include employment by industry, personal income, gross regional product, business output, national and state benefits, and export activity. A further layer of analysis included in TREDIS is benefit-cost calculations.

Of the three categories of methods discussed, dynamic models are the most rigorous means by which to assess economic impacts. Because of their long-term year-by-year focus, their attention to supplier

Resource

More information on dynamic economic models can be found in Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

³⁵ Commercial dynamic economic models are identified for information purposes only and no endorsement should be implied.

³⁶ Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

networks, demand and supply factors, and detailed interregional interactions, dynamic models provide the most accurate picture available of real economic processes. Changes in regional competitiveness can be inferred from cross-region comparisons produced by the models.

The calculation of user impacts is not inherent in dynamic economic models. Generally, user impacts must be provided as inputs. However, models that incorporate transportation planning and travel demand forecasts, such as TranSight and TREDIS, will calculate user impacts of transportation projects as part of their processes.

Table 4.1 summarizes the various analysis methodologies and the degree to which they can assess user impacts and economic impacts.

Table 4.1: Comparison of Analysis Methods in Regard to Impact Types

Method	User Impacts	Economic Impacts		
		Primary Impacts	Secondary Impacts	Tertiary Impacts
Simple Methods				
Interviews	N/A	provides qualitative assessment of all economic impacts		
Surveys	N/A	as inputs to economic models, can help to assess any level of economic impact		
Market Studies	N/A	can partially assess any level of economic impact		
Transportation Forecasts	can calculate user impacts	N/A	N/A	N/A
I-O Models	can calculate user impacts if coupled with transportation model	provides partial information on primary and secondary impacts		cannot assess tertiary impacts
Dynamic Economic Models	can calculate user impacts if coupled with transportation model	provides most complete information on all economic impacts		

Plugging Outputs into a Quantitative Framework

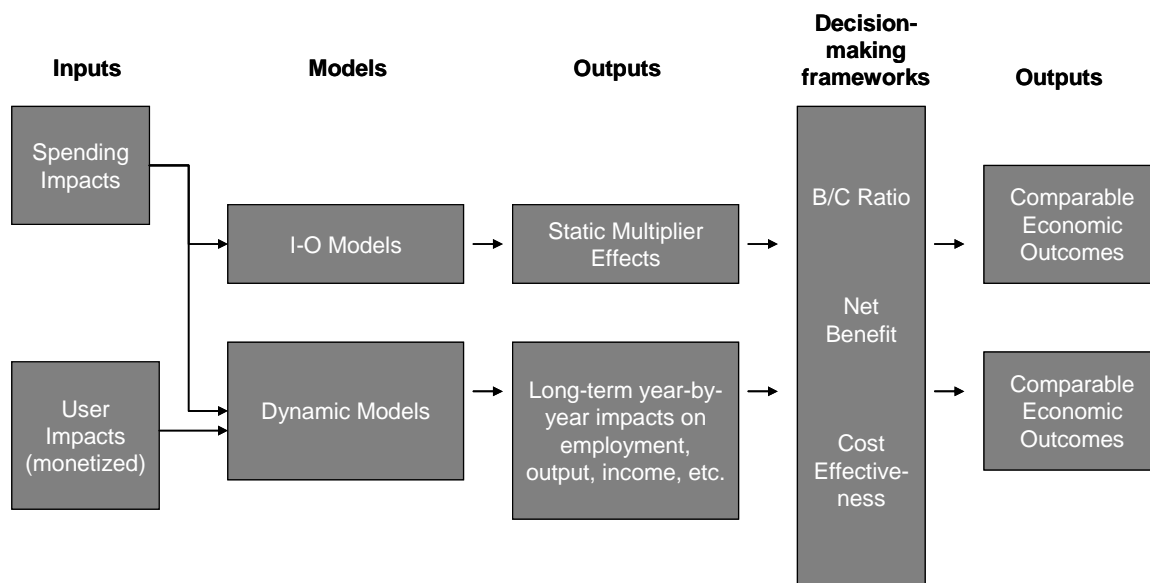
Once the impacts of a proposed transportation project have been assessed and quantified as much as possible, many agencies find it useful to apply one of several quantitative decision-making frameworks. As discussed in section 3.2 above, these frameworks include Benefit-Cost Analysis, Net Benefit, and Cost Effectiveness. These frameworks help to address a final challenge in the process of economic development evaluation. Even when we know how much a project costs and all the benefits that it would provide, how do we know if it is a good project? The function of these frameworks is to translate widely different project characteristics into readily understandable and comparable outcomes. In a benefit-cost or net benefit framework, a basic rule of thumb is to pursue only those projects that have benefits that exceed their costs. In a cost effectiveness comparison of two projects, the better project will be that which delivers the desired result for a lower cost. While these quantitative frameworks will not independently determine a project’s worth as an economic development tool, they can be useful in the decision-making process.

Summary of Evaluation Process

Figure 4.1 provides a summary of the evaluation of transportation project impacts in flowchart form. The figure summarizes a typical evaluative process as conducted with the use of an economic model. Initial inputs to the model are the user impacts and the spending impacts of construction. Depending on the input

data available and the depth of analysis desired, either an I-O model or a dynamic model is applied. These models produce different types of outputs, all of which can be input to quantitative decision-making frameworks. Projects can then be compared, provided that consistent modeling processes were employed for each.

Figure 4.1: Calculation of Project Impacts



3.4 Post-Project Evaluations

Economic development analysis can also include evaluations of existing transportation infrastructure and evaluations of projects after they are built. Generally analyses are undertaken at these stages either for the purpose of public education about the importance of transportation infrastructure or as an academic exercise to study the impacts of a specific project. Though some of the methodologies for pre-project evaluations also apply in these cases, the post-project evaluations differ in that most of the input data is empirical rather than projected. As a result, post-project evaluations can rely heavily on time series data.

In general, post-project (or “ex-post”) evaluations are not as common as pre-project evaluations. The reasons for this discrepancy are both regulatory and political. Post-project evaluations are rarely required by law. At the same time there is often little to be gained in the short term in determining the economic impacts of a project that is already in place. Nevertheless, post-project evaluations are extremely valuable in the long term because they provide empirical results to improve the process of pre-project evaluations.

Considerations

The necessary considerations in the design of a post-project evaluation mirror those for a pre-project consideration. The mode, scale, and type of the project are essential to understanding the impacts of the project. The stated purpose of the project will highlight the intended impacts, on which the analysis should largely focus. In addition, the spatial and temporal scope of the analysis should be established at the outset. These factors are particularly important in an ex-post study because if the time span or geographic area is too small, the analysis may find no significant economic impacts. The time span for the analysis should be that which will most effectively capture the changes in each economic indicator. The geographical scope should reflect the scale of the project and the extent to which distributional shifts between areas are an issue.

Framework and Methods for Post-Project Evaluations

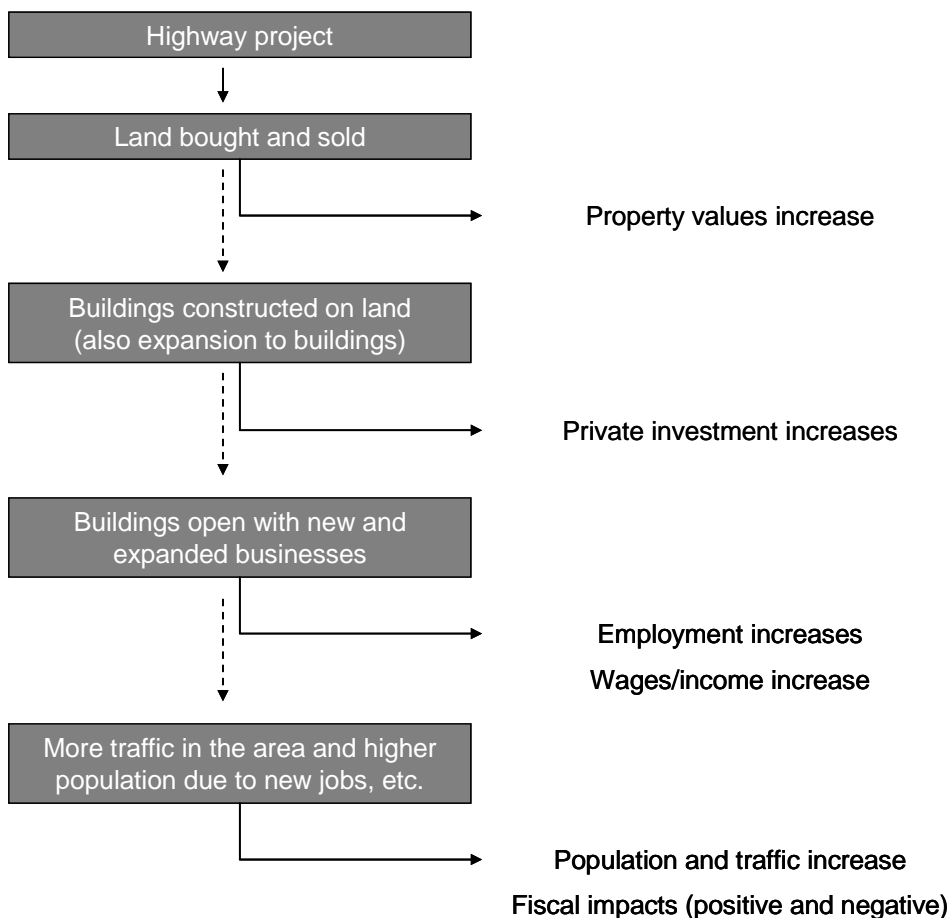
Post-project evaluations generally consider the following potential indicators of economic impacts:³⁷

- Jobs
- Wages and other income
- Number of businesses
- Business volume and sales (output)
- Population
- Capital investment (in buildings, equipment, and supporting infrastructure)
- Property values

These indicators provide a reasonable picture of economic changes and cover all major factors in the economic development chain. Although interactions between these different elements will vary from situation to situation, there is a basic temporal pattern of shifts among them. The analysis should consider which indicators are likely to be in flux in which time periods. In general, property values are a leading indicator of economic growth while output is a lagging indicator. Figure 4.2 below shows one possible time phasing for economic development impacts.

³⁷ *Using Empirical Information to Measure the Economic Impact of Highway Investments*, Volume 1: Review of Literature, Data Sources, and Agency Needs. Prepared by Economic Development Research Group, Inc. and Cambridge Systematics, Inc, Prepared for Federal Highway Administration, April 2001.

Figure 4.2: Example of Time Phasing for Economic Development Impacts



Source: *Using Empirical Information to Measure the Economic Impact of Highway Investments*. Volume 2: Guidelines for Data Collection and Analysis, Prepared by Economic Development Research Group and Cambridge Systematics, Prepared for Federal Highway Administration, April 2001.

The basic framework for conducting post-project evaluations includes three steps:³⁸

1. Measure gross change in economic growth
2. Isolate the net component of that change that is not due to existing trends
3. Determine causal relationship between the project and the net change

Depending on the analysis at hand, the three steps can be performed using a variety of methods. The post-project evaluation seeks to establish that a transportation project was directly responsible for an increase in local economic activity. Therefore, the first step in the process is to establish that the economy of an area grew during and after the construction of a transportation project. The measurement of gross economic change typically uses time series data from before, during, and after the construction of a

³⁸ *Using Empirical Information to Measure the Economic Impact of Highway Investments*, Volume 2: Guidelines for Data Collection and Analysis, Prepared by Economic Development Research Group and Cambridge Systematics, Prepared for Federal Highway Administration, April 2001.

project. The data collected should include information on the number of businesses, total employment, and wages. A simple historical analysis will reveal whether, how, and how much an economy grew.

Second, the analysis must separate the net component of economic growth from growth due to existing economic trends. This net component is the part of growth that was potentially caused by the project. Net growth can be determined by comparing gross change in the area of interest with gross change in surrounding or similar areas where no project was constructed. These comparison areas provide a rough control group with which to determine underlying economic trends. Alternatively, a regression analysis can work with data from many different areas to break out the component of economic growth associated with the transportation project. Finally, a dynamic economic model can be used to estimate how the local or regional economy would have performed in the absence of the transportation project. This result is then compared to the empirical results to isolate net change.

The final step in the post-project evaluation is to establish to what extent the project is responsible for net economic growth. The second step described above can determine that some additional economic growth was associated with the project, but it does not establish that the project caused that growth. Interviews with economic development experts or with business leaders can help to establish causation. These individuals should be able to speak to changes in economic performance from before to after the completion of a project and to offer opinions on whether and to what extent growth was caused by the project.

Wisconsin State Highway 29 Post Project Evaluation

Wisconsin State Highway 29 is a 182 mile stretch of highway running East-West through central Wisconsin. Work began in 1988 to convert the highway from 2 lanes to 4 lanes. The new highway was opened to traffic in 2000. Wisconsin DOT, in cooperation with the Federal Highway Administration and the Economic Development Research Group, undertook a post-project evaluation of the economic impacts of Highway 29. The study analyzed data on planned construction and development, population, income, business growth (particularly in manufacturing), tourism expenditures, property values, and traffic counts over a period of roughly 10 years during the construction of the project. Highway 10, a parallel route to the south of Highway 29, served as a no-project control. Interviews with local officials and business leaders shed further light on the local economic effects of the Highway 29 expansion.

The study found that the rate of growth was higher in the Highway 29 corridor versus the Highway 10 corridor in terms of tourism expenditure, per capita income, population, number of businesses, traffic counts, and property values. Information from interviews reinforced the hypothesis that economic growth along Highway 29 was linked to the higher level of service. The survey also projected total economic growth related to the project up to 2020. The study found that total growth was likely to be much higher than that predicted by the pre-project evaluation study conducted in 1989.

Source: *Economic and Land Use Impacts of Wisconsin State Trunk Highway 29*, Final Report, Wisconsin DOT, July 2004.

Evaluations of Economic Contribution

A subset of evaluations of existing transportation infrastructure seeks to demonstrate the economic importance of entire modes, facilities, or services. This type of study differs from an ex-post project evaluation in that there is generally no marginal change in transportation infrastructure for which discrete pre- and post-project time periods can be established. Instead, these studies seek to determine how much of current economic output is

Resource

More information on evaluations of economic contribution can be found in: Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

dependent upon the mode, facility, or service of interest. Such studies are generally conducted for the purpose of academic research or public education.

In the absence of applicable time series data, the methodology for evaluations of economic contribution is closer to that for pre-project evaluations. A first step is generally to assess the spending impacts associated with the infrastructure of interest, in terms of employment, passenger activity, and freight flow, either through interviews or data collection. Direct impacts on users in terms of cost, congestion, and safety may also be estimated. These results are then input to either an I-O model or a dynamic economic model. It is important to note that the result of such a study does not represent economic output wholly generated by the infrastructure at hand, but rather the volume of output that flows through or is some way dependent on the infrastructure.

REFERENCES

- Aldrich, Lorna and Lorin Kusmin, "Rural Economic Development: What Makes Rural Communities Grow?" *Agriculture Information Bulletin*. U.S. Department of Agriculture, Economic Research Service, Bulletin No. 737, September 1997.
- Appalachia*, "Appalachian Highways are Catalysts of Change," Vol. 15, Nos 2/3, pp.8-17, 1982.
- "Appalachian Development Highways Economic Impact Studies," Wilbur Smith Associates, Prepared for the Appalachian Regional Commission, 1998.
- Economic Analysis Primer*, US Department of Transportation, Federal Highway Administration, Washington DC, August 2003.
- "Economic Benefits of Transportation Investment," Working Paper 1, Prepared for NCHRP Project 8-36 Task 22, Demonstrating Positive Benefits of Transportation Investment, Cambridge Systematics, January 2002.
- Economic Effects of Transportation: The Freight Story*, Prepared for the Federal Highway Administration, Prepared by ICF Consulting and HLB Decision Economics, 2002.
- Economic and Land Use Impacts of Wisconsin State Trunk Highway 29*, Final Report, Wisconsin DOT, July 2004.
- Forkenbrock, David J and Norman S. J. Foster, "Highways and Business Location Decisions," *Economic Development Quarterly*. Vol 10, No 3, 1996.
- Forkenbrock, David J, Thomas Pogue, David Finnegan, and Norman Foster, "Transportation Investment to Promote Economic Development" in *Infrastructure Investment and Economic Development: Rural Strategies for the 1990s*. December 1990.
- Guidance on Using Existing Economic Analysis Tools for Evaluating Transportation Investments*, Final Report, NCHRP 2-19(2), Prepared by Hagler Bailly Services, 1999.
- Harris, Curtis C., "New Developments and Extensions of the Multiregional, Multi-Industry Forecasting Model," *Journal of the Regional Science*, Vol. 20, No. 2, pp 159-71, 1980.
- HERS-ST V2.0, Technical Report*, v 3.54, Federal Highway Administration, 2002.
- Kawamura, Kazuya, "Commercial vehicle value of time and perceived benefit of congestion pricing." Doctoral dissertation, University of California at Berkeley, 1999.
- Montana Highway Reconfiguration Study*, Cambridge Systematics, Inc., Prepared for the Montana Department of Transportation, May 2005.
- Ohio DOT, *Northern Ohio Freight Strategy: Recommendations to Improve Traffic Safety and Congestion*, October 11, 2004.

Rephann, Terance J., and Andrew M. Isserman, "New Highways as Economic Development Tools: An Evaluation Using Quasi-Experimental Matching Methods," *Regional Science and Urban Economics*, Vol. 24, No. 6, 1994.

Smalkowski, Brian, Value of Time for Commercial Vehicle Operators in Minnesota, University of Minnesota, 2003.

Using Empirical Information to Measure the Economic Impact of Highway Investments, Volume 1: Review of Literature, Data Sources, and Agency Needs. Prepared by Economic Development Research Group, Inc. and Cambridge Systematics, Inc, Prepared for Federal Highway Administration, April 2001.

Using Empirical Information to Measure the Economic Impact of Highway Investments, Volume 2: Guidelines for Data Collection and Analysis, Prepared by Economic Development Research Group and Cambridge Systematics, Prepared for Federal Highway Administration, April 2001.

Weisbrod, Glen, *NCHRP Synthesis Report 290: Current Practices for Assessing Economic Development Impacts from Transportation Investments*, Transportation Research Board, 2000.

Weisbrod, Glen and Burton Weisbrod, *Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project*, Transportation Research Circular, Number 477, October 1997.

Weisbrod, Glen and Manisha Gupta, *Study of the National Scope and Potential for Improvement of State Economic Development Highway Programs: Overview of State Economic Development Highway Programs* (Task A-B Report), Prepared for the Federal Highway Administration, March 2005.