NCHRP
SYNTHESIS 290

NATIONAL
COOPERATIVE
HIGHWAY
RESEARCH
PROGRAM

Current Practices for Assessing Economic Development Impacts from Transportation Investments

A Synthesis of Highway Practice

TRANSPORTATION RESEARCH BOARD

NATIONAL RESEARCH COUNCIL

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Current Practices for Assessing Economic Development Impacts from Transportation Investments

A Synthesis of Highway Practice

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SUBJECT AREAS
Planning and Administration

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communication and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

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The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis report will be of interest to department of transportation administrators, supervisors, and staff, as well as to the consultants that work with them in assessing the economic development impacts of existing or proposed transportation investments. Metropolitan Planning Organization regional and local agency staffs might also find it informative. It is intended to help practicing planners become aware of the range of methods available. This synthesis summarizes the current state of the practice through a survey of transportation planning agencies in the United States, Canada, and the United Kingdom. This report provides reviews of the analysis methods used in recent project and program evaluation reports of these agencies. An important aspect is that the discussion of methods is organized in terms of the different categories of agency needs.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

This report of the Transportation Research Board includes an Appendix listing 20 available reports that either (1) review the economic theory and academic literature or

(2) provide user guidance of how to correctly select and apply available research tools. This is in addition to 191 references cited and a multimodal listing of economic development impact studies arranged by study area.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the available information was assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the author's research in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

CURRENT PRACTICES FOR ASSESSING ECONOMIC DEVELOPMENT IMPACTS FROM TRANSPORTATION INVESTMENTS

SUMMARY

Economic development is increasingly recognized as a factor to be considered in transportation planning and transportation investment decision making. In the last decade, there has been an increase in the number of agencies analyzing (or attempting to analyze) the economic development impacts of their investments. A variety of new national and state transportation policies (including the Transportation Equity Act for the 21st Century program in the United States) have also been initiated in recent years, which explicitly recognize economic development as a priority issue.

It thus becomes increasingly important for transportation planning issues to use the most practical and appropriate practices available for evaluation of these issues. The purpose of this synthesis report, then, is to summarize the current state of analysis methods and their use (in actual practice by transportation planning agencies) for assessing the economic development impacts of transportation investments.

In the production of this report, the relevant literature on economic development impact analysis studies was reviewed and also discussed with a review panel of national experts from both academia and practitioner organizations. In addition, a survey questionnaire was distributed to transportation departments representing all 50 states and all Canadian provinces. Selected transportation planning departments in metropolitan planning organizations and other countries were also invited to participate. These planners were asked about current research and practice, and also asked to provide all relevant impact evaluation and measurement reports pertaining to this topic. Detailed responses came from 52 transport planning departments representing 36 states, 7 Canadian provinces, 8 metropolitan planning organizations, and the United Kingdom. Specific conclusions reached from the survey and literature review include the following:

The definition and measurement of economic development impacts can be confusing. The definition of "economic development impacts" is not always clear or consistent. There are many different ways to view and measure such impacts. These include measures of changes in business sales, gross regional product (value added), personal income generated, and associated employment (jobs) within a given study area. Other representations of impacts, such as productivity ratios, are constructed on the basis of those same business or income measures.

Agencies become involved in issues of economic development impact in several different ways. Transportation agencies become involved with issues of economic development through the following:

- *General Investment Programs*—Some agencies explicitly recognize economic development as a factor driving their primary transportation investment programs and forecast economic development impacts of proposed investment to assist them in planning, selection, and funding of projects.
- *Special Economic Development Programs*—Many state agencies offer special transportation investment grant or loan programs aimed specifically at enhancing local economic development.
- *Regulatory Involvement*—Most agencies have examined potential economic development impacts of proposed transportation projects at least superficially (and occasionally at a detailed level) as a required part of the broader environmental impact assessment process.
- *Evaluation or Education*—Some agencies have assessed the economic roles played by existing transportation systems to educate the public about their importance. Relatively few agencies have actually gone back to measure the economic development impacts of their past corridor investments.

There are four basic types of impact studies, each with different motivations and methods. The key approaches and techniques used to assess economic development impacts are:

- *Studies to assess proposed investments* typically are conducted to assist in decision making among alternatives. They estimate the extent to which proposed transportation projects are likely to lead to positive economic development benefits for the regions in which they are located. A range of methods, from market studies to comprehensive economic simulation models, is used to forecast expected project impacts relative to base case forecasts. These impact forecasts could be improved if more information from post-project evaluation was available to provide a stronger basis for them.
- *Studies for planning and regulatory review* typically are conducted in conjunction with a legally mandated environmental review process. Frequently, only a brief summary is made of land takings or impacts on the use of abutting property. For some regionally important or controversial projects, though, sophisticated models are sometimes used. The analysis methods used for these studies parallel those used to assess impacts of proposed investments, although the reporting of the results may differ depending on the nature of public concerns.
- *Studies for public education* are generally conducted to increase public understanding of the interrelationship of existing transportation facilities to the economy of the area they serve. These studies rely primarily on surveys or observations to document direct activity, and input–output models to estimate overall economic effects.
- *Studies for post-project evaluation* measure the actual impacts of transportation facilities or investments after they are finished and in use. These evaluations generally rely on times-series data to measure economic conditions in a study area before a transportation investment is made and after the same transportation investment has been in place for several years. Their findings can be quite useful for improving future investment decisions. However, relatively few studies have been done on such a rigorous basis.

Most agencies assess economic development impacts only when warranted, and use them as a complement rather than a substitute for user benefit studies. Key factors regarding the conduct of economic development impact studies by transportation agencies are:

- *Relationship to Traditional Measures of User Benefit*—Economic development impact analysis is essentially never seen as a substitute for the evaluation of transportation system efficiency (user benefits). Rather, it is used as a complementary form of analysis that provides insight into some nonuser impacts.
- *Motivations for Conducting Economic Impact Studies*—The most common motivation for studying economic development impacts is as a response to local concerns about adverse impacts of proposed projects or as a factor in project ranking or selection. Their uses for public relations purposes or to fulfill environmental impact requirements are less common.
- *Frequency of Applications*—Most agencies have assessed economic development impacts of some past transportation projects. Most agencies currently assess economic development impacts only for large infrastructure projects in which the economic stakes (potential benefits and costs) are relatively high. Few have a formal policy including economic development impact analysis as a regular component of their project evaluation procedures.
- *Use of Agency Staff*—Most transportation planning agencies regularly contract out some of their studies of economic development impacts. This demonstrates that not all state departments of transportation have in-house economists or other staff knowledgeable about economic development impact assessment techniques.
- *Impact Measures*—The ways in which economic development impacts are being measured differs depending on the use to be made of the results—either for communicating to the public or for agency decision making. The single most popular impact measure is employment (jobs), although personal income, tourism, property development/property values, and economic output are also popular.

There is room for improvement. Agencies responding to the questionnaire indicated the following broad views:

- *Problems Using Results*—There is widespread concern about the lack of consistency in methods used to analyze economic development impacts. Sometimes the results of studies have not been universally accepted because the studies gave insufficient attention to unique local political, regulatory, and social or economic factors that can also affect the nature of economic development opportunities.
- *Remaining Needs*—Agencies reported a widespread desire for further research to better validate the link between individual transportation projects and subsequent impacts on local or regional economic development. They also reported a desire for more complete and understandable analysis tools, better staff training, more readily available data, and more consistency in methods for evaluating and measuring economic development impacts of individual transportation projects.

CHAPTER ONE

INTRODUCTION

BACKGROUND

There is a clear relationship between transportation and commerce. The delivery of business goods and services, worker access to jobs, and household access to stores and consumer services all depend on transportation facilities. As a result, decisions about investment in transportation facilities can affect the level, mix, and location pattern of economic activity, which is also the focus of economic development agencies. Because of this relationship, many transportation agencies see some value in assessing the economic development impacts of their programs and projects, as well as potentially justifying some projects on the basis of economic development objectives.

Recognition of the economic development impacts of transportation investments is not new. From ancient Roman roads across Europe to railroads across the United States, transportation investments have long had a role in economic expansion. Empirical research on the economic development impacts of transportation investments has been studied by economic historians for many decades (*1*). The active involvement of transportation agencies in forecasting regional economic development impacts of proposed new projects, however, is a more recent phenomenon. The development of regional economic analysis techniques in the 1960s and 1970s, and subsequent commercial availability of microcomputer tools for regional impact analysis in the 1980s, made it easier for transportation agencies (and their consultants) to conduct regional-level economic impact studies. Given the increase in economic development impact studies in the 1990s, this is an opportune time for a synthesis of transportation agency practice on the topic.

OBJECTIVE

This report is intended to help practicing planners in local, regional, and state agencies become aware of the range of methods available for assessing the economic development impacts of existing or proposed transportation investments. This synthesis report summarizes the current state of the practice by means of a survey of transportation planning agencies and a review of the analysis methods used in recent project and program evaluation reports of those agencies.

For any agency involved in transportation planning this report will provide insight into:

- *Methods*—What types of impact measures and assessment techniques are commonly used to address these issues? Which ones do agencies find most applicable for specific types of issues, needs, or situations? How commonly accepted are they?

- *Practice*—What are others doing to address these issues? In what situations are they conducting studies of economic development impacts? How are they using that information?

An important aspect of this report is that its discussion of methods is organized in terms of the different categories of agency needs.

Because this report focuses on application studies for planning agencies, it does *not* provide a comprehensive review of academic research on the behavioral relationship of transportation and economic activity (although some of that literature is very briefly noted). Similarly, although this report provides insight into the measurement options available to meet the various needs of transportation planning agencies, it is *not* intended to be an instructional guide on how to actually collect and analyze data to conduct such studies. Readers are encouraged to consult the *Bibliography on Economic Impact Literature Reviews and Guides* for a list of other documents that provide broader reviews of the academic research and more detailed guides on how to implement such studies.

INFORMATION COLLECTION

To compile this report, the relevant research literature on the topic was reviewed. In addition, a survey was distributed to transportation departments representing all 50 states and all Canadian provinces. Transport planning departments in metropolitan planning organizations (MPOs) and other countries were also invited to participate. These agencies were queried about current research and practice, and they were also asked to provide all relevant impact evaluation and measurement reports pertaining to this topic. The resulting information provided a comprehensive view of existing research and analysis experience, as well as insight into the problems, challenges, and needs for improvement in this area.

A total of 75 detailed responses were submitted by 52 transportation planning departments representing 36 states,

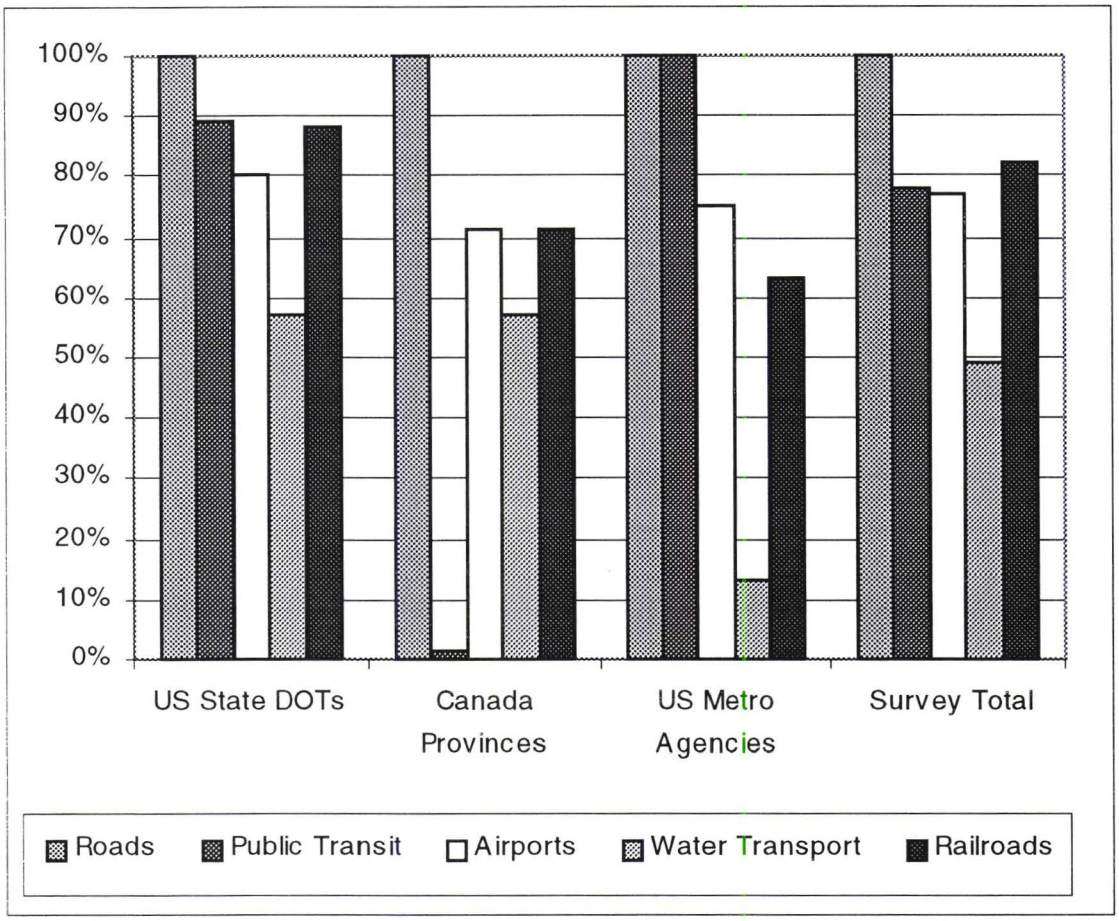

FIGURE 1 Modal responsibilities of responding transportation planning agencies.

7 Canadian provinces, 8 MPOs, and the United Kingdom. Some information from The Netherlands, France, Finland, and Australia was also received. A profile of the responding agencies is provided in Figure 1; it shows that all of the responding agencies are responsible for highway/road planning, whereas a majority are also responsible for public transit, rail, and air transportation planning, and approximately one-half also covered water transportation. This study attempted to assess the state of the practice for measuring economic development impacts for each of these modes. (A more detailed listing of survey respondents is also provided in Appendix B.)

CONTENT

The remainder of this report is organized into three sections:

- *Basic Concepts*—Chapter 2 defines the facets of economic development and the alternative measures of economic development impact, and how they relate to transportation investments (policies or projects).
- *Current State of Analysis Methods*—Chapter 3 summarizes the available measurement methods and analysis techniques, organized in terms of the available approaches, to address different types of planning, policy, or research needs.
- *Current State of Agency Practice*—Chapter 4 summarizes the experience of planning organizations in assessing economic development impacts of transportation projects in terms of when it is being done, how it is being done, and how it can be improved.

Throughout this report, the emphasis is on describing overall findings on the status of research and practice as used by transport planning agencies. Aggregate results are presented for all types of transportation planning agencies. When there are significant differences in practice among states, Canadian provinces, MPOs, or European agencies, they are noted.

CHAPTER TWO

CONCEPTS

This chapter provides a perspective for understanding the ways in which transportation agencies can view economic development impacts. Based on a review of applicable literature, it defines "economic development impacts," discusses how their measurement differs from other types of economic analysis, and explains the different viewpoints for assessing the relationship of transportation and economic development. Readers familiar with these concepts can skip to the subsequent chapters for the findings on the state of research and the state of the practice.

WHAT IS ECONOMIC DEVELOPMENT?

The term "economic development" is often not well understood. In an effort to clarify the meaning of this term, the Council for Urban Economic Development published, in 1997, *What is Economic Development?* (*2*). It acknowledges the complexity of concepts encompassed by the term economic development and does not provide any simple definition. However, it does explain that although economic development is a broad field with different meanings for different people, in general, economic developers work to enhance an area's level of economic activity when it is desirable to provide more jobs, wealth, tax base, and quality of life on a continuing rather than temporary basis. The area in question may be a neighborhood, a city, a region, or an entire nation.

Motivations for desiring economic growth in an area may include:

1. income—to improve the economic well-being of residents by increasing employment and raising personal income levels;
2. job choices—to improve opportunities for job satisfaction and upward occupational mobility by expanding the types of available jobs;
3. activity choices—to improve the quality of life by expanding local opportunities for shopping, social, and entertainment activities in an area; and
4. stability—to improve the stability of jobs and income in an area through diversification to reduce reliance on declining industries and those subject to significant business cycle fluctuations.

Economic development agencies typically seek to increase economic activity by increasing their area's business expansion, retention, new startups, and/or attraction. To accomplish this, they generally work to encourage projects or programs that will: (1) reduce business operating costs and increase business productivity; (2) expand the size of business markets; (3) increase business access to needed labor, supplies, services, and materials; and (4) promote the advantages of their areas. Accordingly, a wide range of books on the economic development process have noted that adequate transportation is seen as one of several site location requirements and key factors (also including utilities, work-force skills, and taxes) that affect an area's business costs, markets, and overall competitiveness for attracting business investment (*3–6*).

WHAT IS AN ECONOMIC DEVELOPMENT IMPACT?

There is a critical (but sometimes missed) distinction between the study of economic development impacts and the broader economic analysis of a project or program.

- *Economic development impacts* relate specifically to development of the economy of an area and the flow of dollars (or number of jobs) in that economy.

- *Economic analysis*, in contrast, can encompass any elements of benefit and cost to society (or subsets of society). It can include the impacts on transportation system users, on the environment, and on the quality of life, as well as economic development or business-related impacts.

The following are working definitions of key terms used in economic analysis and explanations of how economic development impacts relate to the broader issues of economic analysis:

- *Social (or societal) impacts* encompass all types of benefits and costs that have a value to society, including all of the types of impacts identified below.

- *Transportation system user impacts* are impacts on the value of travel time, expense, and safety for travelers. They include both monetary impacts (such as travel expense and business costs of delay) and nonmonetary impacts (such as the value of time delay for personal travel).

- *Economic development impacts* are impacts on the level of economic activity in a given area. They include changes in jobs, wages, and business output resulting from monetary effects of transportation on income and costs for households and businesses. When there is a study of the "economic impact" of a project or program on a specific area, this normally refers to those same economic development impacts.

- *Environmental and other external impacts* include impacts on air pollution, noise, visual blight, and other quality-of-life factors. These are often considered to be intangible or nonmonetary impacts, although they can be valued in monetary terms.

In its classic textbook form, benefit/cost analysis provides an assessment of the "social" efficiency of projects, programs, or other decisions by comparing benefits and all costs accruing to any or all elements of society (*7*). In the transportation field, the most common form of benefit/cost analysis is known as transportation system efficiency (or user benefit) analysis, which measures the monetary value of travel time, safety, and travel cost savings for users and compares it with the monetary value of the resources used by the project or program (*8–10*). Sometimes, the benefit/cost analysis is broadened to also include the value of other benefits to society beyond those accruing to users. Such benefits can include environmental and quality-of-life factors (e.g., air quality, water quality, noise, and visual blight) (*11,12*). It can also include economic development impacts, to the extent that they are not already covered by other measures of user and nonuser benefits. (For example, this could include the additional value of business productivity benefits related to logistic and production cost savings, which is over and above the value of changes in user time and vehicle operating cost.)

Impacts that do not directly represent changes in the flow of money in the economy (e.g., time savings for personal travel) can still be valued in benefit/cost studies by statistically inferring the "willingness to pay" for changes in them, through either "revealed preferences" (observed patterns of property values or travel decisions) or "stated preferences" (trade-off choices made in survey responses to hypothetical situations) (*13,14*). In most cases, these types of impacts are *not* covered in economic development impact studies.

HOW ARE ECONOMIC DEVELOPMENT IMPACTS MEASURED?

There are many different ways of viewing and measuring the economic development impacts of transportation projects and programs. These measures are summarized here.

Alternatives for Measuring Economic Development Impacts

Standard Measures of Economic Growth

Although economic development has many motivations, economic development success is usually measured in terms of the impact of a project or program on the growth of an area's economy. Principally, it is measured in terms of change in (1) output, (2) gross regional product (GRP), (3) personal income, and (4) employment. The following are working definitions of these measures of economic growth, along with explanations of their interrelationships and comments regarding their popularity (drawn from the findings cited in chapter 3) (*15–17*).

- *Regional output* is the value of all *business sales* of goods and services that take place in an area, regardless of whether they are final products or interindustry sales of intermediate products (sold as inputs to production processes). It is the measure of economic impact that business people most easily understand.

- *GRP* or *value added* represents the value of goods and services produced in the region that are not purchased for further processing or resale within that region. Value added is calculated as output minus the cost of purchasing intermediate products. It is the measure that economists find most useful for representing changes in regional economic activity.

- *Wages* are the financial rewards paid to workers for the use of their services, and they are also the primary component of *personal income*. (The other sources of personal income are self-employment and investment income.) In general, wages represent a portion of business output and value added. Wage income is a popular measure of the regional benefit of a project or program, because the public understands that this money clearly flows to local residents.

- *Employment* is the number of *jobs* associated with the business activity. It is supported by the wages paid to workers. This is the measure of economic impact most popular with the public, because it is most readily understood. It is also the most easily obtained measure of impact; many state economic development grant programs make their public investments or grants contingent on business guarantees of a given number of new jobs to be created.

Other Related Indicators

There are many other indicators that focus on particular aspects of economic development impact, rather than

overall expansion of an area's economy. These include measures of (1) productivity, (2) investment, (3) property values, and (4) taxes. The following are working definitions of these additional indicators of economic development, along with explanations of how they overlap and relate to the preceding economic growth measures.

- *Productivity* measures the efficiency of production and is generally expressed as a ratio of output or GRP to the cost of some input (labor or capital) involved in its production. Increases in productivity are desirable because they indicate that inputs are being used more efficiently to generate output. Regional economic growth may occur either because of greater productivity (from existing resources) or shifts in the location of resources (*18*).

- *Capital investment* is measured as the amount of money being spent in an area for improvements to land, construction of buildings, and purchases of equipment. When an area becomes more productive or profitable for business activity the result is often an increase in investment associated with new start-up businesses, relocation of outside businesses to the area, and expansion of new or existing businesses. The most frequent measures are either total investment being made in an area or construction spending occurring in an area. Capital investment in new equipment can enhance existing business activity by improving productivity, whereas capital investment in land and buildings (as well as equipment) can also be viewed as an indicator of ongoing business expansion.

- *Property value appreciation* reflects a growth in demand for real property (land and buildings) as a result of rising population, personal income, and business activity. Greater productivity and increased business output are key factors that increase personal income and business investment, and hence drive up property values. Property value is thus both an indicator of business investment and growth and also a potential source of wealth for property owners.

- *Tax revenue and public expenditure changes* are sometimes also estimated in economic development impact studies. However, government revenues and government expenditures are actually measures of "fiscal impact" rather than changes in the economy of an area. They show how government operations are affected by population and business growth. For example, changes in business sales, personal income, and property values can affect sales tax, income tax, and property tax revenues. Similarly, changes in population and business activity can directly affect the level (and costs) of required water, sewer, police, and fire services. Although impacts on government can be important to understand, they are not a basic measure of the economic development impact of a transportation project or program.

Proxy Measures and Leading Indicators

The measures of project impacts on employment and income growth can be thought of as very rough indicators of general progress toward the more fundamental goals of increased opportunities for better jobs, wider choices and affordability for shopping and personal activities, and a higher quality of life for residents of a target area. Because those factors are hard to measure directly, the impacts on employment and income growth can also be thought of as "proxy measures" for those broader goals.

Some of the other related indicators, such as investment and property values, can be thought of as "leading indicators" of currently emerging improvements in quality of life and economic opportunity, which may or may not yet be reflected in employment or income changes. For example, increased investment in an area can indicate that it has become a more attractive place to live and/or locate businesses. Increased property values are also an indicator of increased demand for locations in an area, although higher property values do not provide residents with any additional income unless they rent or sell their property.

Ideally, there should also be ways of more directly measuring how well economic growth in a given area helps address public desires for better paying jobs, more stable jobs, more occupational opportunities, and better quality of life. Economic development analysts recognize the need for such impact measures, although practitioners currently do not have access to either consistent definitions or commonly available data sources for assessing them. As a result, direct indicators of those factors are essentially absent from the current practice of assessing economic development impacts of transportation projects and programs.

Measurement Issues

Direct, Indirect, and Induced (Multiplier) Impacts

All of the above-referenced impact measures can reflect the sum of direct effects on business growth (for businesses directly affected by changes in operating costs and markets), indirect effects on business growth (for suppliers to the directly affected businesses), induced effects on economic growth (for businesses affected by the respending of additional worker income), and dynamic or additional induced effects on economic growth (from shifts in population, work force, labor costs, and prices). The sum of all

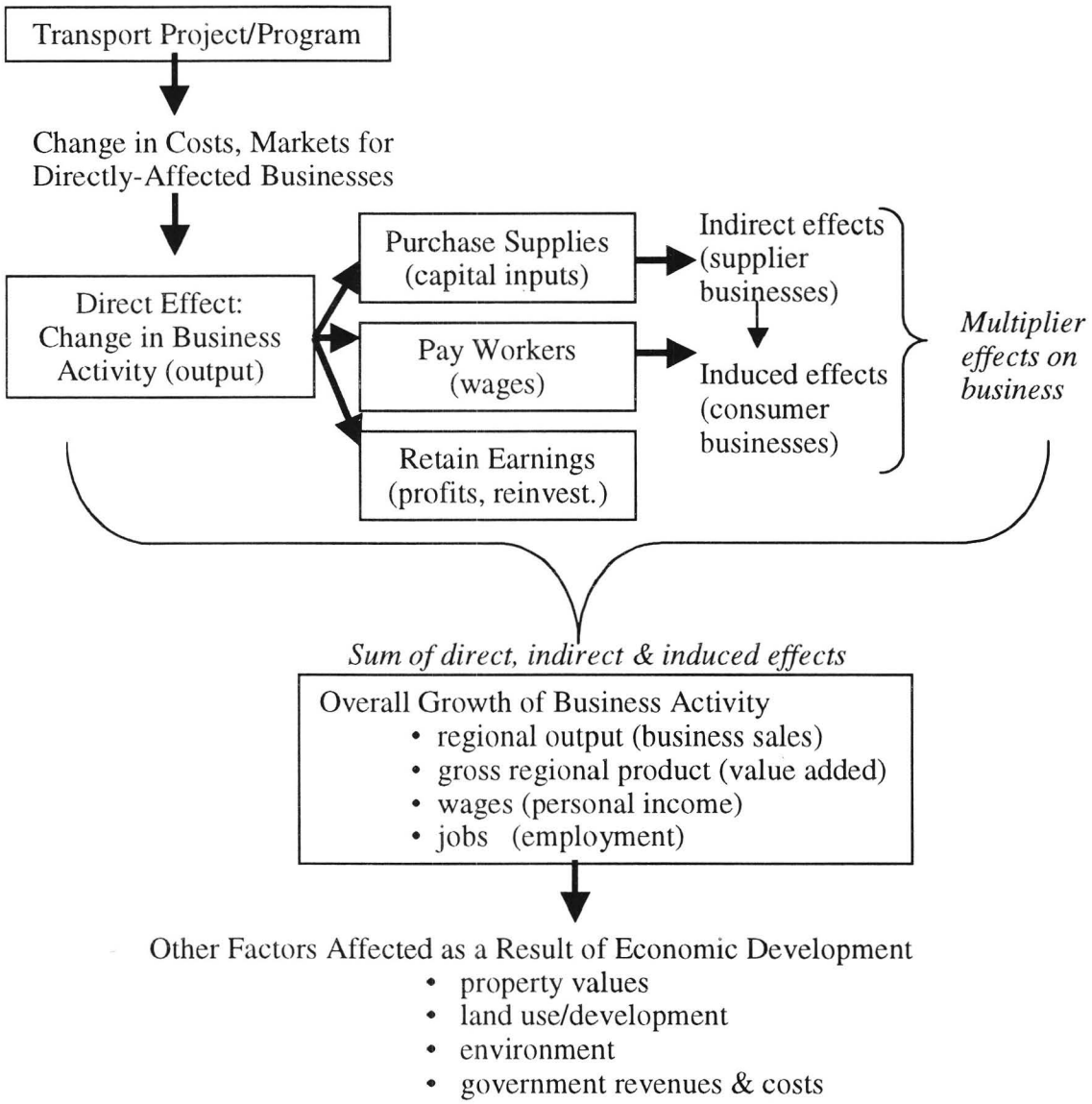

FIGURE 2 Types of economic development impacts.

effects represents the total effect on economic growth. The ratio of the [total effect/direct effect] is commonly referred to as an "economic multiplier," and the various nondirect effects are sometimes grouped together and referred to as "multiplier effects" (*19,20*).

The terminology used to refer to multiplier effects sometimes differs from that cited here. For instance, some studies use "indirect effects" to refer to all nondirect (multiplier) effects. In addition, many airport impact studies follow the recommendation of a Federal Aviation Administration (FAA) guide and use the term "indirect effects" to refer to spending by air travelers within their destination communities, whereas "induced effects" refers to all multiplier effects (*21*).

Some studies focus just on direct effects because they either implicitly or explicitly assume that there will not be any further (multiplier) effect on the area's economic activity. That can be a reasonable assumption in situations where: (1) the study area is a small area (e.g., a neighborhood) and most multiplier effects are likely to be negligible or occur outside of that area, or (2) the study area is a large area with a relatively fixed work force (e.g., a nation) and high employment, so that any multiplier effects are likely to merely shift resources from existing economic activities and thus cause little or no further change in total economic growth. Thus, the estimation of multiplier effects is most relevant when the study area is a region with idle or underutilized workers and resources, or a region with a potential ability to attract more workers or resources.

Overlap and Double Counting

It is important to note that all of the above-referenced measures of economic development impact are interrelated and basically represent different ways to view aspects of the same economic growth. For that reason, the different impact measures, such as business output, wages, investment, and property values, cannot be added together without double counting. Figure 2 illustrates the functional interrelationships of these different impact measures. Although there are many alternative measures of economic development impact, transportation planning agencies do not have to examine all of them; instead, they may focus on one or more of the alternative measures of economic development as appropriate for their needs. (The frequency of use of these different measures is discussed elsewhere in this chapter.)

Study Area Issues

One important aspect of measuring economic development impacts is that the total impacts differ depending on the geographic scale being examined. The larger the area, the more likely that location movements of businesses will be seen as "internal redistributions" of activity within the area rather than as "new" activity.

From the viewpoint of local-level economic development, an increase in desired business activity is a benefit regardless of whether it is a locally generated change (expansion or new start-up) or a redistribution of business activity from elsewhere. Indeed, many national policies seek to encourage business investment and business relocation into economically depressed areas to improve the distribution of income across regions. In the United States, this includes programs of the Department of Housing and Urban Development, the Economic Development Administration, and the Appalachian Regional Commission (ARC), as well as state enterprise zones. Accordingly, evaluations of those federal programs count business attraction to the depressed target areas as an element of program success (*22–25*). This view is also reflected in studies by transportation agencies of local and regional economic impacts (see chapter 3).

From the viewpoint of national-level economic development, internal redistributions of activity may have little or no impact on the national total of economic activity. This explains why national level studies on the economic effects of national transportation spending (sponsored by the federal government and national transportation organizations) have focused largely on the national productivity impacts of transportation investment (*26,27*). In practice, the distinction between locally generated and redistribution impacts of transportation improvements is not always distinct, because (1) businesses generally do not move unless there is at least some perceived productivity or profitability benefit derived from moving, and (2) even locally generated growth may reflect investment that would otherwise occur elsewhere.

ALTERNATIVE MEASURES OF ECONOMIC IMPACT

Use of Different Impact Measures

Figure 3 shows the alternative types of impact measures covered under either economic development impacts or other types of economic analysis (including benefit/cost analysis). The figure also shows findings from this report's survey of transportation planning agencies concerning the extent to which each indicator has been used in the past. Although this does not necessarily allow us to judge the level of agency interest in assessing economic development impacts, nevertheless, the systematic differences in the use of the various measures are notable. In particular:

- The measures of transportation system efficiency (user benefits), including travel time, travel expense, and safety, are the most common economic measures of project benefits;
- A slightly smaller portion of the respondents reported having assessed economic development impacts in terms of employment changes; and
- Far fewer regions have assessed the economic development impacts in terms of changes in income, business output, value added, productivity, tourism, or property values.

Responses also differed by type of agency. The Canadian provinces and the United Kingdom had the highest rates of using all of these impact measures, the responding states followed, and the MPOs had the lowest rates. Specific differences were as follows:

- All responding Canadian provinces and the United Kingdom, plus 35 of the 36 responding states and 4 of 8 responding MPOs, indicated that they have assessed transportation system efficiency (user) benefits of projects in terms of the value of either time or safety.
- All responding Canadian provinces and the United Kingdom, as well as 27 of the 36 responding states, and 3 of the 8 MPOs, indicated that they have also assessed economic development impacts in terms of jobs.
- Further details of the state of the practice are provided in chapter 4.

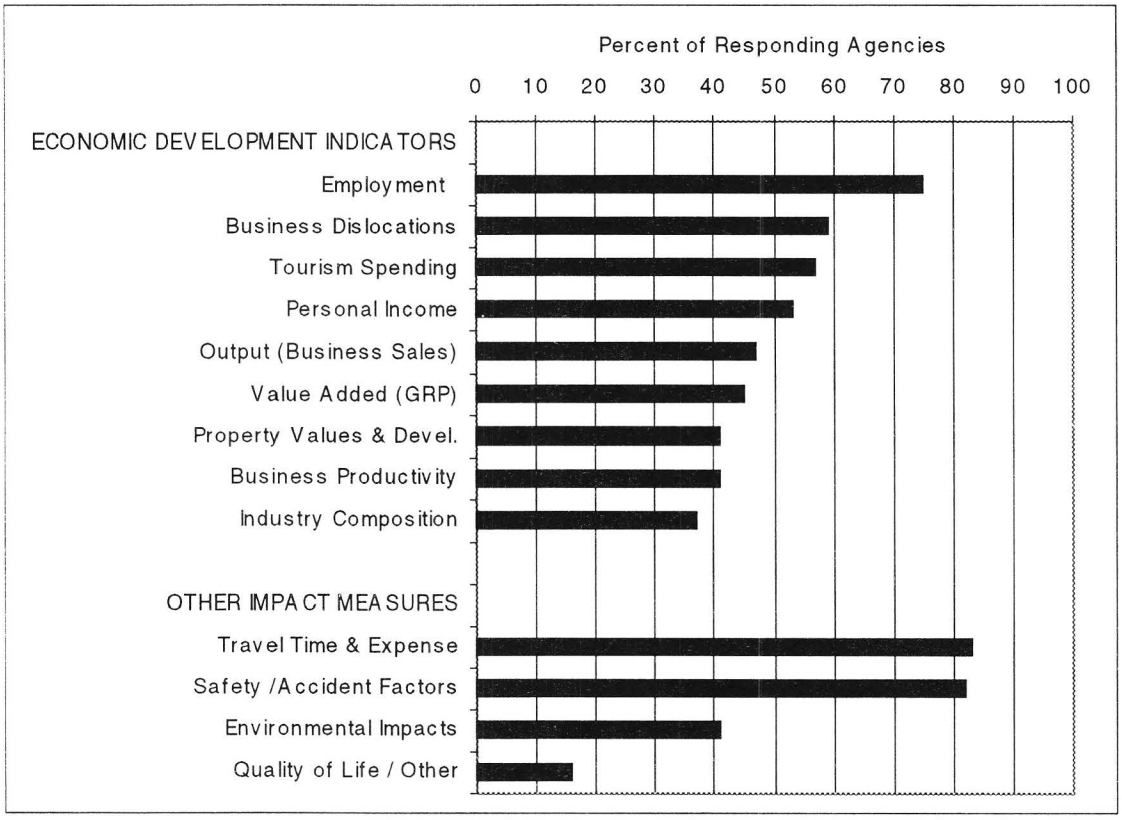

FIGURE 3 Use of alternative economic indicators of project impact in the past *(Source:* Survey of transportation planning agencies, question 1).

RELATIONSHIP OF TRANSPORTATION AND ECONOMIC DEVELOPMENT

The relationship of transportation and economic development is viewed differently, depending on (1) the perspective for viewing the relationship and (2) whether "transportation" is defined in terms of investments or access.

- From the micro-level perspective of an economic developer concerned with specific business site location decisions, the need for adequate transportation access is clear. Essentially, all businesses require some level of transportation access to labor, materials, and/or customers in order to operate and survive. When transport system investments that reduce business operating costs, expand market size, and/or improve the breadth of available labor and material inputs are made, affected businesses can become more competitive and capture a greater share of the market for their products. This is why a variety of state and regional funding programs have been developed to provide needed access improvements in order to attract individual businesses to desired areas. (These programs are summarized in chapter 4.) Literature on business location decisions also reveals that business sensitivity to transportation differs by type of business (*28*). However, once a certain level of accessibility has been achieved, further transportation investments may have little or no additional value to a business.

- From the perspective of evaluating a specific proposed transportation improvement project, the economic development impact of transportation investments differs depending on the nature of the project, its utilization, and characteristics of travel conditions and economic patterns in the affected area. For example, business surveys associated with highway projects in several regions have found that a north–south highway in a given area may benefit different industries than would an east–west highway serving the same region (*29,30*). As a result, all existing guides on assessing economic development impacts of individual transportation projects call for information on the use of the facility, as well as on the regional economy (*31–34*).

- From the broader perspective of evaluating an entire transportation funding program, the relationship of transportation and economic development becomes a question of how regional or national economic growth correlates with levels of public investment in (or accrued capital stock of) transportation infrastructure. This line of research, which to date has focused primarily on highway spending, is useful in

helping to justify capital investments in transportation (primarily highway) infrastructure. Among researchers there is a broad consensus that economic growth in the United States and Western Europe has in the past benefited from the development of highway systems, although there has been continuing discussion and research to refine estimates of the magnitude of the relationship and assumptions regarding the valuation of accrued capital stock (*35,36*). Most critiques of the research on infrastructure spending and economic development have not questioned the link between access improvements and business growth. They have instead questioned whether additional highway spending automatically brings additional economic growth, especially in situations where there is a well-developed transportation system already in place or other local circumstances constraining economic growth (*37–39*).

It is notable that each of the three levels of analysis accounts for a different set of impact factors. Differences in individual business needs, which are accounted for in the micro-level analysis, are most often not analyzed at the project level. Similarly, differences in transportation facility use and location, which are accounted for in project-level analysis, are most often not analyzed at the program level. The literature review in chapter 3 discusses the ways in which economic development impacts have been assessed at the project and program levels.

SUMMARY OF KEY FINDINGS

Key findings regarding impact definition and measurement concepts are as follows:

- Economic development encompasses a range of objectives and concerns centered on goals of enhancing an area's base of jobs, income, and business activity, where desired. Economic development impacts are just one part of the broader subject of economic analysis.

- There are many different ways to view and measure economic development impacts. The appropriate measures depend in part on the purpose of the analysis (e.g., for benefit/cost analysis, planning, public education, or post-project evaluation), as well as the type of project and impact area.

- In general, jobs, business sales, and tourism are the most common measures of economic development impact used by transportation agencies.

A more complete statement of key findings is provided in chapter 5 (Conclusions).

CHAPTER THREE

CURRENT STATE OF ANALYSIS METHODS

This chapter reviews the analytic methods currently being used to assess economic development impacts of transportation investments at the local, regional, and national levels. It summarizes the types of studies conducted, or commissioned, by government agencies to assess the economic development impacts of current transportation facilities or proposed transportation projects. There is also a broader literature of academic research on the interrelationship of economic growth and transportation. That research literature is noted, but not fully reviewed in this document. However, other available reports summarizing the existing research literature and explaining how to conduct analysis studies are listed in the Bibliography at the end of this report.

The fundamental basis for this review is the recognition that there are several different purposes for public agencies to be evaluating economic development impacts. Depending on the study purpose or issue to be addressed, the form of analysis and applicable methodology may be different. Thus, the discussion of available analysis methods is organized on the basis of the different motivations for conducting these studies.

OVERVIEW OF MOTIVATIONS AND METHODS FOR ASSESSING IMPACTS

A large number of studies have examined aspects of the economic development impact of transportation. These studies range from academic research to planning studies, and from national-level program impacts to localized project-level studies. Researchers have tended to group the alternative approaches by analysis method. For instance, a recent National Cooperative Highway Research Program study categorized economic analysis methods into the following four groups: (1) user impact tools, (2) regional economic impact tools, (3) fiscal impact tools, and (4) other/mixed impact tools (*40*). Of those groups, category "2" encompasses studies of economic development impacts. These can include both macroeconomic (regional or national-level investment) analysis and microeconomic (project-specific) analysis.

One of the goals of this study is to assist practitioners in understanding how to select appropriate methods to answer specific questions about the economic development impacts of transportation investments. Therefore, the discussion of previous studies in the literature has been organized by the purpose of the study. There are essentially four such categories:

- Forecasting of expected impacts of proposed projects for investment decision making,
- Planning and regulatory review of proposed projects (including environmental impact reports),
- Public education about the current economic value or role of an existing facility, and
- Evaluations of the actual impacts of past (completed) projects.

Table 1 provides a list of methods that fall under each of these study purposes and identifies cases where each of these methods has been applied. Those methods and examples are discussed in more detail in the remainder of this chapter.

It is important to note that methods are not exclusive to any single category of study purpose. For example, methods used to meet regulatory requirements also may be used to support investment decisions. Post-project evaluations may also be used for public information dissemination. The adoption of specific analysis methods is not solely determined by study purpose, but is also influenced by resources available, the expertise of the analyst, familiarity of study sponsors with specific methods, and other factors.

FORECASTING IMPACTS TO SUPPORT INVESTMENT DECISION MAKING

Over the past 15 years, public agencies have put increasing emphasis on the need to estimate the magnitude of economic development impacts associated with proposed transportation projects. This is usually motivated by a desire to compare the potential economic development effects of project alternatives to support either planning design decisions or investment decisions. In most cases, the focus is on estimating how the projects will affect the economic development within the specific local areas or regions in which they are located. A wide range of methods has been employed to measure these benefits; from qualitative surveys to detailed market studies and comprehensive economic simulation models. In many cases, the analysis compares a no-build or base case scenario to one or more transportation investment scenarios. Impacts are often forecast 20 or more years into the future.

TABLE 1
MOTIVATIONS AND METHODS FOR ASSESSING ECONOMIC DEVELOPMENT IMPACTS

Motivation	Analysis Method	Representative Examples
Forecasting impacts to support investment decisions	Surveys and interviews	Multimodal: Florida; Highways: Pennsylvania; Parking: Sacramento; Bridges: Minnesota, Wisconsin
	Market studies	Access Road: New York, Maryland; Bridge: Minnesota, Wisconsin; Rail: San Diego
	Case studies: comparables	Highways: Minnesota, Georgia; Airport: Denver
	Regional economic models: Input–output multipliers	Highways: Labrador, Northwest Territories (Canada), Port of New York; Rail: Northeast Corridor
	Regional economic models: Productivity impact models	Highways: Virginia; Rail: California
	Regional economic models: Forecasting simulation model	Highways: Indiana, Michigan, Wisconsin, Iowa; Transit: New York City, Rochester, Philadelphia; Airports: Los Angeles (REMI)
	Hybrid model systems: Land-use/economic models	New Jersey (TELUS), New York (Metrosim)
	Hybrid model systems: Traffic/economic models	Columbus (Freight Trans Investment Model)
	Benefit/cost and prioritization systems	Airports: Wisconsin; Highways: Indiana (MCIBAS)
Forecasting impacts for planning and regulatory review	Regional economic models	Highways: Massachusetts, Indiana; Transit: Puerto Rico
	Market studies	Highways: Rochester, New York
	Site analysis: Windshield surveys	Transit lines: Massachusetts; Highway Interchanges: Pennsylvania
	Business and expert interviews	Highways: North Carolina, Indiana, New York
Public education: demonstrating the economic role of existing facilities	Input–output multipliers and surveys (of economic roles)	Airports: Chicago, Honolulu, Massachusetts, New York State; Seaports: Baltimore, Portland, Florida; River: Tennessee; Bicycle: Maryland; Highway: Maryland, Wisconsin
	Scenario analysis: (of economic dependence)	Transit: San Diego, Philadelphia, Miami, Los Angeles
Post-project evaluation	Pre/post comparisons: System-wide improvements	Highways: Mississippi Delta Region, Appalachian Region, Wisconsin
	Pre/post case studies: Individual projects	Highways: Australia, France, Finland, Texas, North Carolina, Iowa, Wisconsin
	Regional economic models: Simulation models	Highways: Appalachian Region
	Regional economic models: Input–output models	Highways: Texas, Maryland, Kansas
	Statistical analysis models	Highways (productivity): U.S., Netherlands; Transit (property values): San Francisco

Source: Survey of transportation planning agencies.

Surveys and Interviews to Assess Impacts of Proposed Projects

Survey-type methods used for economic development impact analysis include (1) expert interviews, (2) business surveys, (3) vehicle origin-destination logs, (4) shopper origin–destination data, and (5) corridor inventory methods. These methods serve two purposes: (1) interviews and surveys of economic development experts and businesses can provide a wealth of local insight and a direct basis for estimates of the most likely scenarios for project impacts; and (2) the business surveys, along with vehicle logs and windshield surveys, can also serve as a source of data useful for more formal economic forecasting models (as discussed later). The use of each method is summarized here.

Expert interviews generally provide qualitative information about the expected economic development impacts of changes in transportation services or infrastructure on business activity within an area. The interview subjects are typically local or state authorities (public officials or planners) or staff of public or private economic development organizations, who have expertise regarding business conditions and economic development opportunities in the study area. The interview subjects may also include key business leaders or representatives of business organizations. Through the interview process, researchers ask their subjects to discuss the area's transportation needs, constraints, and threats to economic growth, and how transportation system improvements might improve economic growth prospects.

This method was used in a study of the Florida Chamber of Commerce to assess the extent to which statewide economic development could be affected by proposed transportation policies (*41*). In that study, information was collected about the transportation needs of three cluster industries—trade and distribution, high technology, and tourism—by means of interviews with leading firms in each cluster, and focus groups were conducted with public and private stakeholders in four cities. There were no quantitative forecasts of future economic development, although there were qualitative assessments of the severity

of transportation investment needs to maintain and increase the state's competitive position for those three economic clusters.

Another example of the qualitative assessment of economic development impacts is the feasibility study concerning proposed commuter rail in the Twin Cities' region (*42*). That study relied on interviews for a qualitative discussion of the likely job, property value, tax revenue, and development impacts of the commuter rail service. This discussion complemented a quantitative benefit/cost analysis of the expected savings in the costs of parking as well as air and noise pollution.

In Scotland, interviews with real estate agents, developers, and local authorities were conducted in order to identify how the proposed Strathclyde Tram would likely affect urban redevelopment opportunities at 15 specific urban sites (*43*). The interviews provided the basis for estimates of the potential project impacts and also the extent to which success in achieving those impacts was contingent on broader public sector promotion and support. At a broader regional scale, interviews with local authorities were used to estimate likely economic growth associated with proposed improvements to the Midland Main Line rail service (*44*).

In each of these examples, the interviews provided a direct basis for deriving estimates of the most likely magnitude of economic development impacts. However, it is also important to note that interviews with economic development experts and decision makers are also often conducted in conjunction with economic modeling studies, to compare the model forecasts with the expectations of those directly involved in economic development processes. These include a variety of modeling studies assessing the economic growth impacts of new highways (*30,45,46*). The dual use of interview-based methods and forecasting model methods allows an agency to increase its "triangulate," the likely range of impacts, thus increasing confidence in the study findings. Details of these modeling applications are discussed later.

Business surveys typically are designed to collect quantitative as well as qualitative information on the expected behavior responses of affected parties (and hence economic activity changes) if certain transportation investments are (or are not) made. The survey approach typically provides a larger base of responses than individual interviews, although it does not allow for follow-up clarification questions or discussion of key points of interest in the way that interviews do.

An example of this approach comes from the Pennsylvania DOT survey of businesses in different sectors, undertaken to identify potential growth in employment, population, and profit associated with highway improvements. The results of the survey indicated an expected employment growth and profit growth rate, given proposed improvements to US Highway 219 (*47*). The survey results were used as input for an analysis of cost-effectiveness that compared user benefits with construction and maintenance costs. Although the project was not justifiable based on traditional measures of user benefits, the study identified economic development transfer benefits, such as long-term population gains, long-term employment gains, and long-term property value increases to include in the analysis.

In the United Kingdom, business interviews were also used to provide estimates of the business response to proposed improvements to the Midland Main Line (*44*). Firms were surveyed about their existing use of (or dependence on) the rail line, the extent to which proposed improvements would provide benefits, and their likely changes if the line was improved. Similar types of questions were also asked in a business survey conducted for a proposed major bridge and highway project in Louisiana (*46*) and for proposed multimodal freight transportation improvements in eastern Washington (*48*).

At a more localized level, surveys of real estate developers were conducted for the evaluation of proposals for the Griffin Light Rail Transit Line in Hartford, Connecticut (*49*). The surveys were used, in conjunction with the separate data analyses of commercial and residential development patterns, to identify opportunities and likely impacts of the proposed transit line on local land development.

Business surveys are also commonly used to assess the current importance of existing transportation facilities and the future importance of continuing improvements to them. That type of application is discussed later in this chapter.

Truck Origin–Destination Logs

Several studies have used truck origin–destination logs to identify how the existing transportation network is used by businesses, the value of shipments, and the potential business cost savings associated with proposed highway projects. For studies of proposed highways in both Wisconsin (*50*) and Kentucky (*30*), such data were collected, geographically coded, and used to map the patterns of business supplier, customer, and worker travel. The data were then used to calculate the aggregate impact of proposed projects on business operating costs, and those values were then input into economic simulation models (discussed later in this section) to forecast impacts on expanding economic activity.

Shopper Origin–Destination Data

There are examples where researchers have used shopper surveys to collect information about the impact of a proposed

transportation facility on the economy of a community. A recent study for the Minnesota and Wisconsin DOTs assessed the potential economic impacts of a proposed new river crossing on a local downtown economy (*51*). The researchers used shopper surveys (collected at the point of sale in stores) along with a traffic intercept survey to identify who uses the downtown area, and the extent to which those shoppers access downtown by means of a river crossing. The survey found that the majority of shoppers in the downtown area do not use the existing river crossing to access the area and that it was possible that a new river crossing bypassing downtown might enhance it as a destination by eliminating pass-through traffic in the area.

Other studies have used license plate data, collected (with permission) at a sample of business locations, to derive origin–destination patterns of shoppers. These include studies of proposed new bridges and bypasses in Durand, Wisconsin (*52*), and De Pere, Wisconsin (*53*). A direct survey of shoppers was conducted in downtown Sacramento, California; that study focused on where visitors park and shop, and how changes in parking fees at city-owned garages would affect the economic development of the downtown area (*54*).

Corridor Inventory Methods

"Windshield surveys" are inventories of the types of business activities and business conditions that exist along a highway right-of-way. These surveys have traditionally been conducted by driving through a corridor where changes are proposed. More recently, it has also been possible to use geographically coded business establishment databases to compile similar corridor inventories.

Once the business inventory data were collected, several studies used a spreadsheet-based model to assess the vulnerability of local business establishments to future losses associated with the transportation changes that either (1) inhibit their local access, (2) bypass them, or (3) take their property. For the studies of Wisconsin Highway 29 (*50*) and the proposed Southwest Indiana Highway (*45*), such surveys were conducted to identify the number, type, and size of businesses that would be effected by transportation improvements. Spreadsheet models were then applied to estimate the dependence of each type of establishment on highway traffic, the volume of sales at each establishment, and the expected decrease in sales that would result when the highway improvements occurred. A similar spreadsheet model for assessing business dependence on traffic flow changes was also produced as part of an NCHRP study of impacts of turn restrictions (*55*).

The following is an example of a local business inventory and customer analysis: Durand, Wisconsin, US Highway 10 Relocation Alternatives (*52*).

Issue—The city of Durand, Wisconsin, was facing traffic safety and congestion problems in its downtown area because of the increase in heavy truck and pass-through traffic. To address the problem, two alternative plans were proposed: (1) relocate US Highway 10 north of downtown Durand along a new right-of-way, connecting to a new bridge across the Chippewa River; and (2) keep the current highway alignment through downtown, connecting to the new river bridge. Wisconsin DOT's Economic Planning and Development Section conducted the study to assess the effects of the two proposed alternatives on local business.

Analysis—The analysis consisted of five steps:

- a license plate survey of customers in the parking lots of four key businesses in the corridor, representing restaurant, retail, and gasoline service establishments;
- computer matching of the license plates to their registered home locations;
- representation of the home locations and distances of those business visitors by means of a geographic information system;
- classification of the extent to which the existing business activities are highway-oriented or local-serving, depending on the location of their customer base; and
- forecasts of future changes in traffic levels along the affected roads under both proposed scenarios.

Results—The study found that most of the surveyed businesses were indeed highway dependent and would lose some business if US Highway 10 traffic was diverted. However, it also found that this loss would be largely offset by forecasted growth in local traffic along the existing route, as well as by a realignment of State Highway 25 proposed as part of one of the options. As a result, it was concluded that highway-oriented businesses would most likely experience some fluctuation in sales after completion of the highway project, but that sales volumes should subsequently return to previous levels. It was also recommended that highway-oriented and downtown businesses prepare an active marketing campaign to improve the city as a tourist destination and recapture potential customers from the US Highway 10 realignment. This recommendation was designed to support the city's economy by attracting tourism downtown, while keeping through traffic out of that area.

Market Studies to Assess Impacts of Proposed Projects

Market studies are a second methodology sometimes used (either alone or in conjunction with other methods) to evaluate the economic development impacts of proposed transportation investments. In general, market studies measure the existing level of supply and demand for some type of business activity within an area, and then provide a basis for forecasts of how supply and demand would change under alternative future scenarios. This can include studies of the office market, the tourism market, the real estate market, or the market for industrial growth and location.

For transportation studies, market data and market forecasting models can be used to estimate how proposed projects would change the market size and/or cost of doing business in a given area, leading to changes in its relative competitiveness and thus also changing its expected future share of broader economic growth. Market studies are generally site or corridor specific. These studies may be used either to support an investment decision or as part of an environmental impact analysis (as discussed later). The results of market studies are sometimes also used to develop inputs for more detailed economic impact models (also discussed later). For example, real estate market studies can be used to forecast (1) the square footage of new development likely to occur if a new transportation facility is constructed, (2) the increase in property values (and related tax revenue) that will accrue from new development at land parcels served by a new transportation facility, and/or (3) the increased employment that will occur as land is developed.

Researchers in Maryland used a market analysis to identify how alternatives for improved access to the Middle River Employment Center would impact land development and, therefore, job creation (*56*). The researchers evaluated the marketability of the site for development given alternative transportation access improvements, and identified whether or not each alternative would provide sufficient access for a targeted list of businesses. The researchers conducted an assessment of competing sites in the region to identify absorption rates and rents in order to determine the value of the land for development and the level of employment the land could support.

For the proposed Griffin Light Rail Transit Line in Hartford, separate studies were conducted of the markets for residential and commercial development along the study corridor (*49*). The results were used, in conjunction with a survey of developers, to assess land development opportunities and likely development scenarios.

An economic market analysis was also conducted for the Monroe County (New York) Route 65 Airport Access Road Study. In this case, an analysis of the market for land development was used to forecast future employment in the study area and its implication for induced traffic growth. This economic market study was part of a Major Investment Study (*57*).

The San Diego Association of Governments conducted a market study of the competitive position of the San Diego region for attracting businesses from several geographic and industry markets, given proposed improvements to rail connections (*58*). The study forecast potential future growth in specific business markets and developed an estimate of how much of the business growth the region could capture with improved rail connections and associated cost and time savings.

Another type of market study focuses on just one single industry. An example is Maryland's logistics and distribution industry study (*59*). A consortium of private companies and state agencies co-funded the project to assess needs for strategic investments associated with emerging new markets and technologies for distribution and logistics. The analysis examined Maryland's comparative advantages for logistics (based on indicators of accessibility, road density, and cargo facilities), profiled the contribution of distribution industries to Maryland's economy (based on employment and income statistics), and evaluated Maryland's market strengths, weaknesses, and competitive position for logistics (based on the relative concentration and growth trends of logistics industries in Maryland compared with adjacent states). Needs for public and private sector investments to improve distribution facilities and traffic flow were then identified.

Use of Comparable Case Studies to Assess Localized Impacts of Proposed Projects

Case studies are stories documenting the actual before-and-after experiences of other communities or regions that had completed similar types of transportation projects. Such studies are most often used by researchers to evaluate the localized economic impacts on neighborhoods, downtowns, or small towns. For researchers, this type of analysis is particularly useful for small areas, where readily available economic data are limited, and where parallels to experiences elsewhere are more easily drawn. This type of real-life experience is also particularly useful when presenting information at public meetings, because it is easier for lay people to understand than rigorous economic analyses that involve technical terms and concepts.

For the St. Croix River crossing project (Minnesota/Wisconsin), researchers used case studies of similar size communities with similar levels of tourism-related activities to identify how bypasses had affected the economies

of communities in other states (*51*). Similarly, for the Eisenhower Parkway Extension in Macon, Georgia, researchers compiled information on relevant case studies in order to provide observations about the likely magnitude of economic impacts attributable to the parkway extension project (*60*).

In an effort to estimate the expected impacts of the then-proposed new international airport in Denver, Colorado National Banks conducted case studies of economic impacts around three other new/expanded airports—Dallas–Fort Worth International Airport, Atlanta's Hartfield International Airport, and Kansas City International Airport (*61*). Researchers studied business mix, timing of growth, and critical infrastructure availability at these airports. They also identified similarities and differences among these airports and Stapleton International Airport (at that time Denver's major airport), in terms of international flights, on-airport development policies, supportive public policies, and other airport services that might affect economic development in the vicinity of the airports.

Use of Productivity Impact Forecasts to Assess Impacts of Proposed Projects

In a few cases, researchers have applied the findings from state and national productivity research studies (as discussed later in this chapter) to forecast the aggregate economic growth that is expected to result from proposed additional highway spending. The Virginia DOT used this approach to estimate the statewide productivity impacts associated with 12 highway spending alternatives for proposed I-73 (*62*). The study estimated the change in total economic activity expected for every percentage change in highway capital expenditures, in terms of pessimistic, mid-range, and optimistic results. The analysis was at a broad level that did not distinguish how the economic growth would be affected by differences in the highway location and level of use.

Regional Economic Models to Assess Impacts of Proposed Projects

During the past decade, there has been a substantial increase in the use of regional economic models as a means for estimating the economic development impacts of transportation investments. In application, regional economic models are used to forecast how future economic growth in a given region would change if various policies or projects were to be implemented. These studies typically have four components:

- a base case forecast of future economic growth or decline in the region;
- some technique to estimate how businesses would grow in response to direct changes in their relative operating costs and markets;
- input–output (I-O) tables to calculate overall changes in the flow of money in the regional economy, including indirect and induced effects; and
- forecast of a new scenario representing how future economic growth or decline would be different than the base case if the project were to be implemented.

A key element of these studies is that they represent changes in the regional economy over a long period of time (a 20- to 30-year analysis period is typical). The outputs from these studies are typically estimates of changes in employment, personal income, business output, and gross regional product (value added).

There are basically two approaches to the regional economic modeling of transportation project impacts. One is to rely on a "dynamic simulation model," which forecasts year-to-year changes in the regional economy under a base case scenario and a project alternative scenario. This approach essentially encompasses all four study components (as noted above) in a single model. The other approach is to rely on an "input–output model," which addresses only the third study component. I-O models are static (lacking any time component); therefore, they must be used together with other methods to generate long-term forecasts and estimate how business competition and output are affected by factors such as operating cost changes.

Dynamic Simulation Models of Specific Project or Program Scenarios

The most frequently used regional forecasting/simulation model in the United States is the REMI (Regional Economic Models, Inc.) model (*20*). (This is referred to as a *dynamic* model because it forecasts changes over time, as opposed to a *static* model, which has no time dimension.) That model includes base case forecasts, information on interindustry (I-O) purchasing relationships, and modules to forecast how alternative project or policy scenarios would change economic and demographic patterns (including not only business output and employment, but also shifts in wages, prices, business productivity, cost of living, and interregional migration of businesses and households) among regions within the United States. It can operate at several different levels of industry detail, but is most commonly applied with 53 industry sectors. The model is custom calibrated for any specified number of regions, which can be defined to be any specific county or aggregation of counties. This often makes it possible to represent subareas of a state or metropolitan area. The model forecasts shifts in economic and demographic patterns for the designated regions and the rest of the United States for

a "base case" and "project alternative" scenario for each year up to 2035.

The relevant inputs to this modeling system depend on the type of transportation project and the purpose of the project impact analysis. In some past studies they have included:

- Changes in household cost of living or disposable income, because of savings in expenses of personal vehicle operation and accidents, as well as costs of parking, tolls, and fares;
- Changes in the cost of doing business, because of savings in expenses of commercial vehicle operation and accidents, driver "on-the-clock" travel time, and commuter wage compensation for parking, tolls, and other excess expenses;
- Additional shifts in tourism industry attraction, because of expansion of tourism markets;
- Additional changes in industrial and commercial business growth, because of expanded accessibility and opportunities for improved freight logistics, just-in-time manufacturing, and scale economies of operation, because of expanded supplier or customer markets;
- Additional changes in the amenity or attractiveness of living in a region, because of nonmonetary benefits of improved air quality, mobility, or other quality-of-life factors;
- Changes in public spending associated with construction and operation of the new or improved transportation facilities; and
- Changes in the pattern of demand for fuel, vehicle repairs, medical care, and other elements of household and business spending.

These inputs have been derived primarily from travel model calculations of user benefits, commercial or industrial market studies, and/or project spending budgets.

The REMI model has been used to estimate the long-term economic development impacts of many proposed highway projects including Wisconsin Highway 29 (*50*), Southwest Indiana Highway (*45*), Iowa Highway 20 (*63*), Michigan US-131 extension to I-75 (*64*), Corridor 18 (*65*), Avenue of the Saints (*66*), I-35 Corridor (*67*), Indianapolis–Texas Corridor (*68*), I-95 Extension in Maine (*69*), Kentucky Highway 69 (*30*), Indiana US-31 (*70*), Louisiana's Zachary Taylor Parkway (*46*), and Maine's East–West Highway (*71*). In many of these studies, the economic simulation model was used to forecast impacts on different parts of the highway corridors and on the rest of the state, and to forecast how the impacts would differ for several alternative alignments. Of particular concern for the multi-area studies was the analysis of the extent to which economic growth within the corridor would be occurring at the expense of the rest of the state.

This same REMI forecasting and simulation model has also been used to estimate the regional economic development consequences of alternative scenarios for public transit, high-speed intercity rail, seaport, and airport investments. Examples of transit investment studies using this model include studies for the Philadelphia metropolitan area (*72*), New York City metropolitan area (*73*), Los Angeles metropolitan area (*74*), Hartford area (*75*), and Rochester area (*76*). In each of those cases, the alternative scenarios typically represent differing levels of funding for public transit, and in some cases alternative mixes of rail versus bus system investment. The inputs are typically differences in personal costs and business costs associated with varying levels of public transit availability and ridership, with associated differences in the costs of traffic delays, accidents, and parking when transit investment is reduced. In addition, the model also has been used to assess the impact of airport investment scenarios for Los Angeles (*77*), high-speed rail alternatives for California (*78*), and alternative port investment scenarios for Connecticut (*79*). In general, each of these studies examined the long-term consequences of alternate scenarios for business cost competitiveness and business attraction.

At times, simulation models have been applied to estimate the economic development consequences of a broad package of investments spanning many modes. In the case of Richmond, Virginia, researchers used the REMI model to estimate roadway improvements with different financing options, development of a multimodal station, airport expansion, and high-speed rail in the Washington, D.C., corridor (*80*). Gross regional product, output, and employment were used as measures of economic impact. Other applications of REMI models used to measure the economic role of existing transportation modes and facilities are discussed later in this chapter.

To estimate world trade impacts, the Wharton Econometrics forecasting model was used for the evaluation of impacts associated with the Alameda Corridor Project (*81*). That project, now under construction, is providing new grade-separated truck and rail routes to expand land-side access to the San Pedro (Los Angeles and Long Beach) ports, which comprise the largest port complex in the United States. The model forecast Pacific Rim trade with the United States through the year 2015, under a base case scenario of increased future costs for land access (because of existing constraints on rail and truck access) and an alternative scenario in which there is unconstrained capacity and no increase in land access costs.

At a global scale, The Netherlands Bureau for Economic Policy Analysis has been applying WORLDSCAN, a dynamic economic model that forecasts the impacts of alternative scenarios on long-term changes in economic growth, trade, and economic specialization patterns (in terms

of 11 industry sectors) for 12 regions of the world through the year 2050 (*82,83*). The scenarios involve different assumptions regarding transportation, trade, and technology investments and policies, affecting productivity, migration, energy, and the environment. The scenarios provide a basis for assessing planning needs in The Netherlands regarding land use, transport, energy, and the natural environment. In particular, the model and its alternative scenarios were applied to assess future needs to address road congestion in The Netherlands and expansion of Amsterdam's Schiphol Airport.

The following is an example of regional project analysis using a dynamic simulation model: the Mississippi River Bridge and Zachary Taylor Parkway (*46*).

Issue—Economic development in central and northern Louisiana has lagged significantly behind that of the state's southern tier. One factor identified by state and local officials as a growth constraint for those other areas was the absence of a major east–west highway and bridge crossing the Mississippi River north of I-10 and south of I-20. There is no bridge along a 100-mile stretch of the river. There is a public ferry between New Roads and St. Francisville, but it cannot carry trucks and it is also subject to closure during days of high water levels or mechanical breakdowns. As a result, trucks and buses have to drive an additional 60 miles to travel between those two cities. The proposed new bridge, together with the proposed upgrading of existing state routes east and west of the Mississippi River, comprise the Zachary Taylor Parkway, a 211-mile corridor across the central and northern portions of Louisiana, connecting I-49 to I-59.

Analysis—The Louisiana Department of Transportation and Development study examined the economic impacts of the proposed bridge and highway. The study had five elements:

- a spreadsheet analysis model of traffic diversion, traveler time, expense, and accident cost savings;
- business surveys of truck origin–destination shipment patterns and river crossing impacts on operating cost, by type of industry;
- a tourism attraction market study of visitor origins, destinations, and project effects on them;
- interviews of economic developers, together with an industry screening model, to identify additional opportunities for business attraction related to logistics and market expansion opportunities; and
- a REMI model representing the nine parish (county) highway corridor, the rest of the state of Louisiana, and the rest of the United States. There was also a separate benefit/cost spreadsheet analysis of net benefits at the corridor and statewide levels.

Results—The results were provided in terms of changes in business competitiveness and year-by-year changes (over 20 years) in total business output, gross regional product, personal income, and employment for the corridor and the rest of the state. Construction impacts and longer-term impacts of the completed highway were analyzed separately, and effects of cost savings to existing industries were distinguished from more less-certain impacts on market expansion. The employment effects were further split by industry. Overall impacts included the following:

- Construction period employment—9,121 job-years in the corridor, 9,598 job-years in the rest of the state.
- Construction period income—$176 million in the corridor, $342 million in the rest of the state.
- Post-project employment (year 2035)—2,926 in the corridor, 194 in the rest of the state.
- Post-project income (30 years)—$120 million in the corridor, $78 million in the rest of the state.

A separate state-level benefit/cost study was also conducted, in which benefits were measured (1) by the value of user benefits and (2) by the value of additional disposable personal income, adjusted for in-migration of new population. Construction spending impacts were omitted from the income benefit in recognition of their opportunity costs (other spending foregone). The result was a traditional user benefit/cost ratio of 1.46 and an income/cost ratio of 1.57.

Use of Input–Output (I-O) Models to Assess Impacts of Specific Project Scenarios

I-O models contain information on interindustry relationships. I-O models encompass accounting tables that describe, for each industry, the number of inputs that industry requires from other industries to produce one unit of output. These models provide multipliers that are applied to the estimate of direct effects to calculate the total impact on the economy. The total impacts are typically measured in terms of business sales, GRP, wages, and jobs in the region.

Nearly all transportation impact studies using I-O models in the United States have relied on one of three models that are widely available and can be customized for any county or aggregation of counties (including states and larger regions). The three models are IMPLAN (*11*), RIMS II (*84*), and PC I-O (*85*). RIMS provides tables of multipliers that analysts can apply to their own spreadsheets. IMPLAN and PC I-O, on the other hand, are programs that query users in order to provide a description of the direct effects, and then automatically generate estimates of the indirect, induced, and total effects of the facility.

I-O models alone can estimate the impacts of changes in flows of money, but not the dynamics of business attraction or expansion over time resulting from changes in business costs. Thus, they can be used as a stand-alone means for estimating the job impacts of construction spending (which is a flow of money). However, they must be used in conjunction with a broader set of techniques to forecast the effects of long-term economic development. In particular, they require some other modeling mechanism or set of assumptions to estimate how a project's impacts on business cost changes will affect regional business competitiveness and growth. Some of the applications of I-O models have just assumed that business output would grow by the same amount as the cost savings. However, more recent research provides a more realistic basis for establishing this relationship (*86,87*).

The pioneering application of I-O tables for the long-term forecast of economic development impacts is the Regional Economic Impact Model for Highway Systems (REIMHS), developed in 1984 (*88*). That process, applied for north-central Texas, included a series of calculations to translate capital investment (for new highways) and user-cost savings (from highway improvements) into expected increases in the flow of income. Then, an I-O model was applied to calculate the total value of additional business output, wages, and jobs. REIMHS was also applied for highways in Arkansas, Louisiana, New Mexico, Oklahoma, and Texas (*89*).

A similar example is North Carolina's analysis of the expected employment and income growth that could be supported by Interstate 40 between Wilmington and Raleigh (*90*). Because the highway would pass through a relatively rural and underdeveloped area of the state, employment and wage impacts associated with construction, although not permanent, were also economically important to the region. A new study of the proposed Monroe–Gastonia, North Carolina, Connector also developed estimates of the business attraction opportunities associated with the proposed highway, and then applied an I-O model to forecast overall regional impacts (*91*). Similarly, researchers used an I-O model to estimate the job creation and wage impacts of alternative highway investments for I-71 in Ohio (*92*) and US-287 in Texas (*93*). In each of these cases, additional external calculations were necessary to assess the direct effects of transportation system improvements on the business attraction or expansion.

A regional I-O model was also used to assess the economic impacts of a proposed new intermodal (truck/rail) facility in Atlanta (*94*). That study applied a regional I-O model to calculate the overall regional sales, earnings, and job impacts of spending on project construction and ongoing operations. The I-O model was also applied to calculate impacts associated with travel efficiency cost savings, based on an assumption that the cost savings would translate into increased production.

To assess the economic development impacts of highway investments in the I-66 corridor in southern Kentucky, researchers at the University of Kentucky Center for Business and Economic Research combined an I-O model with an earnings growth model. The latter provided an estimate of the direct change in business wages and hence personal income directly resulting from business cost savings, and that direct earnings estimate of impacts of the investment calculated using the earnings growth model was used as input into the I-O model to estimate job creation by major industry group (*95*).

Several studies in Canada illustrate how an I-O model can be combined with base case economic forecasts and systematic measures of the direct business response to cost or access changes to provide forecasts of those changes that economic growth effects over time. That series of steps provides an output roughly parallel to that of the REMI model in the United States (although without the supply and demand interactions present with REMI). One example is the study of economic development impacts of Canada's proposed Trans-Labrador highway (*96*). Proponents of the highway hoped that its development would spark economic development in an undeveloped area of the province. At the same time, there was concern that negative impacts would occur in neighboring Newfoundland as tourism and other industries were attracted to Labrador. The study estimated economic growth impacts on Labrador, Newfoundland, Quebec, and Canada as a whole. It combined an I-O model with a market analysis, which provided high and low economic growth scenarios associated with the proposed highway. A roughly similar approach was used to assess economic development impacts of a proposed highway in the Slave Province of Canada's Northwest Territories (*97*).

The M74 Motorway Study in Scotland followed a sequence of steps generally similar to the those of the Canadian studies: (1) forecasting base case growth, (2) calculating the transport cost savings by industry, (3) applying factors representing industry-specific growth responses to those cost savings, (4) estimating future growth changes for those businesses most sensitive to motorway improvements, (5) applying I-O multipliers from the University of Strathclyde's Scottish I-O model, and (6) forecasting overall impacts on regional economic growth (*98*).

Applications of I-O models for evaluating proposed projects have *not* been restricted to highways. To study the potential economic development impacts of high-speed rail service between Boston and New York, researchers employed the multiregional PC I-O model (*99*). That analysis was enhanced by a separate analysis of rail–highway–air

diversions, and profiles of the industries using each of those three travel modes, to assess how high-speed rail would change business operating costs in various industries. The researchers then translated those business cost savings into business demand changes, and applied a multiregional I-O model, which traced how impacts would be distributed among different states.

Finally, an I-O model was used to assess four alternative scenarios for the DeKalb Peachtree Airport in Georgia (*100*). The scenarios covered the full range of possibilities—continuation, expansion, reduction, and closure of the airport. The study examined the direct and multiplier effects of changes in airport operation and visitor spending, and also measured the airport's positive impacts on local tax revenue and its negative impacts on property values, as well as the costs of redeveloping the land under the closure scenario. The study concluded that continuation of existing airport activity provided the greatest benefits for local economic development.

Other applications of I-O models, to measure the economic role of already-existing transportation facilities and modes, are discussed later in this chapter.

The following is an example of regional project analysis using an I-O model: the Slave Province Transportation Corridor (*97*).

Issue—Although Canada's Northwest Territories (NWT) is rich in natural resources, it's economic growth has been constrained by the fact that it is far from major markets and lacks the transportation infrastructure necessary to make some of those resources viable in reaching those markets. In response, the NWT government developed a strategy to promote economic development through a series of transportation investments and commissioned a series of studies to examine their expected impacts.

One of those studies examined alternatives for improvements in NWT's Slave Province. Each of the alternatives featured some form of highway corridor from Yellowknife to the Coronation Gulf, connecting existing and proposed new mines with a proposed new deepwater port providing direct access to markets in Europe and Asia.

Analysis—The analysis process involved four steps: (1) a "base case" forecast of future economic growth using provincial-level economic models; (2) development of scenarios (based on market assessment of the expected private sector investment and resulting output increase) representing the direct effects on development of renewable resources (tourism and hydropower) and nonrenewable resources (diamonds, gold, and metal mining); (3) estimation of indirect and induced effects on NWT and the rest of Canada over time, using provincial and interprovincial I-O models, together with a provincial-level economic forecasting model; and (4) a taxation revenue model that reflected how additional income tax revenues at the provincial level would reduce federal transfer payments to the province. There was also a separate benefit/cost study.

Results—The results were provided in terms of 20-year forecasts of changes in employment, gross domestic product, and tax revenues for the NWT and other provinces. The total impacts, summed over a 20-year range (expressed in 1993 dollars, but not further discounted), included the following ranges for the four alternatives:

- Public and private sector capital investment: $0.8–3.9 billion.
- Gross domestic product: $9–32 billion in the NWT, $5–18 billion in the rest of Canada.
- Employment: 27,000–103,000 in the NWT; 84,000–292,000 in the rest of Canada.
- Gross tax revenue: $4–12 billion in the NWT; $2–8 billion in the rest of Canada.

A separate national-level benefit/cost study was also conducted in which benefits were measured in terms of the additional mining output after adjusting for the value of initial capital cost and reduced natural resource supply. Tourism, indirect and induced effects, although included in the regional economic development impact analysis, was excluded from the benefit/cost analysis, because they were considered to be internal redistributions of activity at the national level. The result was a benefit/cost ratio of 1.3 using a 10 percent discount rate.

Hybrid Modeling Systems to Assess Impacts of Proposed Projects

Traffic and Economic Models

The state of Indiana developed an integrated modeling system that includes a macroeconomic simulation model to estimate economic impacts (*101*). Indiana's five-step modeling system includes: (1) a travel demand model to estimate traffic volumes and travel times on the highway network both with and without improvements, (2) a program designed to estimate travel efficiencies related to different types of roadway improvements, (3) a set of linked spreadsheet models developed to calculate direct economic benefits by estimating how different types of businesses respond to changes in transportation access and travel time, (4) the REMI economic forecasting model to estimate total economic growth impacts, and (5) a benefit/cost framework for aggregating and discounting the economic benefits and

calculating the stream of capital and operating costs to arrive at a benefit/cost ratio. The Indiana DOT has continued to expand the application of this modeling system and has now completed its use in three corridor studies (*45,102*).

To calculate the economic impacts of Columbus's inland port, the Mid-Ohio Regional Planning Commission developed a Freight Transportation Investment Model, which used the REMI macroeconomic simulation model (*103*). The Mid-Ohio Regional Planning Commission model uses travel times savings to motor carriers, annual truck trips, and value of time estimates as inputs to the model, which then calculates the direct and indirect economic impacts of transportation improvements serving the Inland Port.

Land-Use and Economic Models

In recent years many regional planning agencies have attempted to integrate transportation and land-use modeling to better predict future transportation demand. Most of the land-use modeling systems do not reflect many economic factors and interactions, and are thus not relevant here. However, three models have been developed that attempt to include significant economic factors to better reflect how markets respond to changes in land use and transportation access. These three models merit some discussion.

The TELUS (Transportation, Economic, and Land-Use System) model was developed by the New Jersey Transportation Institute, Rutgers University, and the North New Jersey Transportation Planning Authority to help MPOs select projects for their transportation improvement programs (TIPs) (*104*). TELUS has three components: (1) a database with key information about projects, (2) an I-O model for estimating jobs created and the income and tax impacts of projects, and (3) a land-use model for estimating property tax impacts. The research team used national interindustry relationships, as well as relationships developed from New Jersey bid sheets, to develop impact factors and economic multipliers for the I-O model. Multipliers reflect the ratio of total/direct effects and are expressed in terms of jobs (by industry), income, and GRP per million dollars of original investment.

The METROSIM model is a unified and market-oriented computer simulation model of multimodal transportation and land use (*105*). The model takes into account both how transportation projects are affected by the current distribution of land uses and how, in the longer term, transportation projects influence development patterns. Unlike other land-use allocation models, this model takes into account how land markets operate. It allows basic and service employment to respond to the transportation system through actions of the labor market and how businesses make decisions. The METROSIM model is a custom model and requires extensive data collection. It is currently being tested in the New York metropolitan area.

The MEPLAN model is an integrated land-use, economic, and transportation modeling system, which has been applied primarily in Europe (*106*). It is sometimes referred to as a "spatial input–output model," because it combines modules for simulating and forecasting transportation patterns (traffic flow), economic patterns (interindustry flows of commodities and trade), and land-use patterns (locations of business and population). It forecasts changes over time in the behavior of consumers and producers along all three dimensions, with changes in rents and prices to balance supply and demand. The MEPLAN model has been used to forecast impacts of local projects on urban areas, such as improvements to the A7/A68 motorway in southeastern Scotland (*107*). It has also been used to forecast broader regional impacts of larger projects, such as the Channel Tunnel (*108*). Local urban applications have typically featured small area zones and very limited industry detail, whereas larger regional applications have typically featured broader zones and a greater level of industry detail.

Benefit/Cost and Prioritization Applications

The use of economic development impact measures for benefit/cost evaluations is reported and discussed later in chapter 4. However, it is clear from this literature review that many of the studies estimating economic development impacts of proposed projects were conducted as part of a broader consideration of the relative project benefits and costs. These applications have varied widely. The measures of economic development benefit have ranged from business output to value added to personal income. The geographic perspectives for benefit measurement have ranged from local to state to national. The appropriateness of these different measures and perspectives for viewing economic development benefits can, of course, depend on the motivation for analysis and the types of conclusions to be drawn from them.

Because this synthesis report focuses just on procedures for assessing economic development impacts, it is beyond its scope to also address procedures for conducting benefit/cost analysis. However, it is notable that some state transportation departments have been developing computer-based systems for project prioritization, which explicitly consider both user benefit/cost comparisons and economic development impact/benefit comparisons, and also separately measure local and statewide economic development benefits. Those include Indiana's Major Corridor Investment Benefit Analysis System for evaluating proposed highway projects (*101*) and Wisconsin's Airport Benefit-Cost system for evaluating proposed airport improvement projects (*109*).

FORECASTING IMPACTS FOR PLANNING AND REGULATORY REVIEW

An analysis of potential economic development impacts of alternative transportation investments is sometimes included as part of the environmental review process. The scope of the analysis may vary greatly, depending on the importance of the economic development impacts as a planning consideration. Many times the required Environmental Impact Report (EIR) makes only cursory mention of economic development impacts, and these are frequently limited to a brief summary of land takings or impacts on the use of abutting property. For large-scale projects in the United States, the analysis of economic development factors may also be included in an alternatives analysis as required for U.S, federally funded major highway or transit projects.

Economic Models

Where regional economic development analysis was a major part of the EIR, there are some significant exceptions. For the Tren Urbano transit project in Puerto Rico, I-O multipliers were applied to estimate regional employment impacts of the proposed project construction as part of the EIR (*110*). For very large projects, such as Boston's Central Artery/Tunnel, a REMI simulation model was used to project the consequences of build versus no-build scenarios for regional economic growth (*111*).

Market Studies

The analysis of localized impacts tends to use more qualitative methods. One reason for this is that the more analytical economic modeling methods generally cannot be applied at the community or neighborhood level because of the unavailability of required data. Many studies of local impacts sometimes use real estate market analysis as a basis for identifying the square footage of development by type that is likely to result in a corridor when a new transportation investment is made. Rules of thumb regarding the number of employees per 1,000 square feet of different types of development are then applied to the results of the market analysis to derive the employment impacts of the transportation project. An example of this is the highway project in Monroe County, New York (*57*).

Site Analysis

Local impacts related to business dislocations are a required economic impact component of environmental impact assessments. To identify the number of dislocations, researchers conduct site analysis to record the location and type of all business establishments likely to be dislocated by alternative transportation investments. To estimate the number of jobs associated with these businesses, researchers may either contact the businesses and request information about employment levels or they may estimate employment based on an estimate of the square footage of each business. Examples include EIRs for the Old Colony Rail Line in Massachusetts (*112*), the Tren Urbano Transit project in Puerto Rico (*110*), the Orange Line replacement in Boston (*113*), and I-85 improvements in South Carolina (*114*). Displacement analysis usually includes an assessment of opportunities to relocate businesses within the same community, thus simply relocating jobs.

Interviews with business owners, economic development professionals, and real estate professionals are often used to understand the types of economic impacts likely to result from a transportation investment. Although interviews may be used as a component of many of the types of studies described above, they often play a prominent role in major investment studies and environmental impact analyses. One reason for this is the lack of data available at the local and corridor level. Researchers often rely on local knowledge to provide qualitative (and sometimes quantitative) information about existing and projected economic conditions, and to provide a check against secondary data sources. Examples include North Carolina US-64 (*115*) and Indiana US-35 (*102*).

PUBLIC EDUCATION—DEMONSTRATING THE ECONOMIC ROLES OF EXISTING FACILITIES AND SERVICES

One type of study, commonly conducted by state DOTs and MPOs in the United States, documents how existing transportation facilities play a role in the overall economy. These facilities are almost always a terminal or transfer facility (e.g., airport or water port) or else an entire mode (e.g., highways or public transit). Although these studies conducted for public education are often referred to as "economic impact" studies, technically they are actually documenting either "economic contribution," that is, showing how money generated by the transportation facilities flow through the regional or state economy, or "economic dependence," that is, itemizing the extent to which jobs and business costs in the region depend on the continuing existence of the transportation facilities or services. Sometimes these studies also estimate the associated tax revenues (including income, sales, and property taxes) generated as a direct or indirect consequence of the transportation facility.

Input–Output Models: The Economic Contributions of Specific Facilities

Studies that review the flow of dollars generated by existing transportation facilities are most often conducted for airports, water (sea or river) ports, or recreation roads.

They generally do *not* include analysis of alternative future scenarios for change in activity, but instead focus on documentation of existing conditions and activity. Studies of the economic contributions of individual airports include the Baltimore–Washington International Airport (*116*); Chicago Airport System (*117*); Honolulu International Airport (*118*); Portland, Maine, International Jetport (*119*); and San Diego International Airport (*120*). Similar documentation of the total economic contribution of statewide and national airport systems includes Colorado (*121*), Massachusetts (*122*), North Carolina (*123*), New York (*124*), Oregon (*125*), Pennsylvania (*126*), Wisconsin (*127*), and Civil Aviation in the United States (*128*).

Studies of the economic contributions of ports include individual ports such as the Port of Baltimore (*129*), Port of Portland (*130*), and Eastport Port Authority (*131*), as well as entire statewide port systems such as Florida's seaports (*132*) and river systems such as ports along the Tennessee–Tombigbee Waterway (*133*).

All of the above-cited studies of economic contribution use a two-step process. The first step is to develop estimates of the direct effects of these facilities on user spending and associated jobs. The second step is then to apply multipliers from a regional I-O model to estimate the indirect and induced economic effects of these existing facilities.

For the first step—develop the necessary estimates of direct effects—researchers generally use one of two methods. The easier approach is to contact individuals associated with the operation of the transportation facility to collect data on the number of persons employed at the facility, passenger activity, freight flow through the facility, and other activities related to the facility. These data are combined with secondary data, such as profiles of typical visitor spending patterns and the value of shipments, to calculate the direct dollar and employment impacts of the facility for use in the I-O model. This approach is particularly practical when the study encompasses many sites. Examples include the previously referenced studies of all airports in North Carolina and all seaports in Florida.

The more accurate method for calculating direct effects of airports and water ports is to conduct separate surveys of passengers, businesses located at facilities, and businesses using the transportation facility. The surveys can cover passenger spending at the (air or sea) port, business spending on the use of the port, tourism associated with the use of the port, industry cargo flowing through the port, and activities of local businesses dependent on proximity to the port. This approach is often labor intensive, requiring significant interview time as well as survey resources. Examples include the previously referenced studies of the Port of Portland; the airports of Honolulu, Baltimore–Washington, San Diego, and Portland; and the study of all public-use airports in Massachusetts. The latter study is notable for its development of a comprehensive set of survey instruments, which were widely administered.

A parallel survey method is similarly used to calculate the economic effects of scenic and recreational transportation facilities. The study of a bicycle trail in Maryland (*134*) includes surveys of the trail users (concerning their home locations and spending patterns associated with use of the trail), business establishments located along the trail corridor (concerning its effects on their business), and abutting property owners (concerning effects on property values).

Studies of scenic byways in Colorado and Virginia similarly use survey data on visitor spending patterns and business sales data on nearby retail businesses (*189,190*).

In every case cited here, the second step (once the direct effects are measured or estimated) is to apply an I-O model to calculate the indirect and induced (and total) economic impacts of the existing transportation facilities. Almost all of these studies use either the IMPLAN or the RIMS-II multiplier models.

More details on these general approaches for data collection and multiplier analysis to estimate the economic contribution of airports and seaports are covered in guides produced by the FAA (*13*) and the Federal Maritime Administration (*135*).

The following is an example of a statewide study of the economic role of existing facilities: Massachusetts Public-Use Airports (*122*).

Issue—Massachusetts Aeronautics Commission (MAC) recognized that there was a lack of public understanding of the public service and economic role played by the state's 42 public-use airports, which are outside of the Boston area. These included both smaller airports with scheduled air service and general aviation airports. To address that issue, MAC commissioned a study to document both the local area and statewide economic roles played by those airports.

Analysis—The data collection phase involved six elements:

- assembling a profile of the number and mix of aircraft operations (landings and takeoffs), based aircraft, and fuel sales taking place at each airport, using a MAC database;
- surveys sent to all aircraft owners in the state, to document their business and personal use of the aircraft;

- surveys of a sample of private and public aircraft passengers, to document visitation and spending patterns by nonresidents;
- surveys of travel agencies, to document commercial traveler origin–destination patterns;
- interviews with all airport managers and airport tenants concerning their business activity at the airports; and
- airport area visits to identify and interview nearby establishments that rely on the airports for some or all of their business.

A spreadsheet system was then applied to analyze the collected data and calculate for each airport the number of workers and associated income attributable to (1) direct operation of the airport, (2) air freight and passenger services located at or adjacent to the airport, and (3) other off-airport business relying on the airport for their business revenues. An important aspect of this analysis was that explicit attention was given to avoid double counting, and only the portion of those business activities attributable to airport users residing outside of the area, who would not otherwise be visiting without the airport, were counted.

I-O multipliers, which were constructed (from RIMS-II) for the county surrounding each airport as well as for the state as a whole, were used to calculate overall economic impacts. Those multipliers were applied for each major category of airport and related business activity to calculate the total impact of each airport on jobs, wages, and business sales from both the local area (county) and statewide perspectives.

Results—The results were presented in a report entitled, *Massachusetts' Public-Use Airports Are Serious Business.* The following major points were included:

- Each year, the state's 42 public-use airports (excluding the two Boston area airports) directly support 5,174 jobs in their communities, plus another 3,878 jobs attributable to indirect and induced impacts in the surrounding areas.
- The total effect from the statewide perspective is $245 million of annual wages for workers in the state.
- The airports also provide important recreation, education, and public safety services for their communities.

Input–Output Models: The Economic Contribution of Entire Modes

The same kind of multiplier analysis described for air/seaports has also been used for highway construction and public transit operations at the national level. The Federal Highway Administration (FHWA) conducted a study of the total number of jobs supported in the national economy by highway construction (*136*), while the American Public Transit Association conducted a study of the total number of jobs supported by the operation of public transit services (*137*). In both cases, the focus was on calculating the total number of jobs.

The national studies have differed from the individual facility and statewide studies in the type of model used. Rather than relying on a static I-O model, both of these studies used a dynamic economic simulation model, the REMI model, which accounted for price and wage effects in addition to including (interindustry) I-O relationships. However, in both cases cited here, the study focused just on the effect of spending money (on highway construction and transit operations), and not on the economic benefit of having these transportation modes and services available.

Scenario Analysis: Demonstrating Economic Dependence on Existing Facilities and Services

Studies aimed at demonstrating the economic losses to a region, should a facility close or substantially alter operations, are most often conducted for public transit systems. Three examples illustrate this type of study.

The San Diego Association of Governments conducted a study to evaluate the economic impact of public transit on the San Diego region, including not only the economic contribution of the system to the regional economy but also the magnitude of cost savings and business output that would not occur if the transit system did not exist (*138*). In an effort to address criticism that the public transit system is oversubsidized, the researchers looked at the economic impact of maintaining the system in terms of (1) the impact on job creation and higher business sales of federal and state funds expended on public transit, (2) the monetary value of congestion relief measured in terms of value of time savings, (3) cost savings related to air quality improvements (i.e., costs of cleanup avoided), and (4) increased output due to greater labor force participation.

The Miami Valley (Ohio) Regional Transit Authority also assessed the economic impact of its bus system in terms of how the region's economy would suffer if the transit system did not exist (*139*). The data collection included a broad set of surveys covering Regional Transit Authority riders, workers, and vendors. The economic impact was measured in terms of the total jobs lost, and the value of increased accidents, increased congestion, increased air pollution, and increased public assistance that would result without the system. I-O multipliers were applied to calculate the total impact on the regional economy, including effects on suppliers and consumer sales.

At the national level, the Campaign for Efficient Passenger Transportation conducted a study to measure the benefit of maintaining public transit by estimating the added public and private costs that would be incurred if there was no public transportation (*140*). Information was drawn from existing research literature to derive estimates of the value of excess costs that would be incurred if transit riders were to shift to car travel (or else go on welfare). These estimates included user traveling, congestion, accident reduction, parking, social program, roadway maintenance, and emergency response cost savings, in addition to other benefits. All of these costs affect personal and net business income, although implications for national economic growth were not directly addressed.

Other studies of local transit system impacts parallel the above studies, in that they itemize the wide range of excess costs that would be incurred without the transit system. These include studies of transit in the Housatonic (Connecticut) area (*141*) and Atlanta (*142*). A different approach was done to assess the economic development contribution of transit in San Antonio, Texas. That study showed the differences in costs and spending patterns associated with transit and auto usage, and then applied an I-O model to show that transit spending keeps more money in the local economy, whereas automobile-related spending has greater "leakage" of dollars out of the local area (*143*).

There are several guides that describe the processes for itemizing the economic benefits associated with transit systems and they are listed in the *Bibliography of Economic Development Impact Literature and Guides*. Most of the individual studies cited here, as well as those reference guides, address the existing economic effects of transit on spending by households and businesses, but do not forecast changes in a region's future economic growth or development. The forecasting of future regional economic development impacts associated with alternative scenarios for transit services were discussed previously in the context of evaluating proposed projects.

The following is an example of a local study of a transportation mode: Housatonic Area Regional Transit (*141*).

Issue—The Housatonic Area Regional Transit District (HART), in Danbury, Connecticut, wanted to improve public understanding that a transit system is "more than just a social program," and is indeed "an economic player" in the community. To illustrate the breadth of ways in which transit services affect the local economy, HART commissioned a study of the community role and benefits of HART services.

Analysis—The analysis study consisted of five steps:

- assembling data on the pattern of HART's direct expenditures on local wages and purchases of goods and services from local vendors;
- surveys of HART bus riders, indicating how they would change their travel and spending patterns if HART services were not available;
- calculation of direct, indirect, and induced effects of HART operating expenditures on local employment and wages, using I-O multipliers;
- calculation of the benefits of continuing HART services, based on the savings of user costs of switching modes, foregoing trips, increasing traffic accidents, and increasing air pollution without HART; and
- calculation of the public cost savings that would occur without HART subsidies.

Results—Based on the data collection and user survey, the study found that HART's operations support $3.3 million of local wage income. HART's service benefits include user cost savings of $5.5 million (representing the savings in costs of additional private automobile ownership, taxi fares, and auto accidents, as well as the value of foregone trips). However, these are partially offset by an additional local public cost of $3.3 million for HART operations, as well as a public subsidy of $4.2 million. This leaves a net benefit of $1.3 million for the local economy.

POST-PROJECT EVALUATION FOR HIGHWAY SYSTEMS

Post-project evaluations measure the actual impacts of transportation facilities or investments "after the fact," that is, after they are finished and in use. Many of these studies are conducted as academic research, although the results are sometimes used for public information or as case studies useful for future investment decision making.

Several techniques have been used by researchers for post-project evaluations. These evaluations have generally relied upon times-series data to measure economic conditions within a defined study area, both before a transportation investment is made and after the same transportation investment has been in place for several years. To varying degrees, many of the studies have used control groups or interview methods in an attempt to assess the extent to which observed economic changes can be attributed to the transportation investments. All of these methods have some limitations concerning their effectiveness in isolating transportation project effects. Typical measures of economic impact evaluated in post-project evaluations include output, jobs, property values, sales, business development, and changes in land uses.

Pre/Post Comparisons to Measure Regional (System-Wide) Impacts

For highway programs, there also have been pre/post studies, focusing on the impact of entire highway investment programs. Those studies typically include "before-and-after" data on regional economic conditions in the study area, and also compare changes over time in that area with economic changes in other regions.

An example of time-series comparison is the FHWA study of economic impacts associated with a series of highway, seaport, and railroad improvements made in the Mississippi Delta region (incorporating portions of seven states) between 1990 and 1995 (*144*). The study used U.S. Bureau of Labor Statistics data to calculate the change in regional employment from 1990 through 1995, compared with changes occurring at the national level. The study found that employment in the region grew nearly 20 percent faster in the area of transportation investment than in the nation as a whole. The study also recorded changes in labor force, unemployment, gross domestic product, population, international visitations, state tourism, public roads, miles of state roads, annual vehicle miles of travel, motor fuel tax rates, capital outlays for roads, port tonnage, and other factors to support a conclusion that the transportation investments made in the region stimulated economic growth. No statistical methods or control groups were used to assess causality between economic growth and transportation investments. Instead, the researchers interviewed key stakeholders and businesses in the region and solicited their comments on the importance of the transportation improvements to the region's economic growth. Those surveyed expressed a strong perception that the trans-portation investments in the region were indeed a key to the region's growth, as were supporting government initiatives and private sector support.

Another study (*145*) examined economic impacts of the Appalachian Development Highway System (ADHS). That study used a pre/post time series to measure economic changes in the affected Appalachian counties, and compared those changes with a statistical control group of other counties. It is described in more detail in the following example.

The following is an example of comparative pre/post impact measurement: the Appalachian Development Highway System (*145*).

Issue—The Appalachian Regional Commission (ARC) was established in 1965 with the goal of improving regional economic development in an isolated and economically depressed region of the United States. Its most prominent element was the initiation of an Appalachian development highway system, intended to open "areas with a development potential where commerce and communication have been inhibited by lack of adequate access." Subsequently, a series of studies on the effectiveness of this program have been conducted. One such study that compared before-and-after changes with a control group of other areas is described here.

Analysis—First, the study identified 391 counties in the Appalachian region. For each one, a county outside of the Appalachian region, which, as of 1959, was statistically matched to be its nearest twin in terms of population, economic profile, income level, distance from larger cities, and access to interstate highways was also identified. These twins represented a control group. To verify its appropriateness, the economic performance of the control group was compared with that of the ARC counties over a 6-year period preceding the start of the ARC (1959 to 1965) and found to have no statistically significant difference.

The study then tracked the economic (income) growth of the Appalachian and control counties over the initial start of ARC programs (1965 to 1969) and subsequent 21 years (1969 to 1991), during which there were continuing ARC investments in highways and other programs. Three subgroups of Appalachian counties were also identified: (1) those that had an interstate highway present, (2) those that had at least 3 miles of Appalachian development highways built during the period, and (3) those that had been designated as Appalachian Growth Centers.

Results—The analysis results were provided as the income growth rates among the Appalachian counties compared with that of their control group counterparts. It was found that the Appalachian counties grew faster, but that this difference was particularly large for those counties with Appalachian highway investments. The additional growth when compared with their control group counterparts from 1969 to 1991 were:

- +17 percent for all 391 counties served by the ARC,
- +32 percent for the 110 ARC counties with Appalachian Development Highways, and
- +15 percent for the 152 ARC counties with existing interstate highways (including those with no interchanges).

The Wisconsin DOT has also studied the overall statewide impact of its highway investments by completing a series of in-house research projects documenting how the spatial patterns of growth in business location and tourism changed over time, following the completion of new highways, rehabilitation projects, and bypass routes (*146–148*).

Pre/Post Case Studies of Localized Economic Development Impacts

Bypass Highways

There have been many case studies that examined the community economic development effects of local highways that bypass town centers. These studies have focused on assessing pre/post changes in the level of business activity in the town centers. They include a Wisconsin study of 17 communities (*149*), a Kansas study of 21 communities (*150*), an Iowa study of 11 communities (*151*), a Washington State study of 3 communities (*152*), and statewide studies of bypassed towns in Texas (*153*) and North Carolina (*154*). Highly detailed case studies of bypassed towns have also been done in Australia (*155*).

These various studies have largely relied on a combination of employment trend data and business interviews to assess whether business activity in the central business districts of small and medium-size towns declined after a new highway allowed through traffic to bypass that area. The studies essentially all showed that local factors can lead to positive or negative economic impacts on the central business districts. They generally concluded that bypasses typically had relatively little net impact on the economic activity in most communities, and those impacts were as often positive as negative. The larger and more tourist-oriented communities were most likely to enjoy positive impacts. When there were negative impacts, most of them were in smaller communities.

Highway Interchanges and Medians

Other nationwide case studies have examined localized economic development patterns associated with the openings of new highway interchanges in local areas (*156*) and the changes in business patterns associated with the imposition of highway median barriers restricting turns into businesses (*55*). Both types of studies collected information on cases throughout the United States, and how the patterns of business establishments at those locations changed compared with surrounding areas that were not directly affected.

Highway Rehabilitation

Wisconsin also has assembled case studies of the impacts of highway rehabilitation projects. Those case studies covered impacts on user travel time and cost, safety, tourism impacts, and the relationship to local economic development initiatives (*148*).

Regional Highway Corridor Projects

In the United States, most of the pre/post studies of economic development impacts have been either at the regional level of large multistate investment programs (such as the Appalachian Region and Delta Region studies) or at the very localized level of town center bypasses and areas around highway interchanges (as previously cited). There has been relatively little in the way of empirical data collection on how specific individual intercity highways in the United States have subsequently affected regional growth along their corridors.

Further examples of pre/post studies of regional economic impacts of individual highways can be found in Europe. In France, the Ministry of Transport sponsored evaluation studies of seven large motorway projects (*157*). These studies examined before and after changes for each of the motorway corridors and compared them with changes occurring in other areas with similar socioeconomic characteristics. The studies tracked changes in population and employment patterns over time (1975 to 1990) and also surveyed how the motorways affected the costs, markets, competition, and transport patterns for firms within the project area. The study showed that there were clear effects on business behavior and the spatial pattern of economic activity, although it was still difficult to quantify the net economic impact attributable just to the motorway projects.

Several studies of pre/post changes have been conducted in Finland (*158*). One was a study of the regional development effects of a new highway between Lahti and Orimattila. It found that the highway caused shifts in regional shopping trips and retail sales patterns, particularly from smaller villages and cities in the middle of the corridor to a larger city at the end of the new road. A broader study in 1996 surveyed local authorities in 62 rural districts and 19 cities regarding the impacts of road, rail, and airport changes occurring during the 1980s. There was also a statistical analysis of population and economic changes in those areas. A general finding concluded that intercity access improvements helped the commercial growth of cities after a 5- to 10-year period, and also helped the industrial base of cities after a 10- to 15-year lag. Such improvements were also found to help rural communities attract more commercial and service employment, which helped increase their tax base.

Looking to the future, a long-term pre/post (longitudinal) study design has now been implemented to track future economic development impacts of the Oresund Bridge, which will connect Sweden and Denmark (*159*).

The following is an example of a study measuring the localized impact of a built highway: the Berrima and Mittagong Bypasses (*155*).

Issue—Australia's Bureau of Transport and Communications Economics selected the Berrima and Mittagong

bypasses "as the first in a series of case studies which are examining the regional development effects of infrastructure investment, and assessing whether significant economic growth benefits are omitted in conventional benefit/cost analysis." Both are small towns, and their bypasses were part of a more extensive project of upgrading the Hume Highway from Sydney to Melbourne.

Analysis—The analysis process involved six elements:

- measurement of the change in traffic volumes through the towns;
- face-to-face interviews with retail and tourism businesses in the towns, with a follow-up telephone survey, to collect information on actual changes in business sales and employment as well as their expected future changes;
- a mail survey of retail and tourist businesses in the neighboring towns of Moss Vale and Bowral, to serve as a control group;
- a mail survey of manufacturing businesses in all four towns and surrounding areas, to collect information on changes in their production and freight costs;
- contacts with city officials and real estate brokers to obtain information on land and property values and changes in income tax revenues; and
- a survey of tourists along the Hume Highway.

Results—The study found that the loss of local traffic congestion increased the relative tourist and shopper appeal of Berrima from 1993 to 1995, leading to net increases of 7 percent in gross sales, 2 percent in employment, 8 percent in property values, and 5 percent in income tax revenue. Surveys indicated expectations that these increases would double in the long run. Conversely, Mittagong's economy suffered short-term losses of 6 percent in gross sales, 3 percent in employment, and 4 percent in income tax revenues, with no loss in property values. However, local business operators perceived those changes to be short-term effects of traffic rerouting and still anticipated net increases in their long-term patterns. It was concluded that the Berrima impacts appeared more positive because of the town's greater "historic appeal," greater increase in parking, and the longer time period for observing changes.

Use of Economic Simulation Models to Assess Highway System Impacts

In some cases, simulation models have also been employed to assess changes in economic conditions before and after a transportation investment and to pinpoint causality for differences over time. A 1998 study for the ARC used an econometric model "to measure, in retrospect, the extent to which the completed portions of the Appalachian Development Highways System (ADHS) have contributed to the economic well-being of Appalachia" (*160*). The researchers used the REMI forecasting and simulation model as a primary research tool. (Because that model is normally used to forecast future conditions resulting from a proposed project or program, a full discussion was provided earlier in this chapter, in the context of its primary use for investment decision making.) In this particular study of the ADHS, the researchers wanted to adapt the economic simulation model to forecast how past regional economic growth would have been different had the ADHS never been built, so they could compare those expected conditions with actual economic conditions that have occurred since the highway investments were made. The study estimated the travel efficiencies and business cost competitiveness improvements resulting from completion of segments of the ADHS, and then used the economic simulation model to calculate changes in the region's economy. Researchers used the model results to calculate the net present value of the highway investment, the internal rate of return of the highway investment, and a benefit/cost ratio.

Use of Input–Output Models to Assess Highway System Impacts

Several state transportation departments also have commissioned studies of the effects of their highway programs on statewide economic development. Studies of statewide highway systems in Texas, Maryland, and Kansas estimated the statewide economic growth impact of their highway spending programs. In each case, researchers used an I-O model to calculate the total economic activity supported by highway spending and subsequent purchases of labor, goods, and services (*89,161–163*). Using the results from the I-O modeling, these studies assessed how the state's economy would differ with and without the highway investment. The Maryland study also employed an econometric model to account for changes in business operating costs over time and industry "cost functions" to capture business productivity growth attributable to highway investment.

Statistical Analysis Models of the National and Regional Productivity Benefits of Prior Highway Spending

Beginning in the late 1980s, a series of academic research studies in the United States and The Netherlands examined regional or national economic growth and change over time, applying regression and simultaneous equation models to assess the relationship between levels of transportation investment and resulting changes in business location and regional development patterns. This included work done in the United States by Duffy-Deno and Eberts (*164*) and work in The Netherlands by Evers et al. (*165*).

A separate group of researchers addressed a different question, which was how the existing stock of transportation infrastructure has affected national economic productivity and the level of national economic growth over time. For each of these studies, the amount of transportation infrastructure was measured as the dollar value of the "capital stock," which essentially represents an estimate of the amount of usable highway facilities in the nation. Pioneering work on this topic by Aschauer (*166*) in 1989 showed a positive relationship between highway capital stock and productivity. Subsequently, other studies were conducted to refine the magnitude and causation of those estimated effects. These include (among others) studies in the United States by Munnell (*167*), Pinnoi (*168*), and Bell and McGuire (*169*), and in The Netherlands by Toen-Gout and van Sinderen (*170*). Critical reviews of this line of research are provided by Arsen (*35*) and Boarnet (*36*).

More recent work by Nadiri (*27*) has further refined the causal relationship and shown how it varies by industry, as well as over time. His finding of declining productivity benefits over time was attributed to a more built-up highway network in recent decades. Additional work by Fraumeni (*171*) has addressed a remaining issue, which is the problem of valuing the accrued capital stock of highways. This work has attempted to more closely represent the aggregate level of usable capacity or service provided by highways, rather than merely be an economic measure of depreciated prior spending.

Some of the critiques of this line of research concern not the historical analysis or models, but rather how the findings are interpreted. One interpretation is that the research findings reflect the economic returns from transportation efficiency improvements in the past and do not necessarily conclude that continuing highway building will bring similar efficiency benefits or economic growth (*39*).

In the United Kingdom, the Standing Committee on Trunk Road Assessment recently completed a 3-year review of worldwide evidence and literature regarding transport effects on the economy (*38*). The committee concluded that "theoretical effects can exist but none of them is guaranteed . . . Generalisations about the effects of transport on the economy are subject to strong dependence on local circumstances and conditions."

Statistical Analysis Studies: Local Property Value Impacts of Rail Transit

Pre/post studies of changes in property values have primarily been used to measure the impacts of fixed rail public transit lines. The most famous are the two sets of BART (Bay Area Rapid Transit) impact studies in northern California. These are classic examples of post-project evaluations, which have been used extensively as case study materials in other regions. The BART impact studies used time-series data in a regression analysis in an attempt to identify the impact of the BART system on the economy of the San Francisco region. The original BART impact studies, completed within 5 years of the opening of the system, found, at best, modest impacts. Researchers and policymakers generally agreed that the original BART impact studies were conducted too soon after initiation of BART service to capture the economic impacts expected over time. Thus, a new study was undertaken 20 years after the system opened. Again, regression analyses, including regressions of factors affecting property values ("hedonic price models"), were used to measure impacts on property values, retail sales, regional employment, and land development (*172*). As expected, the second study did identify greater positive impacts from the BART system than did the initial study.

Other notable studies of the effects of access to rail transit on urban land values during the 1990s include the work of Landis (*173*) and Workman and Brod (*174*). In general, these studies use pre/post data on property values for areas that have (and do not have) close access to rail transit, and apply regression techniques to isolate the impact of transit station proximity to changes in those values. The literature in this field is summarized in a guide to the analysis of transit impacts (*175*), in a review of 18 studies (*176*), and in a recent book on public willingness to pay for access and other amenities (*177*).

SUMMARY OF KEY FINDINGS

This chapter reviewed the wide range of applicable analysis methods for assessing economic impacts from transportation investments. Key findings included:

- Transportation agencies assess economic development impacts for a number of different reasons, which dictate whether the analysis perspective is to forecast the future impacts of proposed projects, estimate the current economic role of existing systems and facilities, or measure the actual impact of already-completed projects.
- The different analysis perspectives call for a wide range of applicable data collection methods, including interviews and surveys, direct observations, and/or assembly of economic data from secondary sources.
- The different types of data may be used with a number of analytic techniques, ranging in complexity from simple case studies to statistical regression models and complex economic simulation models.

A more complete statement of key findings is provided in chapter 5 (Conclusions).

CHAPTER FOUR

CURRENT STATE OF AGENCY PRACTICE

OVERVIEW: DIMENSIONS OF AGENCY PLANNING AND OPERATION

Transportation planning agencies—whether operating at the national, state/province, or metropolitan level—usually have a range of responsibilities for programs or projects spanning planning, prioritizing, design decision making, evaluation, and public education. Economic development concerns may play a primary or secondary role in any of these functions. This leads to the following types of agency involvement with economic development impacts:

- *General Investment Programs*—Some agencies explicitly recognize economic development as a factor to be considered in project selection (for their primary transportation investment programs);
- *Special Economic Development Programs*—Some agencies offer special transportation investment programs aimed specifically at promoting economic development;
- *Regulatory Involvement*—Some agencies estimate potential economic development impacts of proposed projects as a required part of the broader environmental impact assessment process; and/or
- *Evaluation or Education*—Some agencies measure economic development impacts of past investments either to evaluate their past investment strategies or to demonstrate their benefits for public education.

This chapter explores how transportation planning agencies have become involved with each of the above types of programs or processes. The following sections address these topics: (1) the various *uses* that transportation planning agencies have for economic development impact studies, (2) the scope of *impact measurement* in the agency studies, (3) the *methods* employed to measure those impacts, (4) the *policies* the agencies have regarding roles of economic development impacts in investment decision making, and (5) the types of *special programs* they offer to promote desired economic development impacts.

The primary source of information for this chapter is the survey of transportation planning agencies described previously in chapter 1. The survey questionnaire is provided in Appendix A.

USE OF ECONOMIC DEVELOPMENT IMPACT STUDIES

Motivations for Valuing Project or Program Impacts

Before focusing specifically on economic development, it is useful to note the extent to which transportation planning agencies perform any kind of empirical analysis of the economic value of their projects or programs (in terms of either user-benefit or economic development impact). Survey results, shown in Figure 4, indicate that a majority of the agencies have at some time conducted assessments of the value of road, airport, and railroad projects. However, only a minority (between one-third and one-half) has a policy of regularly calculating such values for their major projects. Such economic valuation is less common for public transit and water (port) projects.

The major reasons for assessing the value of project impacts are reported to be (in order of descending frequency):

- benefit/cost analysis,
- program or project planning, and
- public information or discussion.

Conversely, when the values of impacts or benefits associated with transportation projects are not assessed, the most common reasons for not doing so are that they are not needed or required, or that there is no demand or audience for the information. A more complete breakdown of the reported motivations for assessing the value of project impacts is shown in Table 2.

Reliance on Economic Development Impact Analysis

Economic development impact analysis is essentially never viewed as a substitute for the evaluation of transportation system (user) impact analysis. Rather, it is used as a complementary form of analysis, which provides insight into some nonuser impacts. Figure 5 shows that for all transportation modes economic development impact analysis is conducted by fewer agencies than transportation system (user) impact analysis. There are also some differences among types of agencies: the metropolitan planning agencies are less likely to assess economic development impacts than are state and provincial transportation departments.

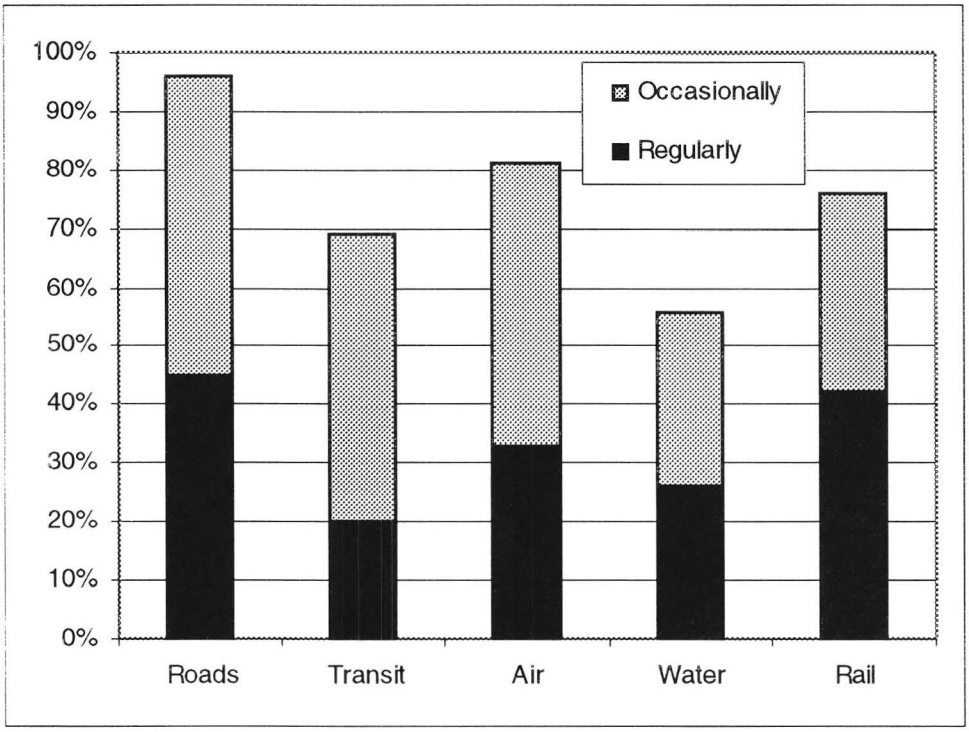

FIGURE 4 Percentage of agencies assessing the value of transportation project impacts or benefits. (*Source*: Survey of transportation planning agencies, question 4.)

TABLE 2
PURPOSES FOR ASSESSING THE VALUE OF PROJECT OR PROGRAM IMPACTS

	Percentage of All Agencies Conducting Impact Valuation Studies for the Given Travel Mode*				
Purpose for Assessing Impacts	Highways	Transit	Air	Water	Rail
a. Program or project planning	84	58	59	73	55
b. Rank alternatives	69	50	41	33	45
c. Environmental impact assessment	57	42	48	40	31
d. Benefit/cost analysis	86	63	44	53	62
e. Evaluate prior investment	12	8	11	7	7
f. Public information or discussion	65	58	70	60	59
g. Other	6	4	4	6	3

*Many agencies had more than one purpose for assessing impacts.
Source: Survey of transportation planning agencies (question 5).

Motivations for Specifically Focusing on Economic Development

Motivations for specifically studying economic development impacts differed from the broader motivations for valuing user benefits or impacts. Figure 6 shows the percentage of respondents reporting each major reason for studying economic development impacts.

These results show that more than one-half (50 to 60 percent) of all agencies reported having been motivated to study economic development impacts as a response to local concerns about the adverse effects of proposed projects, or as a factor in project ranking, selection, or benefit/cost analysis. Significant minorities of agencies (40 to 50 percent) reported that they studied these impacts for other reasons: for public relations, to fulfill environmental impact assessment regulations, or to assist in refining project plans.

Combining the results of Table 1 and Figure 6, it becomes apparent that benefit/cost analysis is the most common motivation for assessing the value of user benefits, whereas local concerns about adverse impacts are the most common motivation for assessing economic development impacts.

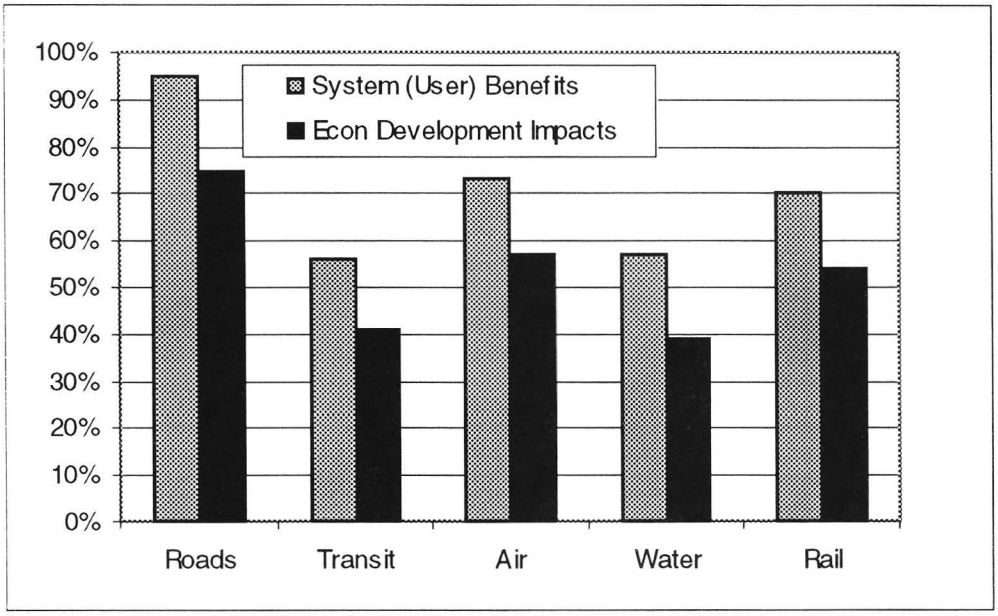

FIGURE 5 Percentage of agencies that have assessed economic development and other user benefits. (*Source*: Survey of transportation planning agencies, question 7.)

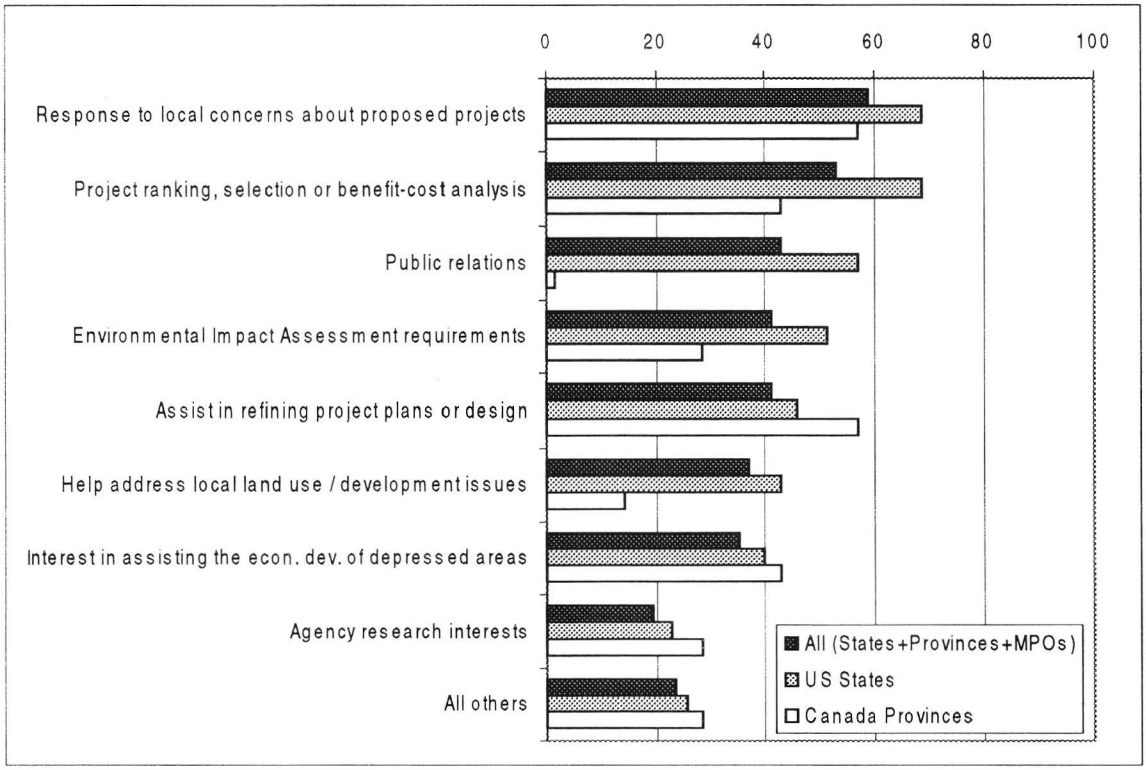

FIGURE 6 Motivation for specifically studying economic development impacts. (*Source*: Survey of transportation planning agencies, question 16.)

Types of Applications

Economic development impacts are usually assessed for large infrastructure projects. For highway and transit modes these are likely to be major system improvements, such as new or expanded highways or transit lines. For other modes, these projects tend to be specific terminals, such as airports, seaports, or rail/truck intermodal facilities. Economic impact analysis is done less commonly at the state/province or metropolitan area for entire spending

programs or for incremental system improvements, presumably because of greater difficulty in establishing the causal link between spending and economic growth at those geographic levels. The following list cites the most common types of subjects for the assessment of economic development impacts, as derived from those respondents answering yes to question 7 of the survey questionnaire (percentages reflect the portion of all agencies that have conducted at least one study of economic development impacts for that mode):

- *Road transport investments*—Highway system capacity enhancement (97 percent), highway interchange (46 percent), and overall spending program (46 percent).
- *Public transit investments*—System capacity enhancements (64 percent) and intermodal (bus/car) facilities (50 percent).
- *Rail transport investments*—Intermodal rail/truck facilities (71 percent) and rail system capacity enhancements (66 percent).
- *Air transport investments*—Airport facilities (53 percent) and equipment/facilities upgrade (41 percent).
- *Sea transport investments*—Seaport facilities (62 percent) and intermodal (sea/rail/truck) facilities (54 percent).

Use for Project Justification

It is notable that among agencies that have assessed the economic development impacts of a project, roughly one-half have justified some specific projects primarily on the basis of economic development benefits. The percentages, shown in Figure 7, are the highest (50 to 60 percent) for road and rail projects, and significantly lower (20 to 40 percent) for public transit, airport, and water transportation projects.

Role in Standard Project Evaluation

Although one-half of the agencies have had the occasion to use economic development impacts as a project justification, far fewer have a policy of formally including economic development impact analysis as a regular component of their project evaluation procedures. Figure 7 shows that the percentage of agencies with such formal policies is roughly 30 percent for road, air, and water transport; slightly lower for public transit (roughly 20 percent); and slightly higher for railroads (45 percent).

Where an economic development impact analysis is conducted regularly as a component of project evaluation, there is wide disparity regarding rules for when it is necessary. Many of the surveyed agencies reported that this decision frequently is made on a case-by-case basis. There are some major investment projects for which such analysis work is mandated to qualify for federal funding, but more often economic development impacts are seen as an additional level of information for evaluating a project's benefit. A sampling of responses is presented here:

- "on a case-by-case basis prior to project initiation—primary concern is if project complexity justifies the assessment."

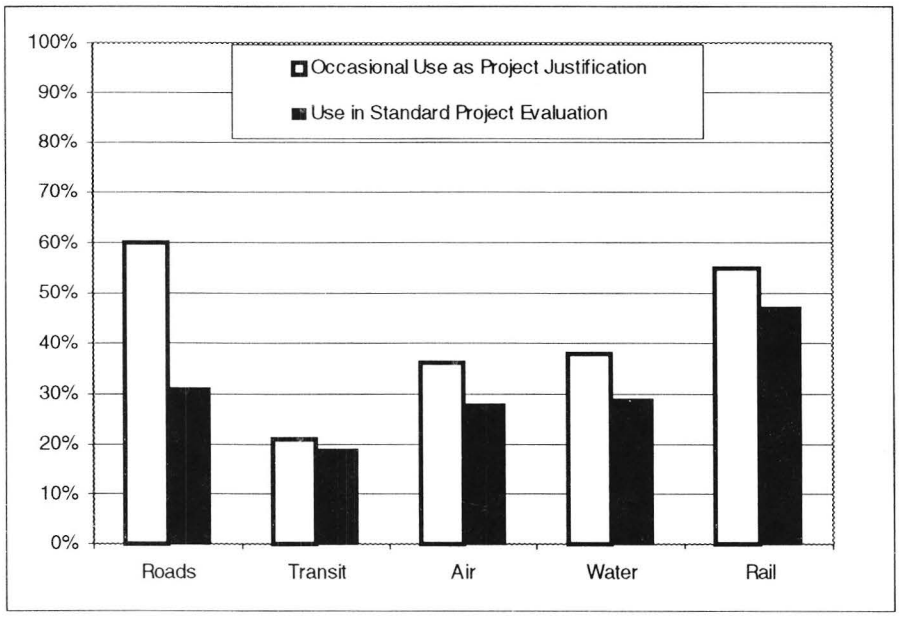

FIGURE 7 Use of economic development as a project justification or project evaluation criteria. (*Source*: Survey of transportation planning agencies, questions 18 and 19.)

- "only system enhancement and economic development projects are selected using economic development potential as a criteria."

- "benefit/cost analysis is conducted for all projects; economic development impacts are also assessed for certain projects that are proposed based on their economic impact on local economies, business, and jobs."

- "for compliance with federal, state, and local laws; for large-scale projects that could require alternative funding sources; all projects significantly affecting the environment undergo economic analysis."

- "most all projects for which an environmental impact report is required, as such reports must include socioeconomic and community impacts and they can include project effects on economic development, activity, and employment."

- "no formal rules; informally, decisions are made when there is a determination that facility use/needed expansion is predicated on economic growth."

- "the (state's) project prioritization procedures consider a subjective assessment of economic development potential or support of existing or ongoing development."

- "required for all new start transit projects; generally used on other projects as well, because we prefer to have broad evaluation measures available and we have in-house expertise (to perform the analysis)."

- "on projects that are (1) expensive, (2) environmentally or historically significant, or (3) controversial—these types are candidates for economic development impact assessment."

- "need public relations value to support the project."

SCOPE OF ECONOMIC DEVELOPMENT IMPACT STUDIES

Impact Measures

There are many different ways of measuring economic development impacts of transportation investments, as described in chapter 2 and Figure 1. When selecting among those impact measures there are several factors to be considered, including: (1) information available, (2) usefulness for public information, and (3) usefulness for decision making.

The most popular measures of economic development impacts as used in studies by transportation planning agencies (shown earlier in Figure 1) are employment, personal income, and tourism. In the past, a lower percentage of agencies have also assessed effects on business output, business productivity, business (dis)location, and property values/development. However, survey respondents felt that there were significant differences in the measures of greatest public interest and those of greatest importance to decision makers. These differences are shown in the following list, which presents the most widely used measures of economic development for each of these different criteria as derived from the responses to questions 1–4 of the survey questionnaire (percentages reflect the portion of all agencies that have conducted a study of economic development impacts):

- *Most frequent in past studies*—Employment (79 percent), personal income (57 percent), and tourism (57 percent).
- *Most useful for public information*—Employment (76 percent) and property development and values (28 percent).
- *Most interest for potential future studies*—Employment (77 percent), tourism (68 percent), and business (dis)location (66 percent).
- *Most important for decision makers*—Employment (52 percent), economic output (33 percent), and tourism (29 percent).

Although the survey shows that many different measures of economic development impacts have been used by public agencies, this state of practice is consistent with the academic research literature described in this chapter, which has also used essentially all of these different impact measures.

Among agencies using these economic development impact measures, the ones perceived as most important for communicating to the public are employment and property development/property values. Those rated as most important to decision makers are employment, economic output, and tourism. Those rated as most desired for future analyses are employment, tourism, and business location patterns. Weighing all of these criteria, employment changes represent the most important and universally recognized measure of economic development impacts.

Study Area and Time Frame

Economic development impacts must be defined in terms of a specific study area (as discussed in chapter 2). The vast majority (more than 80 percent) of agencies conducting economic development impact studies reported conducting such studies both for the agency's own jurisdiction (i.e., the state, province, or metropolitan region) and for the localized area surrounding the project itself. Only two states and two Canadian provinces reported also assessing economic development impacts at the national level.

TABLE 3
ECONOMIC DATA SOURCES USED IN ASSESSING ECONOMIC DEVELOPMENT IMPACTS

Source of Economic Data	Agencies Using this Data Source for Assessing Economic Development Impacts (%)
Census and other population and workforce data	84
Local interviews or surveys	79
Local/regional economic forecasts	70
Freight or commodity flow data	58
Economic Census or BEA business data	56
Tourism, convention, and visitor data	52
County Business Patterns and other employment data	56
Business market studies of local area	40
BTS travel data	35
Case studies of other areas	35
Private business data sources (ABI, D&B, etc.)	33
Property value data	30
All other types of data	19

Note: BEA = U.S. Bureau of Economic Analysis; BTS = U.S. Bureau of Transportation Statistics; ABL = American Business Lists; D&B = Dun & Bradstreet.
Source: Survey of transportation planning agencies (question 12); results among respondents answering yes to question 7.

Nearly all (98 percent) of the agencies reported conducting forecasting studies, focusing on expected impacts of proposed projects. Far fewer agencies (47 percent) reported conducting evaluative studies, focusing on the measurement of actual impacts of past investments. However, there were significant differences among agencies in the amount of evaluative analysis reported. The rate was highest for Canadian provinces (85 percent), and significantly lower for states (42 percent).

METHODS USED FOR ASSESSING ECONOMIC DEVELOPMENT IMPACTS

There are three elements required to assess economic development impacts of transportation investments: (1) the necessary data, (2) appropriate analysis tools, and (3) staff resources. Typical practice for each of these is summarized here.

Data Sources

To analyze economic development impacts, basic data must normally be assembled covering business and employment patterns for the study area. Depending on the nature of the study, information also may be required on tourism patterns, property values, and business markets. Table 3 summarizes the extent to which agencies rely on the various sources of economic data. The two most commonly reported categories are census data and travel data.

Analysis Tools

The assessment of economic development impacts may require several types of analysis tools. They include:

- *Transportation tools*—to analyze the nature of the transportation projects or investments and the resulting changes in travel conditions and patterns (using travel demand and/or traffic network models). These do not address economic development impacts directly, but they may provide an input into economic analysis tools.

- *Economic development analysis tools*—to forecast future economic conditions in the study area (using tools such as input/output models, economic simulation models, market studies, or case studies) or to analyze current or past impacts on the study area economy (using statistical analysis tools, on-site observations, or surveys). These tools and their applications are addressed in chapter 3 of this report.

- *Related analysis tools*—to forecast other implications that follow from the analysis of economic development impacts. These may include fiscal (tax/revenue) models and/or benefit/cost spreadsheet methods.

Table 4 shows the extent to which these various analysis tools are used.

A variety of factors go into the choice of analysis tools. Survey respondents were asked why they selected various methods or tools and what were the perceived benefits or liabilities of these methods and tools. The most frequently cited factors were costs, data availability, and time constraints. A sampling of responses is presented here:

- "to get a more comprehensive picture of impacts."

- "each method has limitations in terms of scope and capability."

TABLE 4

ANALYSIS TOOLS USED FOR ASSESSING ECONOMIC DEVELOPMENT IMPACTS

Analysis Tools Used in Studies Assessing Economic Development Impacts	Agencies Assessing Economic Development Impacts (%)
Transportation tools	
Travel demand or traffic network models	67
Economic development analysis tools	
Direct surveys or interviews	67
Direct on-site observations	58
Input/output models (IMPLAN, RIMS-II, etc.)	56
Statistical/regression tools	51
Macroeconomic simulation models (REMI, etc.)	44
Comparison to case studies elsewhere	44
Custom spreadsheet tools	43
Economic market studies	40
Geographical information systems (GIS)	37
Related analysis tools	
Benefit/cost analysis tools	88
Fiscal impact models	21
All other types of tools	9

Source: Survey of transportation planning agencies (question 13).

- "different requirements by the Federal Government."
- "speedy decision requirements may preclude detailed economic impact study."
- "methodologies not definitive; multiple methods needed to increase confidence in findings."
- "different methods are needed for program vs. project analysis; economic development impacts may be on statewide, regional, or local basis—so methods are project dependent."
- "analytic tools which are not data hungry, complicated, and expensive are NOT available."
- "time constraints and data availability dictate methods; regression analysis is respected but rarely used; the (state) Employment Commission can process a scenario through their I-O model in several days but it has little value for long-term forecasting."
- "different models are used for different components of the analysis: economic impacts, fiscal/tax impacts, benefit/cost analysis."

ECONOMIC DEVELOPMENT ANALYSIS STAFF

The surveys showed that the primary individuals conducting the economic development impact analyses were outside contractors (reported by 93 percent of all respondents), followed by in-house planners/engineers (73 percent) and economists (37 percent). However, the distinction between planners, engineers, and economists is potentially misleading, for it can indicate an agency's generic position titles rather than the educational training or actual responsibilities of the individual staff member.

The differences among transportation departments of the Canadian provinces and those of the United States are particularly striking. The Canadian provinces reported a much higher dependence on their own staff economists and planners/engineers when conducting economic development studies than did the states, where the DOTs have a much greater reliance on outside contractors to conduct those studies (see Figure 8).

The transportation planning agencies were also surveyed concerning the size and type of those in-house staff actively involved in assessing economic development impacts. It was found that most state and Canadian provincial transportation departments address economic development issues within their planning or policy divisions. However, some state DOTs do have a section or division charged specifically with economic development. For example, the New York State DOT has a Freight and Economic Development Division, the Washington State DOT has a Transportation Economic Partnerships Division, and the Wisconsin DOT has an Economic Development and Planning Section.

In Europe, economic development issues are most often addressed by a separate economics division. For example, in the United Kingdom, the Department of Environment, Transport and Regions addresses economic impacts within its Highways Economics and Traffic Appraisal division. In The Netherlands, there is a Transport Economics and Cost-Benefit Analysis Unit, but it is officially located within the Ministry of Economic Affairs' Central Planning Bureau

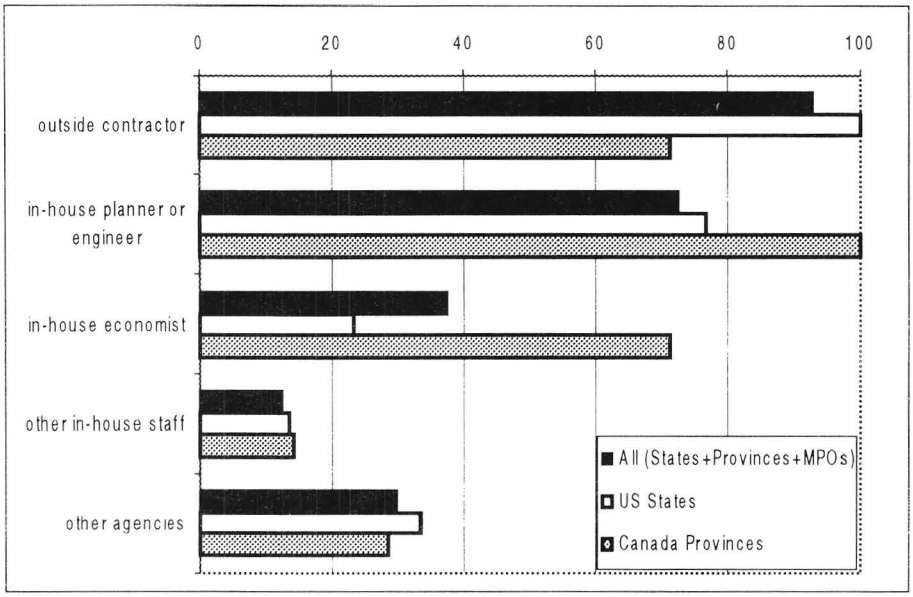

FIGURE 8 Primary individuals conducting economic development impact analysis, by job classification. (*Source*: Survey of transportation planning agencies, question 15.) Percentages total more than 100 percent because of multiple responses.

(specifically its Bureau for Economic Policy Analysis), rather than within the Ministry of Transport and Public Works.

Almost all responding state and Canadian provincial agencies indicated that their staff work part-time on economic development and part-time on other planning or policy issues. In most cases, the number of part-time staff with some involvement in economic development issues numbered between 1 and 4, although several state DOTs reported that they can bring in more than a dozen staff members to address economic development issues on an as-needed basis. The only survey respondents that confirmed having full-time staff involved in assessing economic development impacts were the states of North Carolina and Wisconsin, and the United Kingdom.

NEEDS FOR IMPROVEMENT IN ANALYSIS METHODS

Evolving Needs

It is generally perceived that the need to examine economic development impacts has increased over time. As projects become larger and more complex, and as public participation plays a larger role in transportation project evaluation, information on economic development impacts increasingly is being perceived as valuable for understanding the total impact of project proposals. As one respondent wrote, ". . . the public is more sophisticated in its expectations and its scrutiny of proposed projects and impacts. More projects are focused on enhancing freight flows. However, resources are limited and the needs are significant. We need to be assured we are obtaining the greatest return on our transportation investments."

Satisfaction and Remaining Problems

As previously noted in this chapter (and shown in Figure 6), transportation planning agencies reported that their motivations for conducting economic development impact studies were to assist them in decision making, planning, regulatory reporting, and public information dissemination. Respondents were then asked to report on how successful the actual studies were in addressing those stated needs. A majority reported that the studies were successful in addressing their needs. The remaining minority (about one-third) reported that the studies were "partially successful" in meeting their needs. However, even those who reported that their past studies were successful often reported that they still saw significant limitations affecting their ultimate usefulness. Some of their major points are summarized here:

- One common complaint was that the results of economic development impact studies are not accepted universally, because of many local and regional variations in the economies of project locations. This point was summarized by one respondent: "The absence of a clear, single way to do the studies and interpret the results leaves the impression with all parties that it is possible to 'shop' for desired results."

- Another problem offered by several respondents was that there do not seem to be any consistent standards for the analysis of economic development impacts, either methodologically or in interpreting results.

- Others noted difficulties resulting from the inexperience of agency staff, inadequate data, and the complexity of the analysis. These difficulties made the analysis of economic development impacts more expensive to address, because they increased requirements for outside contractors and additional data collection.

- Still others noted that in congested metropolitan areas, as well as some other high-density regions, further economic development associated with a transportation project is not always welcome.

Priorities for Improvement

In a nearly unanimous position, the responding agencies indicated a desire to better address economic development impacts. They perceive an ongoing need for further research to validate the link between transportation and economic development. They also cited a need for more complete and understandable analysis tools, more available data, better staff training, and the clarification of standards. Approximately 60 percent of respondents rated each of these items as being of major importance and 30 percent rated them of minor importance.

PLANNING POLICIES REFLECTING ECONOMIC DEVELOPMENT FACTORS

As noted earlier, approximately 30 percent of the responding transportation agencies indicated that they have processes for recognizing economic development impacts as a regular component of their project evaluation procedures. In some cases, there are merely procedures for recognizing such impacts, whereas in other cases there are more formal policies. Some examples of more formal policies for highway investment planning (as of the beginning of the year 2000) are provided here.

National Policies (United States)—The Transportation Equity Act of the 21st Century (TEA-21)

TEA-21 provides federal funding and processes for planning and distribution of federal funds for the period of 1999 to 2003. It is more explicit than previous funding laws in identifying economic development as one of the key considerations in planning and funding decisions. TEA-21 includes the following components:

- *State and Metropolitan Planning Processes*—sets forth the framework, jointly administered by FHWA and FTA, for making transportation investment decisions by state DOTs and MPOs. One of the seven planning factors is to "support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency." The other six planning factors—connectivity, accessibility and mobility, environment/energy/quality of life, system management, system preservation, and safety—can also affect economic development.

- *National Corridor Planning and Development Program*—allocates funds to states and MPOs "for planning and construction of corridors of national significance, economic growth, and international or interregional trade."

- *Appalachian Development Highway System (ADHS) Program*—provides continuing funds for the construction of Appalachian corridor highways in 13 states "to promote economic development."

- *Transportation and Community and System Preservation Pilot Program*—provides grant funding for planning and implementation of projects that "ensure efficient access to jobs, services, and centers of trade."

- *Railroad Rehabilitation and Improvement Financing Program*—provides loans and loan guarantees for railroad capital improvements. Project selection criteria specifically includes promoting economic development and enabling U.S. companies to be more competitive in international markets.

- *Access to Jobs Program*—provides grants to local governments and nonprofit organizations "to connect welfare recipients and low-income persons to employment. . ."

The ADHS is of particular note because it represents a program implemented in a partnership between the federal government and 13 states, through the ARC. The ADHS is an ongoing effort to develop a 3,035-mile highway system to open up access to communities in an economically depressed and historically isolated region (*178*).

National Policies (United Kingdom)—Trunk Road Review Process

In the United Kingdom, decisions regarding national investment in highways are made on the basis of a multiattribute "Roads Review Appraisal." The new system, initiated in 1998, provides a process combining monetary

measurement of user benefits together with a qualitative (nonmonetary) scoring system for other economic development, environmental, and public accessibility criteria. It implements new approaches for specifically recognizing the impact of proposed projects on "journey time reliability" and "regeneration" (revitalization of distressed areas). The latter is defined on the basis of (1) "whether or not the scheme serves a regeneration priority area and may have a general potential to help regenerate the area" and (2) "whether or not the specific developments in these regeneration priority areas are dependent on the trunk road alone" (*179*).

World Bank Investment Policies

The World Bank invests in transportation and other infrastructure projects in developing countries, with the specific intent of promoting economic development. These investments may include airport, highway, rail, sea/river port, or urban transport projects. Specific potential investments are assessed by considering a wide variety of factors including their potential effectiveness in reducing transportation costs for the distribution of products, improving worker access to jobs, and/or improving economic linkages between farms, factories, ports, and international markets.

These types of factors are considered in constructing measures of the expected social value and rate of return on transportation investments. A variety of different impact measures have been applied for various World Bank projects over time, including local agency economic performance, user impacts, and economic development (business expansion) impacts. The latter include factors such as increases in household income for the lowest income groups, increases in exports, and stabilization or reduction in commodity prices (*180*).

Examples of State Policies (United States)

Several states have adopted project selection and prioritization criteria that specifically include economic development impacts as decision criteria. Examples include the following:

- *Wisconsin DOT's "TransLinks 21"*—This investment strategy was adopted in 1994 as a 25-year planning document to provide a multimodal framework for evaluating transportation priorities (*181*). By means of this process, alternative statewide transportation strategies were explicitly rated by how they would affect the state's key target industries. From within this framework would later emerge more detailed plans for highway, airport, rail, bicycle, and transit modes for the year 2020. The highway plan is now referred to as "Corridors 2020" (*182*). As part of this process, Wisconsin DOT's Economic Development and Planning Section met with business and economic development organizations in the state to identify needs and opportunities, and it is now continuing to coordinate policy and programming strategies for each of the modal plans.

- *Louisiana's Port Prioritization Program*—Louisiana has implemented a system for prioritizing port investments among the state's 6 seaports and 18 river ports (*183*). The program evaluates all proposed port investments in the state on the basis of their strategic benefit or economic return for the state's economy. Projects are then ranked on the basis of benefits to shippers, permanent job creation and payroll, and economic return to state taxpayers. By requiring a cost/benefit analysis from the statewide perspective, it optimizes statewide economic return and avoids investing in port projects that merely relocate existing activity.

- *Montana's TranPlan 21*—The Montana DOT commissioned a review of the state's economic development trends, issues, needs, and opportunities, and linked them to transportation issues in four areas: rural access to outside markets, economic diversification, international trade, and tourism (*184*). Based on those findings, the Montana DOT adopted a series of policy actions and goals:

  - to promote access for industries that export to neighboring regions and the global marketplace, by working with surface mode shippers and carriers;
  - to ensure consideration of economic development priorities in transportation programming, through coordination with the state department of commerce and recognition of economic development in the project selection process;
  - to engage in multistate and regional initiatives to facilitate international cooperation through coordination with Canadian provincial governments and participation in trade corridor initiatives; and
  - to promote tourism, through funding for scenic byways and tourism access, as well as project evaluation criteria that recognize "preservation of community character that enhance tourism and local development."

Many other states have also adopted statewide transportation system plans or policies that are specifically designed to improve connections between economic generators and population centers. These overall plans explicitly cite

goals of enhancing intrastate accessibility and connections to support statewide growth and economic development objectives. Examples of these other programs or policies include:

- *North Carolina: Economic Development Highways*—The *Highway Trust Fund* is a statewide program designed to improve connections between population centers, with the explicit intrastate purpose of supporting "statewide growth and economic development objectives." *Transportation 2001* is a more recent state policy, which accelerates funding specifically for "key economic development highways through the state," and specific corridors within the North Carolina Intrastate Highway System (*185*).

- *Minnesota's Interregional Corridors Plan*—This is an ongoing study and policy process aimed at formally establishing a system of interregional corridors to guide future decision making. It is part of the Minnesota DOT's strategic objective "to develop an interregional corridor system that enhances the economic vitality of the state" (*186*).

- *Illinois: Economic Corridors*—The state's transportation needs assessment and plan (*Lifelines to the Economy*) includes explicit designation of "economic corridors" to open industrial access to rural areas and to national and international markets (*187*).

- *Georgia: Economic Development Highways*—The Governor's Road Improvement Program was initiated in 1989 by a resolution of the state legislature and the governor to connect 95 percent of the state's cities (with a population of 2,500 or more) to the Interstate system. This program consists of 14 "economic development highways" (*188*).

Several states reported that they require economic development considerations be considered in the analysis of all proposals for major projects. For example, North Carolina incorporates economic development considerations in a "benefit/cost matrix" for its assessment of competing highway proposals. The Wisconsin DOT includes economic development impacts in a multi-attribute "scoring system," which is applied for all major highway projects as a prerequisite for their inclusion in their State Transportation Improvement Plan. The Wisconsin DOT also includes economic development impacts in its "airport benefit-cost system," which is used to prioritize projects for the State Airport System Plan.

TRANSPORTATION INVESTMENTS TO SUPPORT LOCAL ECONOMIC DEVELOPMENT

A number of state DOTs reported that they currently have programs aimed at providing investment in transportation infrastructure to promote local economic development. Some states have their own programs for making grants to fund specific local transportation facilities, which will leverage greater private sector investment and permanent job creation. For 13 eastern states, the ARC provides a similar type of state-based transportation investment funding for economic development. Examples of these individual programs are summarized here:

- The ARC's Infrastructure Program provides grants to pay for access roads serving new sites for industrial parks and individual industries. The sites must be located within the Appalachian Region, which encompasses portions of 13 states (Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia). The ARC provides the grants directly to state and local agencies, which then administer the grant funds. ARC projects must be part of a package that includes other public and private economic development support.

- Iowa's RISE (Revitalize Iowa's Sound Economy) Program for Roads funds construction, improvement, and maintenance of roads and streets to encourage economic diversification, new business opportunities, small business development, exporting, import substitution, and tourism. Eligible projects must demonstrate a local or regional economic development need and must have a transportation justification. The program is funded from dedicated fuel taxes and is targeted toward the growth of value-added activities. Job creation commitments are a part of the program, and the state has subsequently tracked the extent to which those additional jobs have actually occurred (*192*).

- Iowa's Railroad Economic Development Program has objectives similar to the RISE road program and also requires that applicants demonstrate job creation or capital investment commitments. It is complemented by three additional state programs: (1) a rail revolving loan fund, (2) a rail assistance program to rehabilitate branch lines, and (3) the Iowa Railway Finance Authority. These programs provide loans, grants, or other financial assistance for the acquisition, refinancing, restoration, or construction of rail lines.

- Maine's Industrial Rail Access Program provides grants and loans for investment in rail or rail-related infrastructure, including rail sidings, right-of-way acquisition, and intermodal facilities. Projects are evaluated on the basis of "employment and economic development opportunities" created, as well as transportation need and other public benefits. Priority (a more competitive ranking) is given to projects that

generate new employment and private investment in the state, open up new economic markets, make Maine more competitive in the global marketplace, and/or are located in economically distressed communities.

- Mississippi's Economic Development Highway Program assists the state's political subdivisions with the construction or improvement of highway projects that encourage "high economic benefit projects" to locate in specific areas. Eligible economic projects are those that leverage a new private investment of at least $50 million (or $20 million if the company already has a statewide capital investment of at least $1 billion).

- New York State's Industrial Access Program provides grant funding for highway and bridge improvements that facilitate economic development and result in the creation or retention of nonretail jobs in the state. Recipients may be municipalities or industrial development agencies. Their applications must document the job and other developmental benefits. Awards are made on a 60 percent grant/40 percent interest-free loan basis, up to a maximum of $1 million.

- Oregon's Immediate Opportunity Fund was established to support primary economic development through the construction and improvement of streets and roads. It is limited to projects that require a quick response and commitment of funds to retain or attract new jobs to the state. Projects must be in negotiation, must have a demonstrated transportation need, must improve a public road and serve the general public, must hinge on immediate dedication of funds, and must meet all necessary environmental and land-use regulation. Funding comes from motor vehicle gas taxes.

- Washington State's "transportation policy in support of economic development" allows projects that demonstrate an economic development need to compete for general mobility funding under the priority programming process. The state is also establishing a separate funding allocation to allow a quick response program (similar to Oregon's program) to meet the transportation needs of emergent economic development projects.

- Wisconsin's TEA (Transportation Economic Assistance) Program provides 50 percent funding grants, ranging from $30,000 to $1 million, to eligible communities or to private businesses for projects that are necessary to help attract employers to Wisconsin or to encourage business and industry to remain and expand in the state. Grants are for the completion of transportation infrastructure improvements, such as railroad segments, roads, airport runways, or harbor improvements. Job creation is a specific requirement for these grants, and applications are ranked on the basis of cost per job promised ($5,000 maximum), as well as the local unemployment rate and benefits to regional transportation. The state has also audited actual job creation compared with promised job creation.

SUMMARY OF KEY FINDINGS

This chapter reviewed the current state of agency practice in assessing economic development impacts from transportation investments. The key findings are as follows:

- Most transportation agencies at the state/province and national levels recognize economic development as an important consideration for some of their transportation investment decisions.

- Most transportation agencies, however, only sporadically conduct (or commission consultants to conduct) detailed studies of economic development impacts. Such studies are usually undertaken only for large investments or for situations where concerns about economic development impacts emerge as a major factor.

- Transportation agency staff indicate that their use of economic development impact assessments is hampered by perceptions of a high level of complexity in current data collection requirements and a lack of consistency in analytic methods and reporting for such studies.

- Although there are some perceived barriers to conducting more analysis studies, many states nonetheless are actively pursuing programs to promote economic development through their transportation investments.

A more complete statement of key findings is provided in chapter 5 (Conclusions).

CHAPTER FIVE

CONCLUSIONS

INVOLVEMENT OF PUBLIC AGENCIES IN ECONOMIC IMPACT ANALYSIS

Based on the survey of transportation planning agencies and the review of studies sponsored or conducted by them, it is clear that there is now a high level of recognition of the role of economic development impacts in transportation planning. This is reflected by the number of agencies analyzing these issues and by the emergence of national and state transportation policies explicitly recognizing economic development as a priority issue.

It is also clear that there has been a significant increase in the number and sophistication level of economic development impact studies conducted or commissioned by public agencies in the last decade. This appears to be enhanced by the emergence of increasingly sophisticated economic impact software tools during this period.

Transportation planning agencies become involved with issues of economic development impacts in several different ways:

- *General Investment Programs*—Some agencies explicitly recognize economic development as a factor driving their primary transportation investment programs and forecast economic development impacts of proposed investment to assist them in planning, selection, and funding of projects.

- *Special Economic Development Programs*—Many state agencies offer special transportation investment grant or loan programs aimed specifically at enhancing local economic development.

- *Planning and Regulatory Processes*—Most agencies have examined potential economic development impacts of proposed transportation projects at least superficially (and occasionally at a detailed level) as a required part of the broader environmental impact assessment process.

- *Education and Evaluation*—Some agencies have assessed the economic roles played by existing transportation systems to educate the public about their importance. Relatively few agencies have actually returned to measure the economic development impacts of their past corridor investments.

At the national level, TEA-21 has played a role in raising the visibility of economic development as a component of transportation planning in the United States by explicitly identifying economic development considerations as one of several key factors in project funding decisions. In the United Kingdom, the "Roads Review Process " explicitly adds recognition of economic "regeneration" as a planning and funding decision factor.

At the state level, a growing number of states have added economic development criteria in some aspect of their transportation capital planning or funding processes. Several state DOTs also have designated specific funding programs for making public investments in specific transportation facilities where they will leverage greater private sector investment and permanent job creation.

APPROACHES FOR ASSESSING ECONOMIC DEVELOPMENT IMPACTS

Despite an increasing recognition of economic development impacts as an issue to study, the meaning of "economic development impacts" remains multifaceted, and its definition is not always consistent within academic literature or practice. This is partly because there are many different ways to view and measure economic development impacts. In the context of transportation project evaluation, economic development impacts are most frequently measured in terms of changes in business output (sales), income generated (value added or wages), and associated employment (jobs) within some given study area. Other representations of impacts, such as productivity ratios, are constructed on the basis of those same output or income measures.

The terminology used in the field of economic development and the broader field of economic analysis is often confusing and even inconsistent. In particular, the measurement of economic development impacts is also often referred to as "economic impacts," and this leads to confusion between it and the broader study of social benefits and costs. In fact, a transportation planning agency—whether operating at the national, state/province, or metropolitan level—may be interested in economic development impacts of past or proposed projects (or programs) for a wide variety of different purposes, besides just benefit/cost analysis. This includes applications for project planning, prioritizing, design, evaluation, and public education.

Survey respondents indicated that economic development impact analysis is essentially never seen as a substitute for the evaluation of transportation system efficiency (user benefits). Rather, it is used as a complementary form of analysis, which provides some insight into nonuser impacts. Regardless of mode, economic development impact analysis is conducted by fewer agencies than the evaluation of transportation system efficiency (user benefits) associated with past or proposed projects.

Economic development impact studies fall into four broad categories:

- Forecasting expected project impacts, for investment decision making;
- Forecasting expected project impacts, for planning and/or regulatory review (including environmental impact reports);
- Public education, demonstrating the current economic role of an existing facility or service; and
- Post-project evaluations of constructed projects (or programs).

Nearly all of the agencies reported conducting studies to forecast the expected economic development impacts of proposed projects, but a minority of the agencies reported conducting evaluation on current or past projects.

The techniques used to assess economic development impacts vary greatly, depending in large part on the motivation for the study and the use of its results. The key approaches and techniques for assessing economic development impacts are as follows:

- *Assessments of proposed investments* typically are conducted to assist in decision making among alternative project choices. These studies estimate the extent to which proposed transportation projects are likely to lead in the future to positive economic development benefits for the regions in which they are located. A wide range of methods have been employed to measure these benefits, ranging from forecasts based on market studies for specific industries to forecasts generated by comprehensive economic simulation models. In most cases, the analysis compares economic growth forecasts under a no-build or base case scenario with economic growth forecasts associated with alternative transportation investment scenarios.

- *Planning and regulatory reviews* typically are conducted as part of a legally mandated environmental review process. Often the required environmental impact documentation makes only cursory mention of economic development impacts, which are frequently limited to a brief summary of land takings or impacts on the use of abutting property. There are, however, some significant exceptions, where detailed analyses of local or regional economic development impacts have been conducted as a major part of an environmental impact report. The analysis methods used for these detailed studies parallel those used to assess impacts of proposed investments.

- *Public information studies* typically are conducted to increase public understanding of the interrelationship of existing transportation facilities to the economy of the area they serve. The facilities are almost always a terminal or transfer facility (airport, waterport), or else a transit system. These studies generally either (1) document "economic contribution," that is, show how dollars generated by the transportation facilities flow through the regional or state economy, or (2) document "economic dependence," that is, itemize the economic loss to a region in terms of jobs and business costs should the transportation service no longer exist.

- *Post-project evaluation studies* measure the actual impacts of transportation facilities or investments "after the fact," that is, after they are finished and in use. Most of these studies are conducted as academic research, although "lessons learned" from case studies are sometimes used to aid in future investment decisions. These evaluations generally rely on times-series data to compare changes in economic conditions (in a study area) before and after transportation investment is made. Many of them use some control group, statistical method, or interviews to distinguish transportation project effects from other factors. The effectiveness of these methods in isolating transportation effects varies widely.

Survey respondents indicated that the most common motivation for studying economic development impacts is as a response to local concerns raised about adverse impacts of proposed projects or as a factor in major investment decisions. A significant minority of the surveyed agencies also reported studying these impacts for public relations, to fulfill environmental impact assessment regulations, or to assist in refining project plans.

For most agencies, economic development impacts are assessed on an irregular rather than a regular basis. Although one-half of the responding agencies noted that they have had the occasion to use economic development impacts as a project justification, only approximately one-third have a policy of formally including economic development impact analysis as a regular component of their project evaluation procedures.

Economic development impacts most commonly are assessed for large infrastructure projects. For highway and transit modes, these tend to be major system improvements,

such as new or expanded highways or transit lines. For other modes, these tend to be specific terminals, such as airports, seaports, or rail/truck intermodal facilities.

One important aspect of measuring economic development impacts is that the total impacts differ depending on the geographic scale being examined. Most of the metropolitan and state or provincial agencies analyze economic development impacts in terms of changes in jobs, income or business activity within the local area, region, or state/province. In many cases, there is a particular interest in encouraging business investment into economically depressed areas to improve interregional equity.

The measures selected for assessing economic development impacts depend on the purpose of the analysis:

- The economic development impact measures perceived as most important for communicating to the public are employment and property development or property values.
- Those rated as most important to decision makers are employment, economic output, and tourism.
- Those rated as most desired for future planning are employment, tourism, and business location patterns.

By all of these criteria, employment changes represent the most important and universally recognized measure of economic development impacts. Among transportation planning agencies, empirical analysis (using any of these measures) to assess project impacts was most common among Canadian provinces, somewhat less common among the states, and least common among MPOs.

NEEDS FOR FUTURE IMPROVEMENT

The usefulness of economic development impact studies currently is hampered by several remaining problems, which indicate a need for additional research and development:

- The most common perception among the staffs of responding agencies is that the results of economic development impact studies are not accepted universally, due in part to insufficient attention to unique local and regional factors in the application of economic impact models. Another reason for this problem is a perceived lack of consistency in the analysis of economic development impacts, in terms of both methodology and interpretation of results.

- Many agencies also noted difficulties in analyzing economic development impacts because of inadequate data, the complexity of the existing analysis methods, and the inexperience of agency staff in their use. The lack of adequate data and methods raises the cost of addressing economic development impacts. The lack of experienced staff reflects that not all state DOTs have in-house economists or other staff knowledgeable about economic development impact assessment techniques. As a result, many state DOTs currently rely primarily on outside contractors. (Canadian provinces have a much higher rate of conducting economic development studies using their own staff economists.)

- Several agencies also noted that further economic development associated with a transportation project is not always welcome, particularly in congested metropolitan areas, as well as some other high-density regions.

In a nearly unanimous position, the responding staff of the surveyed agencies indicate a desire to better address economic development impacts. They perceive a remaining need for funding of future work to address needs in the following areas:

- *To validate the link between transportation and economic development at the project corridor or facility level.* There is currently a lack of pre/post measurement of project impacts, which could validate future economic impact studies, as well as enhance the accuracy and sensitivity of economic impact models to different types of projects and situations.

- *To develop more complete and understandable analysis tools.* There are many useful types of economic data and models in existence, but it can be a complex and expensive process to assemble and apply them in a comprehensive manner. Thus, there is a need for data collection and analysis approaches for assessing economic development impacts that: (1) planning agencies can understand and feel confident are sufficiently complete and comprehensive to be publicly credible, (2) can be shown to be consistent with generally recognized findings and methods being used elsewhere, and (3) can be obtained and used in-house at a reasonable cost.

- *To develop better staff training and standards for measurement.* One factor limiting staff training on economic development impact analysis is that there are no consistent standards or guidelines regarding how and when such impacts should be evaluated and measured. That creates uncertainty about the value and cost-effectiveness of any particular type of staff training on this topic. There is thus a need to develop more consistent definitions of economic development impacts for various types of applications and to develop programs of staff training on how to assess them.

REFERENCES

1. Gordon, C., "Does America Really Need More Infrastructure? Lessons from the Debate About the Role of the Railroads in the Development of the American West," *Public Works Management and Policy*, Vol. 2, No. 2, October 1997, pp. 129–139.
2. *What is Economic Development?*, Council for Urban Economic Development, Washington, D.C., 1997.
3. National Council for Urban Economic Development and PHH Fantus Consulting, *Benchmarking Practices to Achieve Customer Driven Economic Development*, Council for Urban Economic Development, Washington, D.C., 1996.
4. *Developing Strategies for Economic Stability and Growth*, Council for Urban Economic Development, Washington, D.C., 1987.
5. Blair, J., *Local Economic Development: Analysis and Practice*, Sage Publications, Thousand Oaks, Calif., 1995.
6. Kotval, Z., J. Mullin, and K. Payne, *Business Attraction and Retention: Local Economic Development Efforts*, International City/County Management Association, Washington, D.C., 1996.
7. Nas, T.F., *Cost-Benefit Analysis: Theory and Application*, Sage Publications, Thousands Oaks, Calif., 1996.
8. *A Manual on User Benefit Analysis of Highway and Bus Transit Improvements*, American Association of State Highway and Transportation Officials, Washington, D.C., 1977.
9. Cambridge Systematics, Inc., *The Highway Economic Requirements System*, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C., 1998.
10. Texas Transportation Institute, *Microcomputer Evaluation of Highway User Benefits*, Report 7-12, Transportation Research Board, National Research Council, Washington, D.C., 1993.
11. Delucchi, M., "Summary of the Non-Monetary Externalities of Motor Vehicle Use," No. 9 in the series: *The Annualized Social Cost of Motor Vehicle Use in the United States*, Report UCD-ITS-RR-96-3(9), Institute of Transportation Studies, University of California–Davis, September 1998.
12. Litman, T., *Transportation Cost Analysis: Techniques, Estimates and Implications*, Victoria Transport Policy Institute, Victoria, BC, Canada, 1999.
13. Kruesi, F.E., "The Value of Travel Time: Departmental Guidance for Conducting Economic Evaluations," Office of the Secretary, U.S. Department of Transportation, Washington, D.C., April 9, 1997.
14. Miller, T.R., "The Value of Time and the Benefit of Time Savings," The Urban Institute, Washington, D.C., 1989.
15. Bendavid-Val, A., *Regional and Local Economic Analysis for Practitioners*, 4th Ed., Praeger Publishers, Westport, Conn., 1991.
16. McConnell, C. and S. Brue, *Economics: Principles, Problems and Policies*, 14th Ed., McGraw–Hill, Boston, 1999.
17. De Rooy, J., *Economic Literacy*, Three Rivers Press, New York, 1995.
18. The Dismal Scientist, "Dictionary." [Online] Available: www.dismal.com/toolbox/dict_productivity.htm.
19. *IMPLAN Professional Users Guide*, Minnesota IMPLAN Group (MIG), Inc., Stillwater, Minn., 1999.
20. Treyz, G., D. Rickman, and G. Shao, "The REMI Economic-Demographic Forecasting and Simulation Model," *International Regional Science Review*, Vol. 14, 1992.
21. Butler, S. and L. Kiernan, *Estimating the Regional Economic Significance of Airports*, Office of Airport Planning and Programming, Federal Aviation Administration, Washington, D.C., 1993.
22. Rutgers University, New Jersey Institute of Technology, Columbia University, Princeton University, National Association of Regional Councils, and University of Cincinnati, *Public Works Program Performance Evaluation*, Prepared for Economic Development Administration, U.S. Department of Commerce, Washington, D.C., 1997.
23. Green, R.E., ed., *Enterprise Zones: New Directions in Economic Development*, Sage Publications, Thousand Oaks, Calif., 1990.
24. Brandow Company and Economic Development Research Group, *Evaluation of the Appalachian Regional Commission's Infrastructure and Public Works Projects*, Prepared for the Appalachian Regional Commission, Washington, D.C., 1999.
25. Jones, S. and G. Weisbrod, "Urban Enterprise Zones: How Have the Panaceas Panned Out?," Economic *Development Commentary*, National Council for Urban Economic Development, Washington, D.C., Summer 1986.
26. *Economic Returns from Transportation Investment*, Eno Transportation Foundation, Inc., Washington, D.C., 1996.
27. Nadiri, M.I. and T.P. Mamuneas, "Contribution of Highway Capital to Industry and National Productivity Growth," Prepared for Federal Highway Administration, Washington, D.C., 1996. [Online] Available: http://www.bts.gov/ntl/data/growth.pdf.
28. ULI Industrial and Office Park Council, *Business and Industrial Development Handbook*, The Urban Land Institute, Washington, D.C., 1988.

29. Weisbrod, G. and J. Beckwith, "Measuring Economic Development Benefits for Highway Decision-Making: The Wisconsin Case," *Transportation Quarterly*, January 1992, pp. 57–79.
30. Economic Development Research Group and Bernardin Lochmueller & Associates, *Economic Impact Assessment of KY69 Improvements*, Kentucky Transportation Commission, Frankfurt, Ky., 1998.
31. Wilbur Smith Associates, *Guide to the Economic Evaluation of Highway Projects*, Iowa Department of Transportation, Ames, 1993.
32. Weisbrod, G. and B. Weisbrod, *Transportation Research Circular 477: Assessing the Economic Impact of Transportation Projects: How to Match the Appropriate Technique to Your Project*, Transportation Research Board, National Research Council, Washington, D.C., 1997.
33. Lewis, D., *NCHRP Report 342: Primer on Transportation, Productivity and Economic Development*, Transportation Research Board, National Research Council, Washington, D.C., August 1991.
34. Hartman, J., *A Primer on Transportation Investment and Economic Development*, Transportation Association of Canada, Ottawa, ON, 1994.
35. Arsen, D., "Is There Really an Infrastructure/Economic Development Link?," in Bingham, R. and R. Mier, eds., *Dilemmas of Urban Economic Development*, Chapter 4, Urban Affairs Annual Reviews 47, Sage Publications, Thousand Oaks, Calif., 1995.
36. Boarnet, M., *Highways and Economic Productivity: Interpreting Recent Evidence*, University of California Transportation Center, Berkeley, October 1995.
37. Nijkamp and Blaas, *Impact Assessment and Evaluation in Transport Planning*, Kluwer Publishers, Dordrecht, The Netherlands, 1993, pp. 45–49.
38. Standing Advisory Committee on Trunk Road Assessment (SACTRA), "Transport and the Economy," U.K. Department of the Environment, Transport and the Regions, London, 1999. [Online] Available: http://www.roads.detr.gov.uk/roadnetwork/sactra/report99/index/htm.
39. Litman, T. and F. Laube, *Auto Dependency and Economic Development*, Victoria Transport Policy Institute, Victoria, BC, Canada, 1999.
40. Hagler Bailly Services, Inc., and MORPACE International, Inc., *NCHPR Report 436: Guidance for Communicating the Economic Impacts of Transportation Investments*, Transportation Research Board, National Research Council, Washington, D.C., 1999.
41. Cambridge Systematics, Inc., Economic Development Research Group and Economic Competitiveness Group, *Transportation Cornerstone Florida*, Florida Chamber of Commerce, Tallahassee, May 1999.
42. *Twin Cities' Metropolitan Commuter Rail Study: Draft Final Summary Report*, Minnesota Department of Transportation, St. Paul.
43. Halcrow Fox, *Strathclyde Tram: Development Impacts, Phase III Report*, Strathclyde PTE, Glasgow, Scotland, 1996.
44. WS Atkins, Steer Davies & Gleave and ECOTEC, *Midland Main Line Strategy Study, Technical Report*, United Kingdom, 1990.
45. Cambridge Systematics, Inc., *Economic Impacts of the Southwest Indiana Highway Corridor*, Prepared for Indiana Department of Transportation, Indianapolis, 1996.
46. N–Y Associates and Economic Development Research Group, *Economic Impact Study (Phase II) of the Proposed Mississippi River Bridge at St. Francisville, Louisiana and the Zachary Taylor Parkway Alexandria, Louisiana to Poplarville, Mississippi*, Prepared for the Louisiana Department of Transportation and Development, Baton Rouge, May 1999.
47. Peat Marwick Main & Co., *Economic Impacts of Upgrading US Route 219 To Interstate Standards from Springville, New York to Du Bois, Pennsylvania*, Prepared for the New York State Department of Transportation, Albany, 1988.
48. Gillis, W.R. and K. Casavant, *Linking Transportation System Improvements to New Business Development in Eastern Washington*, EWITS Research Report 1, Department of Agricultural Economics, Washington State University, Pullman, 1994.
49. Bechtel Corp., Bartram & Cochran, Clarke Tamaccio Architects, Fitzgerald & Halliday, Basile Baumann & Prost, FAS Consultant Services, *Griffin Line Corridor, Economic Development Assessment*, Greater Hartford Transit District, Hartford, Conn., 1994.
50. Cambridge Systematics, Inc., *Highway 29/45/10 Corridor Study: Economic Benefits and Cost-Benefit Evaluation, Final Report*, Wisconsin Department of Transportation, Madison, 1989 (see also in Ref. 29).
51. Economic Development Research Group and SRF Consulting Group, *Economic Impact Analysis: St. Croix River Crossing*, Minnesota Department of Transportation, St. Paul, and Wisconsin Department of Transportation, Madison, 1999.
52. Lichtman, L., *Durand US Highway 10 Relocation Alternatives Economic Impact Analysis*, Bureau of Planning—Economic Planning and Development Section, Wisconsin Department of Transportation, Madison, November 1999.
53. Yeh, D., D. Leong, and R. Russell, *Claude Allouez Bridge Alternatives Analysis: Impacts on the Local Economy*, Economic Planning and Development Section, Wisconsin Department of Transportation, Madison, 1998.

54. Cambridge Systematics, Inc., Applied Development Economics and Research Unlimited, *Downtown Economic Study*, Sacramento Department of Public Works, California, June 1989.
55. Weisbrod, G. and R. Neuwirth, *NCHRP Research Results Digest 231: Economic Effects of Restricting Left Turns*, Transportation Research Board, National Research Council, Washington, D.C., 1998.
56. *Middle River Employment Center Access Study: Land Use Analysis Committee Market Analysis Report*, Maryland Department of Transportation, Baltimore, 1998.
57. Clark Patterson Associates, et al., *Airport Corridor Major Investment Study (Monroe County): Technical Memorandum 1*, Rochester, N.Y., November 18, 1998.
58. *Economic Feasibility Study of the San Diego & Arizona Eastern Railway*, San Diego Association of Governments, California, 1996.
59. Feldman, M., M. Bell, and L. Salamon, *The Distribution Industry: An Engine for Maryland's Growth*, Institute for Policy Studies, The Johns Hopkins University, Baltimore, 1996.
60. Mudge, R., C. Secrest, J. Crossett, and A. Sultz, *Eisenhower Parkway Extension, Macon, Georgia—A Review of Reported Economic Impacts for Selected US Highway Construction Project*, Hagler Bailly Services for Georgia Department of Transportation, Atlanta, 1999.
61. *Ready for Takeoff: The Business Impact of Three Recent Airport Developments in the US*, Colorado National Banks, Denver, 1989.
62. Gillespie, J.S., *I-73 Economic Impact Analysis*, Virginia Transportation Research Council, Charlottesville, Va., January 1995.
63. Wilbur Smith Associates, *U.S. Highway 20 Corridor Development Study*, Prepared for Iowa Department of Transportation, Ames, 1992.
64. Wilbur Smith Associates, *Final Report: Economic Analysis of the Proposed US-131 Freeway Extension: Cadillac to I-75*, Prepared for the Michigan Department of Transportation, Lansing, 1998.
65. Wilbur Smith Associates and HNTB Corporation, *Corridor 18 Feasibility Study*, Arkansas Highway and Transportation Department, Little Rock, 1995.
66. Wilbur Smith Associates, *St. Louis to St. Paul Corridor Feasibility and Necessity Study: Consultant Report to the States*, Prepared for five state DOTs, 1990.
67. Wilbur Smith Associates, *Economic Feasibility and Impact: I-35 Trade and Transportation Corridor*, Prepared for six state DOTs and the Federal Highway Administration, Washington, D.C., 1999.
68. Wilbur Smith Associates, *Indianapolis to Texas Corridor Economic Feasibility Study*, Prepared by seven state DOTs, 1997.
69. *I-95 Aroostook Corridor Study*, Maine Department of Transportation, Augusta, 1996.
70. Cambridge Systematics, Inc., Bernardin Lochmueller and Associates, and Economic Development Research Group, *Economic Impacts of US 31 Corridor Improvements*, Indiana Department of Transportation, Indianapolis, 1998.
71. RKG Associates, Inc., "Maine East–West Highway Economic Impact Analysis," Maine State Planning Office and Maine Department of Transportation, 1999. [Online] Available: http://janus.state.me.us/mdot/ewhiway/reportlinks.htm.
72. The Urban Institute and Cambridge Systematics, Inc., *Final Report: Public Transportation Renewal as an Investment: The Economic Impacts of SEPTA on the Regional and State Economy*, Delaware Valley Regional Planning Commission, Philadelphia, 1991.
73. Cambridge Systematics, Inc., and Raytheon–Ebasco, *Lasting Economic Benefits from Public Transit Investment: Phase II Final Report*, Metropolitan Transportation Authority, New York, 1997.
74. Cambridge Systematics, Inc., and Economic Development Research Group, *Economic Impacts of the Long Range Transportation Plan*, Los Angeles Metropolitan Transportation Authority, Los Angeles, 1999.
75. Cunningham, S.R. and W. Lott, *Griffin Line Corridor Study: Economic Impact Analysis*, Connecticut Center for Economic Analysis, Department of Economics, University of Connecticut, Storrs, 1994.
76. Wilbur Smith Associates, *Rochester Light Rail Transit Economic Development Feasibility Study: Executive Summary*, Prepared for the City of Rochester, March 1998.
77. Hamilton, Rabinovitz and Alschuler, *Linking Infrastructure to Industry: Estimating the Economic Impacts of Alternative Futures for Los Angeles International Airport*, Los Angeles Department of Airports, Los Angeles.
78. Economic Research Associates, *Economic Impact and Benefit/Cost of High Speed Rail for California*, California Intercity High Speed Rail Commission, Sacramento, 1996.
79. *Port Impact Study*, Connecticut Center for Economic Analysis, University of Connecticut, Storrs, 1999.
80. ICF Kaiser, *Impacts of Transportation Infrastructure Investments on the Greater Richmond Region*, Greater Richmond Chamber of Commerce, Virginia, 1997.
81. DMJM and Moffatt & Nichol, "Alameda Corridor: A Project of National Significance," Alameda Corridor Transportation Authority, 1997. [Online] Available: http://www.scbbs.com/alameda/almeda3.htm.
82. CPB Netherlands Bureau for Economic Policy Analysis, "Globalization, International Transport and the Global Environment: Four Quantitative Scenarios," Working Paper 110, Central Planning Bureau, The Hague, The Netherlands, 1999. [Online] Available: http://www.cpb.nl/eng/pub/pubs/werkdoc110/wd110.pdf.

83. CPB Netherlands Bureau for Economic Policy Analysis, "The Economy and Its Physical Surroundings: Policy Challenges and Possible Solutions," Working Paper 102, Central Planning Bureau, The Hague, The Netherlands, 1998. [Online] Available: http://www.cpb.nl/eng/pub/pubs/werkdoc102/wd102.pdf.
84. *Regional Multipliers: A User Handbook for the Regional Input–Output Modeling System (RIMS II)*, 2nd Ed., Bureau of Economic Analysis, U.S. Department of Commerce, Washington, D.C., May 1992.
85. *PC I-O User's Manual*, Regional Science Research Corporation, Hightstown, N.J., 1996.
86. Mahady, F.X. and B. Stevens, "Estimating the Effects of New Highway Investments on Industrial Production in Buffalo," Presented to the plenary session of the Regional Science Association International, Annual North American Meeting, 1997.
87. FXM Associates, "Project Area and Regional Economic Development Effects," in Genessee Regional Transportation Council, *Route 531 Rochester–Brockport Major Investment Study*, New York State Department of Transportation, Albany, 1999.
88. Politano, A.L. and C. Roadifer, "Regional Economic Impact Model for Highway Systems," *Transportation Research Record 1229*, Transportation Research Board, National Research Council, Washington, D.C., 1989.
89. Stokes, R.W., N. Pinnoi, and E.J. Washington, *Economic Development Impacts of Expenditures for State Highway Improvements in Texas*, Texas Transportation Institute, Texas A&M University for the Texas Department of Transportation, Austin, 1991.
90. University of North Carolina at Charlotte, *Interstate 40 Economic Impact Study: Technical Report*, North Carolina Department of Economic and Community Development, Raleigh, 1991.
91. University of North Carolina at Charlotte, *Economic Impacts of the Monroe–Gastonia Connector*, North Carolina Department of Economic and Community Development, Raleigh, 1999.
92. Burgess and Niple, Ltd., et al., *Final Report: I-71 Corridor Transportation Study*, Prepared for Ohio–Kentucky–Indiana Regional Council of Governments, August 1998.
93. Texas Transportation Institute, *Economic Assessment of the Proposed Improvement of US Highway 287 in Wichita Falls*, Texas Department of Transportation, Austin, 1991.
94. Wilbur Smith Associates, *Economic Impact Study of CSX Intermodal's New Atlanta Intermodal Terminal*, CSX International, Richmond, Va., 1995.
95. Thompson, E., M. Berger, D. Black, A. Chandra, and K. Gintings, *Economic Impact Assessment of a Southern Kentucky Corridor (I-66)*, Center for Business and Economic Research, University of Kentucky, Lexington, April 1997.
96. Fiander–Good Associates, Ltd., *Trans Labrador Highway Social and Economic Project Feasibility Analysis Condensed Final Report*, Prepared for the Department of Works, Services and Transportation Policy and Planning, January 1993.
97. Conference Board of Canada, *Slave Province Transportation Corridor: Economic Impacts and Taxation Review*, Northwest Territories Department of Transportation, Canada, December 1994.
98. Oscar Faber/TPA, Cambridge Systematics, Inc., and Kennedy McTavish, *The Relationship Between Economic Development and Transport Links, Stage 2: Economic Effects of the M74 Northern Extension*, Glasgow Development Agency, Scotland, 1993.
99. Parsons Brinckerhoff, Cambridge Systematics, Inc., and Regional Source Research Institute, *Summary Report: CONEG High Speed Rail Regional Benefits Study: A Report on the Benefits to the Region of Improved Passenger Rail Service Between Boston and New York*, Coalition of Northeastern Governors High Speed Rail Task Force, Washington, D.C., October 1989.
100. RKG Associates, Inc., *Cost Benefit Study of the DeKalb Peachtree Airport*, Board of Commissioners of DeKalb County, Decatur, Georgia, 1997.
101. Kaliski, J., S. Smith, and G. Weisbrod. "Major Corridor Investment-Benefit Analysis System," *Proceedings of the Seventh TRB Conference on the Application of Transportation Planning Method*, Transportation Research Board, National Research Council, Washington, D.C., 1999. [Online] Available: http://www.edrgroup.com/pdf/MCIBAS.pdf.
102. Cambridge Systematics, Inc., *Economic Impacts of SR26 and U.S. 35 Corridor Improvements*, Prepared for the Indiana Department of Transportation, Indianapolis, August 1998.
103. Cambridge Systematics, Inc., IMPEX Logistics, Eng-Wong & Taub Associates, and The Tioga Group, *Summary Report: MORPC Inland Port III*, Prepared for the Mid-Ohio Regional Planning Commission, Columbus, Ohio, March 1999.
104. *TELUS: The Transportation, Economic, and Land-Use System: A State-of-the-Art Transportation Information System for the 21st Century*, New Jersey Institute of Technology, National Center for Transportation Technology, Rutgers University Center for Urban Policy Research, and North New Jersey Transportation Planning Authority, April 1998.
105. Anas, A., "Application of the METROSIM Model in New York," Presented at the Transportation Research Board Annual Meeting, Transportation Research Board, National Research Council, Washington, D.C., January 1999.
106. Echenique, M.H., "Urban and Regional Studies at the Martin Centre: Its Origins, Its Present, Its Future," *Environment and Planning B*, Vol. 21, 1994, pp. 517–567.

107. Marcial Echenique & Partners, *Economic Impacts of A7/M68 Improvements: Final Report,* Scottish Development Agency, 1990.
108. Rohr, C. and I. Williams, "Modelling the Regional Economic Impacts of the Channel Tunnel," *Environment and Planning B*, Vol. 21, 1994, pp. 555–567.
109. Economic Development Research Group, Cambridge Systematics, Inc., and Flight Transportation Associates, *Airport Benefit–Cost Analysis System: Users Guide*, Wisconsin Department of Transportation, Madison, 2000.
110. *Tren Urbano Transit Project, Puerto Rico, Final Environmental Impact Statement,* U.S. Department of Transportation, Federal Transit Administration, Washington, D.C., and Government of Puerto Rico, Department of Transportation and Public Works, Highway and Transportation Authority, San Juan, November 1995.
111. Cambridge Systematics, Inc., "Economic Impacts," Part I, Chapter 2, Appendix 4, and Chapter 3 in Bechtel/Parsons Brinckerhoff, *Central Artery/Third Harbor Tunnel Environmental Impacts Statement/Report*, Massachusetts Highway Department, Boston, 1987.
112. *Final Environmental Impact Statement/Report: Old Colony Railroad Rehabilitation Project from Boston to Lakeville, Plymouth and Scituate, Massachusetts,* U.S. Department of Transportation, Urban Mass Transportation Administration, and the Massachusetts Bay Transportation Authority, Boston, March 1992.
113. Cambridge Systematics, Inc., *Economic and Social Impacts of Orange Line Replacement Transit Service*, Prepared for the Massachusetts Bay Transportation Authority, Boston, May 1988.
114. *Environmental Impact Statement for I-85 Improvements in Spartanburg*, South Carolina Department of Transportation, Columbia.
115. *North Carolina EIS for Road Improvements on US 64*, North Carolina Department of Transportation, Raleigh.
116. Martin Associates, *The Local and Regional Economic Impacts of the Baltimore–Washington International Airport*, Maryland Aviation Administration, 1999; see also Edwards and Kelsey, Inc., *Revised Benefit-Cost Analysis: Piers A and B Expansion at BWI*, Maryland Aviation Administration, 1999.
117. Harrison, D. and A. Nichols, *Contributions of the Chicago Airport System to the Chicago Area Economy*, National Economic Research Associates for the City of Chicago Department of Aviation, 1993.
118. *Economic Impact Study: Honolulu International Airport,* State of Hawaii Department of Transportation, Honolulu, 1997.
119. *Portland International Jetport Economic Benefit Study*, Maine Department of Transportation, Portland, 1995.
120. Sourcepoint, *San Diego International Airport: Economic Impact of Master Plan Implementation*, San Diego International Airport, 1999
121. Wilbur Smith Associates, JPS AeroConsultants and Isbill Associates, *The Economic Impact of Colorado Airports*, Prepared for the Colorado Department of Transportation, Division of Aeronautics, Watkins, 1992.
122. Simat Helliesen and Eichner, Inc., *Economic Impact of Public Use Airports in Massachusetts*, Massachusetts Aeronautics Commission, 2000.
123. University of North Carolina, *Economic Impact of Publicly-Owned Airports in North Carolina,* North Carolina Department of Transportation, Raleigh, 1996.
124. Wilbur Smith Associates and EMJ/McFarland–Johnson Engineers, *Economic Impact of Aviation in New York State*, Prepared for the New York State Department of Transportation, Albany, 1992.
125. The Airport Technology and Planning Group, Inc., *State of Oregon: Economic Impact of Airports*, Prepared for the Oregon Department of Transportation, Aeronautics Section, Salem.
126. The Airport Technology and Planning Group, Inc., *The Economic Impact of Aviation in Pennsylvania*, Prepared for the Pennsylvania Department of Transportation, Harrisburg.
127. Russell, R., *The Economic Impact of Aviation Industry in Wisconsin*, Wisconsin Department of Transportation, Madison, undated.
128. Wilbur Smith Associates, *The Economic Impact of Civil Aviation on the US Economy: Update 1993*, Prepared for the Federal Aviation Administration, Washington, D.C., 1995.
129. Martin O'Connell Associates, *The Local and General Economic Impacts Generated by the Port of Baltimore*, Prepared for the Maryland Port Administration, Baltimore, April 22, 1994.
130. University of Southern Maine–Edmund S. Muskie Institute of Public Affairs, *The Port of Portland: Its Value to the Region*, Prepared for the City of Portland, Portland Chamber of Commerce and South Portland/Cape Elizabeth Chamber of Commerce, October 1993.
131. Booz–Allen & Hamilton, Inc., *An Analysis of the Market Potential and Feasibility of New Port Development at Eastport*, Eastport Port Authority, 1990.
132. MGT of America, Inc., *An Analysis of the Economic and Fiscal Impact of Florida's Seaports,* Florida Ports Association, 1999.
133. Holmes, M.R., An *Analysis of the Annual Economic Impacts of the Tennessee–Tombigbee Waterway,* Troy State University, Presented to the Transportation Research Board Annual Meeting, Transportation Research Board, National Research Council, Washington, D.C., 1999.

134. PKF Consulting, *Analysis of Economic Impacts of the Northern Central Rail Trail*, Maryland Greenways Commission, Maryland Department of Natural Resources, Annapolis, 1994. [Online] Available: http://www.bts.gov/ntl/DOCS/430.html.
135. *Port Economic Impact Kit*, Federal Maritime Administration, Washington, D.C., 2000.
136. Keane, T., *Highway Infrastructure Investment and Job Generation*, Publication FHWA-PL-96-015, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C., 1996. Related version [Online] Available: http://www.tfhrc.gov/pubrds/spring96/p96sp16htm.
137. Cambridge Systematics, Inc., and Economic Development Research Group, *Public Transportation and the Nation's Economy*, American Public Transit Association, Washington, D.C., 1999. [Online] Available: http://www.apta.com/info/online/vary.pdf.
138. *Economic Contributions of Public Transit in the San Diego Region*, San Diego Association of Governments, 1996.
139. University of Dayton, Center for Business and Economic Research, *The Economic Impact of the Miami Valley RTA on Montgomery County*, Dayton, Ohio, 1995.
140. Camph, D.H., *Dollars and Sense: The Economic Case for Transportation in America*, Prepared for the Campaign for Efficient Passenger Transportation, Washington, D.C., 1997.
141. Jack Faucett Associates, Inc., *The Economic Impact of HART to the Housatonic Valley Region*, Housatonic Area Regional Transit District, Danbury, Conn., 1997.
142. Georgia Institute of Technology, *Social Benefits of Transit: Case Study of the Metropolitan Atlanta Rapid Transit Authority*, Atlanta Regional Commission.
143. Miller, J., M.H. Robison, and M. Lahr, *Estimating Important Transportation-Related Regional Economic Relationships in Bexar County, Texas*, Economic Modeling Specialists, Inc., for VIA Metropolitan Transit, San Antonio, 1999. [Online] Available: http://www.vtpi.org/modeshft.pdf.
144. Lower Mississippi Delta Development Center, Inc., *Linking the Delta Region with the Nation and the World*, 1995, and update report, Federal Highway Administration, Washington, D.C., 1996. [Online] Available: http://www.tfhrc.gov/pubrds/winter96/p96w19htm.
145. Rephann, T.J. and A.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, pp. 723–751.
146. Lichtman, L., *A Study of New and Expanding Manufacturing Plants in Wisconsin During 1990–1996 (An Analysis of New and Expanding Manufacturing Plants Along Wisconsin's Highway Transportation Corridors)*, Division of Transportation Investment Management, Economic Planning and Development, Madison, 1997.
147. *Economic Development and the State Trunk Highway System: A Technical Report*, Wisconsin Department of Transportation, Division of Transportation Investment Management, Economic Planning and Development, Madison, 1998.
148. Leong, D., R. Russell, M. Wolfgram, D. Yeh, and B. Shipmen, *Relationship of Highway Rehabilitation Projects and Economic Development*, Wisconsin Department of Transportation, Division of Transportation Investment Management, Economic Planning and Development, Madison, 1996.
149. *The Economic Impacts of Highway Bypasses on Communities*, Technical Report, Economic Planning and Development, Wisconsin Department of Transportation, Madison, February 1998.
150. Burress, D., *Impacts of Highway Bypasses on Kansas Towns*, Prepared by the University of Kansas for the Kansas Department of Transportation, Topeka, 1996.
151. Anderson, C. and D. Otto, *The Economic Impact of Rural Highway Bypasses: Iowa and Minnesota Case Studies*, Office of Advanced Planning, Iowa Department of Transportation, Ames, 1991.
152. Gillis, W.R. and K. Casavant, *Lessons from Eastern Washington: State Route Mainstreets, Bypass Routes and Economic Development in Small Towns*, EWITS Research Report #2, Department of Agricultural Economics, Washington State University, Pullman, 1994. [Online] Available: http://www.bts.gov/ntl/data/732pdf.
153. Texas Transportation Institute, *Effects of Highway Bypasses on Rural Communities and Small Urban Areas*, American Association of State Highway and Transportation Officials, Washington, D.C., 1995.
154. Blackburn, S. and J.W. Clay, University of North Carolina at Charlotte, *Impacts of Highway Bypasses on Community Businesses*, North Carolina Division of Community Assistance and the I-40 Steering Committee, Raleigh, November 1991.
155. *Economic Benefits of Investment in Transport and Communications Infrastructure: Berrima and Mittagong Bypasses*, (Australia) Bureau of Transport and Communications Economics, Canberra, 1994.
156. Hartgen, D. and J.Y. Kim, "Commercial Development at Rural and Small Town Interstate Exits," *Transportation Research Record 1649*, Transportation Research Board, National Research Council, Washington, D.C., 1998, pp. 95–104.
157. Orus, J.-P., "The Economic Impacts of Major Motorways Infrastructures: Main Lessons of Ex Post Studies," SETRA—Ministere de l'Equipement, du

Logement, des Transports et du Tourisme, Banneux, France, 1996.
158. Parantainen, J., "Effects of Transport Infrastructure on Regional and Peripheral Development: Case Study Candidates from Finland," Ministry of Transport and Communications, Helsinki, Finland, 1999.
159. Anderstig, C., B. Harsman, L. Lundqvist, F. Ramjerdi, and F. Snickars, "The Regional Development Impacts of the Oresund Bridge," Department of Infrastructure and Planning, Roal Institute of Technology, Kungl Tekniska Hogskolan, Sweden, 1999.
160. Wilbur Smith Associates, *Appalachian Development Highways Economic Impact Study*, Prepared for the Appalachian Regional Commission, Washington, D.C., July 1998.
161. RESI—A Research Institute of Towson University, *The Economic Impact of Maryland Highway Investment*, Prepared for the Maryland State Highway Administration, Baltimore, 1998.
162. *Economic Impact of Developments of the Texas Trunk System*, Texas Department of Transportation, Austin, 1998.
163. *Economic Impacts of the Kansas Comprehensive Highway Program*, Kansas State University, Manhattan, 1997.
164. Duffy-Deno, K.T. and R.W. Eberts, "Public Infrastructure and Regional Economic Development: A Simultaneous Equations Approach," *Journal of Urban Economics*, Vol. 30, 1991, pp. 329–343.
165. Evers, G.H.M., P.H. Van Der Meer, J. Oosterhaven, and J.B. Polak, "Regional Impacts of New Transport Infrastructure: A Multi-Sectoral Potentials Approach," *Transportation*, Vol. 14, 1988, pp. 113–126.
166. Aschauer, D.A., "Is Public Expenditure Productive?" *Journal of Monetary Economics*, Vol. 23, 1989, pp. 177–200.
167. Munnel, A., "Infrastructure Investment and Economic Growth," *Journal of Economic Perspectives*, No. 6, 1990, pp. 189–198.
168. Pinnoi, N., *Transportation and Manufacturing Productivity (Transportation Productivity and Multimodal Planning)*, Texas Transportation Institute, College Station, October 1993.
169. Bell, M.E. and T.J. McGuire, *NCHRP Report 389: Macroeconomic Analysis of the Linkages Between Transportation Investments and Economic Performance*, Transportation Research Board, National Research Council, Washington, D.C., 1997.
170. Toen-Gout, M. and J. van Sinderen, *The Impact of Investment in Infrastructure on Economic Growth*, Research Report 9503, Research Centre for Economic Policy, Erasmus University, Rotterdam, The Netherlands, 1994.
171. Fraumeni, B.M., *Background Paper: Productive Highway Capital Stocks, Policy Forum, Transportation Investment and New Insights from Economic Analysis*, Eno Transportation Foundation, Inc., Washington, D.C., February 23, 1999.
172. Cervero, R., C. Castellanos, W. Sarosa, and K. Rich, *Land Use and Development Impacts*, "BART @ 20" Study, University of California Transportation Center, Berkeley, 1995.
173. Landis, J., S. Guhathakurta, W. Huang, and M. Zhang, *Rail Transit Investments, Real Estate Values and Land Use Change: A Comparative Analysis of Five California Rail Transit Systems*, "BART @ 20" Study, Monograph 48, Institute of Urban and Regional Development, University of California, Berkeley, 1995.
174. Workman, S. and D. Brod, "Measuring the Neighborhood Benefits of Rail Transit Accessibility," 76th Annual Meeting of the Transportation Research Board, National Research Council, Washington, D.C., 1997.
175. Cambridge Systematics, Inc., R. Cervero, and D. Aschauer, *TCRP Report 35: Economic Impact Analysis of Transit Investments: Guidebook for Practitioners* Transportation Research Board, National Research Council, Washington, D.C., 1998.
176. Vessali, K., "Land Use Impacts of Light Rail," *Berkeley Planning Journal*, University of California, Berkeley, Vol. 11, 1996, pp. 71–105.
177. Lewis, D. and F. Williams, *Policy and Planning as Public Choice*, Ashgate Publishing, Hampshire, U.K., 1999.
178. *An Assessment of Intermodal Transportation Plans, Systems and Activities in the Appalachian Region*, Appalachian Regional Commission, Washington, D.C., 1999.
179. *A New Deal for Trunk Roads in England: Understanding the New Approach to Appraisal*, Department of the Environment, Transport and the Regions, London, July 1998.
180. *Planning of Roads and Highways: Planning Tools and Analysis Measures*, The World Bank, Washington, D.C., undated. [Online] Available: http.//www.worldbank.org/html/fpd/transport/roads/pl sect6.htm.
181. Wisconsin Department of Transportation, *TransLinks 21: A Multimodal Transportation Plan for Wisconsin's 21st Century*, 1995.
182. *Transportation 2020—Economic Development and the State Trunk Highway System*: Technical Report, Wisconsin Department of Transportation, Madison, 1998.
183. Jayawardana, J. and D.J. Webre, Jr., "Louisiana Port Priority Program: An Application of Benefit-Cost Analysis to Project Appraisal," *Transportation Research Record 1511*, Transportation Research Board, National Research Council, Washington, D.C., pp. 26–33.
184. Dye Management Group, Inc., *TranPlan 21: Supporting Economic Development Through the Transportation System*, Montana Department of Transportation, Helena, undated (circa 1995).

185. "Highway Trust Fund," North Carolina Department of Transportation, Raleigh, undated.
186. *Better Connections for Minnesota's Future: Interregional Corridor Study*, Minnesota Department of Transportation, St. Paul, 1999.
187. *Lifelines to the Economy*, Illinois Department of Transportation, Springfield, 1997.
188. *Governor's Road Improvement Program*, Georgia Department of Transportation, Atlanta, 1989.
189. Sem, J. and P. Goff, *The Economic Impact of the Alpine Loop Backcountry Scenic and Historic Byway*, Colorado Center for Community Development, University of Colorado at Denver, February 1999.
190. The Urban Institute, *Final Case Study for the National Scenic Byways Study: Economic Impact of Scenic Byways*, Prepared for the Federal Highway Administration, Washington, D.C., September 1990.
191. Forkenbrock, D., N. Foster, and T. Pogue, "Evaluation of a State-Level Road Program to Promote Local Economic Development, *Transportation Quarterly*, Vol. 45, No. 4, October 1991.

BIBLIOGRAPHY OF ECONOMIC IMPACT LITERATURE AND GUIDES

The following is a list of reports that provide general summaries of research literature on the economic development impacts of transportation and guidance for analyzing those impacts. Please note that additional documents are cited in the separate References section and in the listing of impact studies in Appendix C.

Apogee Research, Inc., and Greenhorne & O'Mara, *NCHPR Report 418: Research on Relationship Between Economic Development and Transport Investment*, Transportation Research Board, National Research Council, Washington, D.C., 1998.

Apogee Research, Inc., *Current Literature on Highway Investment and Economic Development*, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C., 1989.

A Primer on Transportation Investment and Economic Development, Transportation Association of Canada, Ottawa, ON, 1994.

Beinborn, E., A. Horowitz, S. Vijayan, and M. Bordewin, *Land Use and Economic Development in Statewide Transportation Planning*, Center for Urban Transportation Studies, University of Wisconsin–Milwaukee, Prepared for Federal Highway Administration, Washington, D.C., and the Wisconsin Department of Transportation, Madison, 1999. [Online]. Available: http://www.uwm.edu/Dept/CUTS/lu/lu-a112.pdf.

Bell, M. and T. McGuire, *NCHRP Report 389: Macroeconomic Analysis of the Linkages Between Transportation Investment and Economic Development*, Transportation Research Board, National Research Council, Washington, D.C., 1997.

Brown, D., *Highway Investment and Rural Economic Development: An Annotated Bibliography*, Bibliographies and Literature of Agriculture 133, Food and Rural Economics Division, U.S. Department of Agriculture, Washington, D.C. [Online]. Available: http://www.econ.ag.gov/epubs/pdf.blal33/index.htm.

Burkhardt, J., J. Hedrick, and A. McGavock (Ecosometrics, Inc.), *TCRP Report 34: Assessment of the Economic Impacts of Rural Public Transportation*, Transportation Research Board, National Research Council, Washington, D.C., 1998.

Butler, S. and L. Kiernan, *Estimating the Regional Economic Significance of Airports*, Office of Airport Planning and Programming, Federal Aviation Administration, Washington, D.C., 1993.

Cambridge Systematics, Inc., R. Cervero, and D. Aschauer, *TCRP Report 35: Economic Impact Analysis of Transit Investments: Guidebook for Practitioners*, Transportation Research Board, National Research Council, Washington, D.C., 1998.

David Simmonds Consultancy, *Analysis of Transport Schemes: Economic Impact Studies*, Report to the Standing Advisory Committee on Trunk Road Assessment (SACTRA), U.K. Department of the Environment, Transport and the Regions, London, 1999. [Online]. Available: http:www.roads.detr.gov.uk/roadnetwork/sactra/support99/analysis/pdf/analysis.pdf.

Forkenbrock, D., T. Pogue, N. Foster, and D. Finnegan, *Road Investment to Foster Local Economic Development*, Midwest Transportation Center, Iowa State University, Ames, 1990.

Hagler Bailly Services, Inc., *Guidance on Using Economic Analysis Tools for Evaluating Transport Investments*, NCHRP Project 2-19(2), Transportation Research Board, National Research Council, Washington, D.C., 2000.

Hagler Bailly Services, Inc., and MORPACE International, Inc., *NCHRP Report 436: Guidance for Communicating the Economic Impacts of Transportation Investments*, Transportation Research Board, National Research Council, Washington, D.C., 1999.

Hickling, Lewis & Brod, *Measuring the Relationship Between Freight Transportation and Industry Productivity*, NCHRP Project 2-17(4), Transportation Research Board, National Research Council, Washington, D.C., 1995.

Jack Faucett Associates, *Industry Studies of the Relationship Between Highway Transportation and Productivity*, Federal Highway Administration, Washington, D.C., 1994.

Lewis, D., *NCHRP Report 342: Primer on Transportation, Productivity and Economic Development*, Transportation Research Board, National Research Council, Washington, D.C., 1991.

Louis Berger and Associates, *NCHRP Report 403: Guidance for Estimating the Indirect Effects of Proposed Transportation Projects*, Transportation Research Board, National Research Council, Washington, D.C., 1998.

McDonald Transit Associates, *Economic Benefits of Transit*, Indiana Transport Association, undated.

Transportation Research Record 1274: Transportation and Economic Development 1990, Proceedings of a Conference, November 5–8, 1989, Williamsburg, Va., 1990.

Weisbrod, G. and B. Weisbrod, *Transportation Research Circular 477: Assessing the Economic Impacts of Transportation Projects: How to Choose the Appropriate Technique for Your Project*, Transportation Research Board, National Research Council, Washington, D.C., 1997.

Wilbur Smith Associates, B. Allen, C.P. Baumel, D. Forkenbrock, and D. Otto, *Guide to the Economic Evaluation of Highway Projects*, Iowa Department of Transportation, Ames, 1993.

GLOSSARY

The following are working definitions of the most common measures of economic development impacts.

Regional Output—The value of all *Business Sales* of goods and services that take place in an area, regardless of whether they are final products or interindustry sales of intermediate products (sold as inputs to production processes).

Gross Regional Product (GRP) or ***Value Added***—Represents the value of goods and services produced in the region, which are not purchased for further processing or resale within the region. Value added is calculated as output minus the cost of purchasing intermediate products.

Wages—Financial rewards paid to workers for the use of their services, and they are also the primary component of *Personal Income*. (The other sources of personal income are self-employment and investment income.) In general, wages represent a portion of business output and value added.

Employment—The number of *Jobs* associated with the business activity. It is supported by the wages paid to workers.

Productivity—Measures the efficiency of production and is generally expressed as a ratio of Output or GRP to the cost of some input (labor or capital) involved in its production. Increases in productivity are desirable because they indicate that inputs are being used more efficiently to generate output. Regional economic growth may occur due either to greater productivity (from existing resources) or from shifts in the location of resources.

Capital Investment—Money being spent in an area for improvements to land, construction of buildings, and purchases of equipment. When an area becomes more productive or profitable for business activity, the result is often an increase in investment associated with new startup businesses, relocation of outside businesses to the area, and expansion of new or existing businesses.

Property Value Appreciation— Reflects a growth in demand for real property (land and buildings) as a result of rising population, personal income, and business activity. Greater productivity and increased business output are key factors that increase personal income and business investment, and hence drive up property values. Property value is thus both an indicator of business investment and growth and also a potential source of wealth for property owners.

Tax Revenue and Public Expenditure Changes—Sometimes also estimated in economic development impact studies. However, government revenues and government expenditures are actually measures of "fiscal impact" rather than changes in the economy of an area. They show how government operations are affected by population and business growth. Although impacts on government can be important to understand, they are not a basic measure of the economic development impact of a transportation project or program.

Multipliers—Economic development impacts can be classified as *direct effects* on business growth (for businesses directly affected by changes in operating costs and markets), *indirect effects* on business growth (for suppliers to the directly affected businesses), *induced effects* on economic growth (for businesses affected by the respending of additional worker income), and *dynamic or additional induced effects* on economic growth (from shifts in population, workforce, labor costs, and prices). The sum of all *effects* represents the total effect on economic growth. The ratio of the [(total effect/direct effect)] is commonly referred to as an "economic multiplier," and the various nondirect effects are sometimes grouped together and referred to as "multiplier effects."

The terminology used to refer to multiplier effects sometimes differs from that cited here. For instance, some studies use "indirect effects" to refer to all nondirect (multiplier) effects. In addition, many airport impact studies follow the recommendation of an FAA guide and use the term "indirect effects" to refer to spending by air travelers in their destination communities, whereas "induced effects" refers to all multiplier effects.

APPENDIX A

Questionnaire

PROCEDURES FOR ASSESSING ECONOMIC DEVELOPMENT IMPACTS FROM TRANSPORTATION INVESTMENTS

There is a wide variation among transportation agencies in terms of how they consider economic development impacts of their projects and programs. This includes differences in:

- how agencies view the definition and importance of economic development impacts;
- the purposes for which agencies assess those impacts;
- the methods agencies use to assess them;
- the uses agencies make of that information.

This questionnaire seeks to shed light on those issues by documenting the state of practice among transportation agencies. While the survey is being sponsored by the National Cooperative Highway Research Program, it seeks information concerning all modes of transportation, and practices in other countries as well as around the United States.

The questionnaire should be filled out by persons who are familiar with your agency's analysis activities pertaining to the broad area of economic impacts. *Your answers to this are relevant and important regardless of whether or not your agency actively assesses the economic development impacts of its transportation projects or programs.*

Please return the completed questionnaire and any supporting documents by June 15, 1999 to:

Glen Weisbrod
Economic Development Research Group
10 High Street, Suite 620
Boston, MA 02110–1605
USA

If you wish, you may fax your responses to him at 1.617.338.1174.

If you have any questions, you may contact him by telephone (1.617.338.6775) or by e-mail (gweisbrod@edrgroup.com).

BACKGROUND INFORMATION

Agency/Organization Responding: _____

Address: _____

Name of Respondent: _____

Title/Department: _____ Phone: _____

Date: _____ E-mail: _____

Transport modes covered by your agency

(check all that apply) - - - - - →

Road	Transit	Air	Water	Rail
❑	❑	❑	❑	❑

PART I—ECONOMIC IMPACT MEASURES

This section asks about your agency's past use of, or existing interest in, various economic measures of transportation project impacts.

1-2. What measures have you used in the past, or would consider using in the future, to represent the economic value of projects (or programs) to the public or to decision makers?

(check all that apply)

		1. We have done this in the **PAST**	2. We intend to consider this in the **FUTURE**
Economic Development Impact Measures			
a. effect on employment (jobs)	→	a. ❑	a. ❑
b. effect on personal income	→	b. ❑	b. ❑
c. effect on business sales (output)	→	c. ❑	c. ❑
d. effect on economic activity (value added)	→	d. ❑	d. ❑
e. effect on tourism spending	→	e. ❑	e. ❑
f. effect on property values & development	→	f. ❑	f. ❑
g. effect on business productivity	→	g. ❑	g. ❑
h. effect on industry composition or structure	→	h. ❑	h. ❑
i. effect on business (dis)location	→	i. ❑	i. ❑
Economic Value of Transport System Efficiency			
j. $ value of travel time & expense change	→	j. ❑	j. ❑
k. $ value of safety change	→	k. ❑	k. ❑
l. $ value of environmental change	→	l. ❑	l. ❑
m. other (specify measure and units)	→	m. ❑	m. ❑
None of the Above	→	n. ❑	n. ❑

3. Regardless of what you checked on the previous page, please tell us

a. Which of the measures listed on the previous page appear to be of most importance for communicating findings on economic impacts to the public?

_____

_____

b. Which of the measures listed on the previous page appear to be of most importance to decision makers?

_____

_____

(List the one or two impact measures that are most critical for each audience. If the answers differ by type of project, then please explain.)

The questions that follow ask about your agency's use of economic impact analysis (using any of the measures listed on the previous page) for different transport modes. Please fill it out for all modes covered by your agency.

Road projects	Transit projects	Air projects	Water projects	Rail projects

4. How often does your agency evaluate the value of impacts or benefits associated with transportation projects or programs? *(check one for each mode)*

a. We do it regularly (for all major projects) →	a. ☐	a. ☐	a. ☐	a. ☐	a. ☐
b. We have done it for special situations or types of projects →	b. ☐	b. ☐	b. ☐	b. ☐	b. ☐
c. We have not done it →	c. ☐	c. ☐	c. ☐	c. ☐	c. ☐

5. If you checked "a" or "b" for Question 4, what were the primary motivations for assessing those impacts or benefits? *(check all that apply)*

a. Program or project planning →	a. ☐	a. ☐	a. ☐	a. ☐	a. ☐
b. Rank alternatives →	b. ☐	b. ☐	b. ☐	b. ☐	b. ☐
c. Environmental impact assessment →	c. ☐	c. ☐	c. ☐	c. ☐	c. ☐
d. Benefit/cost analyis →	d. ☐	d. ☐	d. ☐	d. ☐	d. ☐
e. Evaluate prior investment →	e. ☐	e. ☐	e. ☐	e. ☐	e. ☐
f. Public information or discussion →	f. ☐	f. ☐	f. ☐	f. ☐	f. ☐
g. Other (specify)					
_____ →	g. ☐	g. ☐	g. ☐	g. ☐	g. ☐

6. When you don't assess the value of impacts or benefits associated with transportation projects or programs, what are the main reasons why not? *(check all that apply)*

a. Not required or needed for decisions →	a. ☐	a. ☐	a. ☐	a. ☐	a. ☐
b. No demand/audience for it →	b. ☐	b. ☐	b. ☐	b. ☐	b. ☐
c. No applicable projects →	c. ☐	c. ☐	c. ☐	c. ☐	c. ☐
d. Simple tools/procedures not available →	d. ☐	d. ☐	d. ☐	d. ☐	d. ☐
e. Too expensive to do →	e. ☐	e. ☐	e. ☐	e. ☐	e. ☐
f. Lack of familiarity with the subject →	f. ☐	f. ☐	f. ☐	f. ☐	f. ☐
g. Other (specify)					
_____ →	g. ☐	g. ☐	g. ☐	g. ☐	g. ☐

PART II—FOCUS ON ECONOMIC DEVELOPMENT IMPACTS

This section asks about the narrower category of "economic development" impacts, as defined in Question 1. Again, fill in columns only for modes covered by your agency.

7. Has your agency assessed a project's or program's **economic development impacts** (effects on jobs, the economy, and development) as distinguished from the economic value of **transportation system benefits** (the $ value of savings in travel time, travel cost, travel safety, or environmental factors)? *(check one for each mode)*

	→	Road	Transit	Air	Water	Rail
a. ***YES**, we have assessed both measures*	→	a. ❑	a. ❑	a. ❑	a. ❑	a. ❑
b. ***YES**, we assessed only econ. devel. impacts*	→	b. ❑	b. ❑	b. ❑	b. ❑	b. ❑
c. ***NO**, we assessed only system benefit measures*	→	c. ❑	c. ❑	c. ❑	c. ❑	c. ❑
d. ***NO**, we have not assessed either measure*	→	d. ❑	d. ❑	d. ❑	d. ❑	d. ❑

If NO to Question 7, then please skip to Part III (question 23).

8. For <u>what kind of projects or programs</u> has your agency assessed economic development impacts? *(check all that apply)*

	→	Road	Transit	Air	Water	Rail
a. *system speed or capacity enhancement*	→	a. ❑	a. ❑	a. ❑	a. ❑	a. ❑
b. *station/port/interchange facilities*	→	b. ❑	b. ❑	b. ❑	b. ❑	b. ❑
c. *demand mgmt. or performance upgrade*	→	c. ❑	c. ❑	c. ❑	c. ❑	c. ❑
d. *inter-modal facilities*	→	d. ❑	d. ❑	d. ❑	d. ❑	d. ❑
e. *policy (incl. pricing & service levels)*	→	e. ❑	e. ❑	e. ❑	e. ❑	e. ❑
f. *overall spending program*	→	f. ❑	f. ❑	f. ❑	f. ❑	f. ❑
g. *other (specify)*						
_____	→	g. ❑	g. ❑	g. ❑	g. ❑	g. ❑

9. Please <u>list</u> examples of cases where your agency has assessed economic development impacts of projects or programs. Include project name, project type, and year. These should be examples of the modes and project types checked above.

(If you have a particular case study that you think we should highlight in our report, then please note it. Use additional sheets if desired.)

_____

_____

_____

_____

_____

_____

_____

_____

Please answer the following questions about your agency's <u>past</u> economic development impact studies (as reported in preceding questions 8 and 9).

10. What study areas were used for the analysis? *(check all that apply)*

a.	*our agency's jurisdiction (e.g., state or region)* →	a. ❑
b.	*the area surrounding the project itself* →	b. ❑
c.	*the nation* →	c. ❑
d.	*other (specify below)* →	
	_____ →	d. ❑

11. What time perspective was used for the analysis? *(check all that apply)*

a.	*"after studies" (impacts of past projects)* →	a. ❑
b.	*"before studies" (expected impacts of proposed projects)* →	b. ❑
c.	*other (specify below)* →	
	_____ →	c. ❑

12. What economic data sources were used for the analysis? *(check all that apply)*

a.	*census & other population data* →	a. ❑	*g.*	*local interviews or surveys* →	g. ❑
b.	*County Business Patterns & other employment data* →	b. ❑	*h.*	*property value data* →	h. ❑
c.	*Economic Census or BEA business data* →	c. ❑	*i.*	*private business data sources (ABI), D&B, etc.)* →	i. ❑
d.	*Local/regional economic forecasts* →	d. ❑	*j.*	*tourism, convention, & visitor data* →	j. ❑
e.	*freight or commodity flow data* →	e. ❑	*k.*	*business market studies of the area* →	k. ❑
f.	*Bureau of Transportation Statistics travel data* →	f. ❑	*l.*	*case studies of other areas* →	l. ❑
			m.	_____ →	m. ❑
			n.	_____ →	n. ❑

Additional notes or comments on the type of economic data sources used: _____

_____

_____

_____

_____

13. What analysis tools or methods were used? *(check all that apply)*

a.	*travel demand or traffic network models* →	a. ❑	*i.*	*direct surveys or interviews* →	i. ❑
b.	*input/output models (IMPLAN or RIMS)* →	b. ❑	*j.*	*direct on-site observations* →	j. ❑
c.	*economic simulation models (incl. REMI)* →	c. ❑	*k.*	*economic market studies* →	k. ❑
d.	*fiscal impact models* →	d. ❑	*l.*	*comparison to case studies elsewhere* →	l. ❑
e.	*benefit-cost analysis tools* →	e. ❑		*other tools or methods (list below)*	
f.	*statistical/regression analysis* →	f. ❑	*m.*	_____ →	m. ❑
g.	*custom spreadsheet tools* →	g. ❑	*n.*	_____ →	n. ❑
h.	*geographic information systems (GIS)* →	h. ❑			

14. If your agency used more than one analysis method or tool for conducting economic development impact analysis, please explain (a) why different methods were employed and (b) the perceived pros and costs (or tradeoffs) associated with alternative methods.

_____

_____

_____

_____

15. Who were the primary individuals conducting the economic development impact analyses? *(check all that apply)*

a.	*outside contractor*	→ a. ❑
b.	*in-house economist*	→ b. ❑
c.	*in-house planner*	→ c. ❑
d.	*in-house engineer*	→ d. ❑
e.	*other in-house staff (specify below)*	
	_____	→ e. ❑
f.	*other agencies (specify below)*	
	_____	→ f. ❑

16. What needs motivated the specific study of **economic development** impacts? *(check all that apply)*

a.	*interest in assisting the econ. development of depressed areas*	→ a. ❑
b.	*to help address local land use or land development issues*	→ b. ❑
c.	*response to local concerns about proposed projects*	→ c. ❑
d.	*to assist in refining project plans or design*	→ d. ❑
e.	*for project ranking, selection or benefit-cost analysis*	→ e. ❑
f.	*Environmental Impact Assessment requirements*	→ f. ❑
g.	*for public relations*	→ g. ❑
h.	*agency research interests*	→ h. ❑
i.	*other (specify below)*	
	_____	→ i. ❑

17. Was your agency staff satisfied that the economic development impact studies conducted by (or for) your agency addressed the above needs?

a.	*YES, they were successful in meeting those needs*	→ a. ❑
b.	*NO, they were not successful in meeting those needs*	→ b. ❑
c.	*PARTIALLY successful*	→ c. ❑

Please explain what made them successful or unsuccessful _____

_____

_____

18. Has your agency justified specific projects primarily on the basis of economic development benefits?

		Road projects	Transit projects	Air projects	Water projects	Rail projects
a.	*NO, it has not* →	a. ❑	a. ❑	a. ❑	a. ❑	a. ❑
b.	*YES, it has* →	b. ❑	b. ❑	b. ❑	b. ❑	b. ❑

Please describe the types of projects that have been justified by economic development benefits.

_____

_____

_____

_____

_____

The next set of questions concerns your agency's <u>current</u> interest and involvement in economic development impact studies.

19. Is economic development impact analysis a <u>regular component</u> of your agency's project evaluation procedures? *(check one for each mode that is covered by your agency)*

		Road	Transit	Air	Water	Rail
a. NO, it is <u>not</u> a regular component	→	a. ☐	a. ☐	a. ☐	a. ☐	a. ☐
b. YES, it is a regular component	→	b. ☐	b. ☐	b. ☐	b. ☐	b. ☐

20. Please explain the <u>rules or criteria</u> your agency uses in deciding that a particular type of project requires an assessment of economic development impacts.

_____

_____

_____

_____

21. Does your agency have a process to assess whether a project is consistent with local economic development or land use plans as part of its assessment of economic development benefits? *(check one for each mode that is covered by your agency)*

		Road	Transit	Air	Water	Rail
a. NO, we do not have such a process	→	a. ☐	a. ☐	a. ☐	a. ☐	a. ☐
b. YES, we do have such a process	→	b. ☐	b. ☐	b. ☐	b. ☐	b. ☐

22. How many people within your agency are actively involved in assessment of economic development impacts?

(Note the nature of full-time or part-time activity) _____

_____

_____

_____

PART III—PERCEPTIONS OF NEED AND OPPORTUNITY

This section examines the adequacy of current resources and methods for assessing economic development impacts of transportation, and opportunities for improvement.

Please respond to these remaining questions regardless of whether or not your agency now engages in economic development impact assessment.

23. How has your agency's need to examine economic development impacts changed over time? (e.g., increased, decreased, or change in nature of interest in this topic) *Please explain.*

_____

_____

_____

24. What are the major problems/deficiencies with economic development impact analysis, as perceived by your agency? (e.g., data deficiencies, lack of standards, inadequate methods, expense, difficult to interpret results, not universally accepted) *Please be specific.*

_____

_____

_____

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25. Does your agency (or some part of your agency) desire to better address economic development impacts?
Yes ❑ No ❑

If yes, what is needed to make this possible? *Please rate each item by its importance in improving the assessment of economic development impacts:*

(2 = of major importance, 1 = of minor importance, 0 = no major change needed)

a.	*Funding*	→ a. —	*g.*	*Clarification of standards (what to measure)*	→ g. —
b.	*Managememt attention*	→ b. —	*h.*	*Research to clarify the transportation/economic development link other (specify below)*	→ h. —
c.	*Staff training*	→ c. —			
d.	*Availability of data*	→ d. —			
e.	*More complete analysis tools*	→ e. —			
f.	*More understandable analysis tools*	→ f. —	*i.*	_____	→ i. —
			j.	_____	→ j. —

Please explain all needs rated "2" (of major importance): _____

_____

_____

_____

PART IV—ADDITIONAL ITEMS

26. It would be very helpful if you could send copies of reports (or relevant excerpts from them) showing what your agency has done in terms of evaluation, research or guidance regarding the assessment of economic development impacts. *(Check below what you will be sending.)*

		We will send reports	We have studies, but call us to discuss them
a.	evaluation reports assessing econ. devel. impacts of proposed projects →	a. ❑	a. ❑
b.	research studies measuring econ. devel. impacts of completed projects →	b. ❑	b. ❑
c.	agency guidelines regarding econ. devel. impact evaluation →	c. ❑	c. ❑
d.	other items (specify below)		
	_____ →	d. ❑	d. ❑

27. If there are studies or documents done by others, which you consider to be useful guides or best practice examples for assessing economic development impacts, please identify them.

_____

_____

_____

_____

28. Other comments:

_____

_____

_____

_____

Please return the completed questionnaire and any supporting documents by June 15, 1999 to:

GLEN WEISBROD
Economic Development Research Group
10 High Street, Suite 620
Boston, MA 02110–1605
USA
Fax: 1.617.338.1174
Tel: 1.617.338.6775
E-mail: **gweisbrod@edrgroup.com**

APPENDIX B

Summary of Responses and Experiences by State

Agency	Responded to Survey	Reported Previous Economic Development Impact Assessment
States		
Alabama Department of Transportation		
Alaska Department of Transportation and Public Facilities		
Arizona Transportation Research Center		
Arkansas State Highway and Transportation Department	X	
California Department of Transportation (Caltrans)	X	X
Colorado Department of Transportation		
Connecticut Department of Transportation	X	X
Delaware Department of Transportation	X	X
District of Columbia Department of Public Works		
Florida Department of Transportation	X	X
Georgia Department of Transportation		
Hawaii Department of Transportation	X	X
Idaho Transportation Department		
Illinois Department of Transportation		
Indiana Department of Transportation	X	X
Iowa Department of Transportation	X	X
Kansas Department of Transportation	X	X
Kentucky Transportation Cabinet	X	X
Louisiana Transportation Research Center	X	X
Maine Department of Transportation	X	X
Maryland Department of Transportation	X	X
Massachusetts Highway Department		
Michigan Department of Transportation	X	X
Minnesota Department of Transportation	X	X
Mississippi Department of Transportation	X	X
Missouri Department of Transportation	X	X
Montana Department of Transportation	X	X
Nebraska Department of Roads	X	
Nevada Department of Transportation	X	
New Hampshire Department of Transportation		
New Jersey Department of Transportation	X	X
New Mexico Highways and Transportation Department		
New York State Department of Transportation	X	X
North Carolina Department of Transportation	X	X
North Dakota Department of Transportation		
Ohio Department of Transportation		
Oklahoma Department of Transportation	X	X
Oregon Department of Transportation	X	X
Pennsylvania Department of Transportation	X	X
Puerto Rico Department of Transportation and Public Works		
Rhode Island Department of Transportation	X	X
South Carolina Department of Transportation	X	X

Agency	Responded to Survey	Reported Previous Economic Development Impact Assessment
States		
South Dakota Department of Transportation	X	X
Texas Department of Transportation	X	X
Utah Department of Transportation	X	
Vermont Agency of Transportation		
Virginia Transportation Research Council	X	X
Washington State Department of Transportation	X	X
West Virginia Department of Transportation	X	X
Wisconsin Department of Transportation	X	X
Wyoming Department of Transportation	X	X
Canadian Provinces		
Alberta		
British Columbia Ministry of Transportation and Highways	X	X
Manitoba Highways and Transportation	X	X
Newfoundland Works Services Transportation	X	X
Northwest Territories Department of Transportation	X	X
Nova Scotia Transportation and Public Works	X	X
Ontario Ministry of Transportation	X	X
Prince Edward Island		
Quebec		
Saskatchewan Highways and Transportation	X	X
Yukon		
Europe		
U.K. Roads and Traffic Directorate	X	X
Metropolitan Planning Organizations		
Central Texas Council of Governments	X	X
Maricopa Association of Governments (Ariz.)	X	
Pima Association of Governments (Ariz.)	X	
Portland Metro (Oreg.)	X	X
San Diego Association of Governments (Calif.)	X	X
Southeast Michigan Council of Governments	X	
Southwestern Pennsylvania Planning Commission	X	X
Strafford Regional Planning Commission (N.H.)	X	

APPENDIX C

Listing of Economic Development Impact Studies

Study Area (State/ Province)	Sponsor Agency	Study Title	Author/ Organization	Year
		AIRPORT STUDIES		
CA	LA Dept. of Airports	Linking Infrastructure to Industry: Estimating the Economic Impacts of Alternative Futures for Los Angeles International Airport	HR&A	1996
CA	San Diego Int. Airport	San Diego International Airport: Economic Impact of Master Plan Implementation	Sourcepoint	1999
CO	CO DOT	The Economic Impact of Colorado Airports	Wilbur Smith	1992
CO	Colorado National Banks	Ready for Takeoff: The Business Impact of Three Recent Airport Developments in the U.S.	Colorado National Banks	1989
CT	CT DOT	Groton Airport Master Plan		1998
CT	CT DOT	Bradley International Airport		1998
GA	DeKalb County	Cost Benefit Study of the DeKalb Peachtree Airport	RKG Associates	1997
HI	HI DOT	Economic Impact Study: Statewide Airport System	HI DOT	NA
HI	HI DOT	Economic Impact Study: Honolulu International Airport	HI DOT	NA
IL	Chicago Dept. of Aviation	Contributions of the Chicago Airport System to the Chicago Regional Economy	National Economic Research Association	1993
KY	KY DOT	Kentucky's Aviation Systems Plan—Economic Impact Analysis		
MA	MA Aeronautics Commission	Economic Impact of Public Use Airports in Massachusetts	Simat Helliesen and Eichner	1999
MD	MD Aviation Admin.	The Local and Regional Economic Impacts of the Baltimore–Washington International Airport	Martin Associates	1999
MD	MD DOT	Forecast of Return—An Investment for New Terminal Development		
ME	ME DOT	Portland Jetport Economic Benefits Study		1995
MI	MI DOT	Michigan Airport System Plans		NA
MS	MS DOT	Regional Airport Study in Turica Gaming Area		1996
NC	NC DOT	Economic Impact of Publicly Owned Airports in North Carolina	NC DOT	1996
NV	AmericaWest Airlines	Estimating the Economic Impacts of a Hub Airline Serving a Tourist Destination: The Case of America West Airlines and Las Vegas, Nevada	Univ. of Nevada	1995
NY	NY DOT	Economic Impact of Aviation in New York State	Wilbur Smith Associates	1992
OR	OR DOT	Economic Impact of Airports	Airport Technology and Planning Group	NA
PA	Penn DOT	Economic Impact of Aviation in Pennsylvania	AirTech	1995
Scotland	Renfrewshire Enterprise	Glasgow Airport—An Opportunities Study	Rendel Planning, TPA, & Cambridge Systematics	NA
USA	FAA	Estimating the Regional Economic Significance of Airports	FAA	1992
USA	FAA	The Economic Impact of Civil Aviation on the US Economy: Update	Wilbur Smith Associates	1995
WI	WIS DOT	The Economic Impact of Aviation Industry in Wisconsin		
WV	WV DOT	I-66 TransAmerica Corridor study–various studies subsequent to ISTEA		
		BICYCLE STUDIES		
MD	MD DNR	Analysis of Economic Impacts of the Northern Central Rail Trail	PKF Consulting	1994

HIGHWAY STUDIES

AR	AR Highway & Trans. Department	Corridor 18 Feasibility Study	Wilbur Smith Associates	NA
Australia	BTE	Economic Benefits of Investment in Transport and Communications Infrastructure: Berrima and Mittagong Bypasses		1994
CA	CA DOT	State Transportation Improvement Program		NA
CA	CA DOT	Proposed highway bypass projects (various)		NA
CT	CT DOT	Hartford West Major Investment Study		1999
DE	DE DOT	US-13 Bypass Environmental Impact Study		1985
DE	DE DOT	US-301 Major Investment Study		NA
DE	DE DOT	Project Prioritization Process Workbook		NA
Finland	MTC	Effects of Transport Infrastructure on Regional and Peripheral Development: Case Study Candidates from Finland		1999
France	METL	The Economic Impacts of Major Motorways Infrastructures: Main Lessons of Ex Post Studies		1996
FL	FL DOT	1996 Florida Trans. Commission & Floridians for Better Transportation		1996
HI	HI DOT	Kealakene Parkway, North Kona, HI, New Roadway		1995
HI	HI DOT	Nimitz Highway improvements, Oahu, HI		NA
HI	HI DOT	Highway viaduct/widening		1996
IA	IA DOT	Guide to the Economic Evaluation of Highway Projects	Wilbur Smith Associates	NA
IA	IA DOT	The Economic Impact of Rural Highway Bypasses: Iowa and Minnesota Case Studies	IA DOT	NA
IA	IA DOT	The Perceptions of Business Owners and Managers of the Impact of the Rural Highway Bypass	Iowa State University	NA
IA	IA DOT	Avenue of the Saints		1990
IA	IA DOT	Highway 63 Corridor		1992
IA	IA DOT	Highway 20 Corridor		1993
IN	IN DOT	Economic Impacts of US-31 Corridor Improvements	Cambridge Systematics	NA
IN	IN DOT	Economic Impacts of SR-26 and US-35 Corridor Improvements	Cambridge Systematics	1998
IN	TRB	Major Corridor Investment–Benefit Analysis System		1999
KS		Economic Impacts of the Kansas Comprehensive Highway Program	Kansas State University	1997
KS	KS DOT	Impacts of Highway Bypasses on Kansas Towns	Univ. of Kansas	1996
KY	KY TC	Southern Kentucky Corridor (I-66) Economic Justification & Financial Feasibility	Univ. of KY	1997
KY	KY TC	Economic Impact Assessment of KY69 Improvements	Economic Development Research Group	NA
KY	KY DOT	ORMIS–Ohio River Bridges Major Investment Study		1998
LA	LA DOT	US-371 Capacity Enhancement		1997
LA	LA DOT	Hickory Avenue—Capacity Enhancement		1998
LA, MS	LA DOT	Economic Impact Study (Phase II) of the Proposed Mississippi River Bridge at St. Francisville, Louisiana, and the Zachary Taylor Parkway	Economic Development Research Group	1999
Labrador	Labrador DWST	Trans Labrador Highway Social and Economic Project Feasibility Analysis Condensed Final Report	Fiander-Good Associates	1993
MA	MA Highway Department	"Economic Impacts" Central Artery/Third Harbor Tunnel Environmental Impacts Statement/Report, Part I, Chapter 2, Appendix 4, and Chapter 3	Cambridge Systematics	NA
MA	MA DOT	Economic Impacts of Proposed Improvements to Route 2/Alewife Brook Parkway	Cambridge Systematics	NA
MA	MA DOT	Environmental Impact Statement—Central Artery/Third Harbor Tunnel	Bechtel/Parsons Brinckerhoff	NA
MD	MD SHA	The Economic Impact of Maryland Highway Investment	Towson University	1998
MD	MD DOT	Middle River Employment Center Access Study		1998
MD	MD DOT	Woodrow Wilson Bridge improvement study		1997
MD	MD DOT	East Street Extension—Capacity Development		1998
MD	MD DOT	Canal Parkway Development Study		1995

ME	ME DOT	I-95 Aroostook Corridor		1996
ME	ME DOT	East–West Highway Study—planning feasibility study		1999
ME	ME DOT	Aroostook City Transportation Study/Environmental Impact Study		
MI	MI DOT	Economic Analysis of the Proposed US-131 Freeway Extension Cadillac to I-75	Wilbur Smith Associates	1998
MI	MI DOT	US-131 Freeway Extension in Northern Michigan		1998
MN	MN DOT	Corridor study for rural highways		1985–95
MO	MO DOT	Route 5 Corridor Study—REMI Model		1994
Multi-state	Five state DOTs	St. Louis to St. Paul Corridor Feasibility and Necessity Study	Wilbur Smith Associates	1990
Multi-state	US DOT	Economic Impacts of Upgrading U.S. Route 219 to Interstate Standards from Springville, New York, to DuBois, Pennsylvania	Peat Marwick Main & Co.	NA
Multi-state	OH—KY—IN Region COG	Final Report: I-71 Corridor Transportation Study	Burgess and Niple	1998
Multi-state		Indianapolis to Texas Corridor Economic Feasibility Study	Wilbur Smith Associates	1997
Multi-state	ARC	Appalachian Development Highways: Economic Impact Study	Wilbur Smith Associates	1998
Multi-state	ARC	Economic Impact of the Appalachian Development Highway System	Wilbur Smith Associates	NA
Multi-state	FHWA	Linking the Delta Region with the Nation and the World, 1995	Lower Mississippi Delta Development Center	1996
NC	NC DOT	Impacts of Highway Bypasses on Community Businesses	NC DOT	NA
NC	UNC–Charlotte	Commercial Development at Rural and Small Town Interstate Exits	UNC–Charlotte	NA
NC	NC DECD	Interstate 40 Economic Impact: Technical Report	UNC–Charlotte	NA
NC	NC DOT	North Carolina Environmental Impact Study for Road Improvements on US 64	NC DOT	NA
NC	NC DOT	I-40 new location Raleigh to Wilmington		NA
NC		Economic Impacts of the Monroe–Gastonia Connector	UNC–Charlotte	1999
NC	NC DOT	Technical Report #9: Before and After Study of the Person Street/Blount Street One-Way Pair	NC DOT	1982
NE, SD	NE DOR, SD DOT	Heartland Expressway: Economic and Engineering Feasibility Study	Wilbur Smith Associates	1993
NJ	NJ DOT	Various major investment studies		NA
NY	NY DOT	Route 531 Rochester–Brockport Major Investment Study	FXM Associates	1999
OK	OK DOT	I-40 Crosstown Environmental Impact Study and Major Investment Study		1999
OR	OR DOT	Tillamook Branchline Benefit—cost study 1985 rail freight		
PA	PA DOT	Rural Community Impact Analysis and Mitigation on the 220 Project in Pennsylvania	Skelly and Loy	1997
PA	PA DOT	US-219 Johnsonbury Bypass		NA
PA	PA DOT	Hazleton beltway projects		NA
PA	PA DOT	Hershey park drive widening		NA
PA	PA DOT	State College Bypass		NA
PA	PA DOT	Keystone Corridor Project (R.C. Banks Study 1997)		1997
PA	PA DOT	Act 3 Report Card (Abrams & Associates)		NA
RI	RI DOT	RT-403 Quonset–Davisville Connector		1997
RI	RI DOT	Highland Industrial Park Connector		1997
SC	SC DOT	Economic Impact Study of I-85 Improvement Alternatives	SC DOT	NA
SC	SC DOT	Western Corridor		1994
Scotland	Glasgow Devel. Agency	The Relationship Between Economic Development and Transport Links, Stage 2: Economic Effects of the M74 Northern Extension	Oscar Faber/TPA, Cambridge Systematics	1993
SD	SD DOT	Eastern Dakota and Pierre to I-90: Expressway Feasibility Study	Wilbur Smith Associates	1994
SD	SD DOT	Expressway Development Plan	SD DOT	1994
SD	SD DOT	Economic Impact Analysis of TEA-21		NA

Sweden	Roal Institute of Technology	The Regional Development Impacts of the Oresund Bridge		1999
TX	TX DOT	Economic Development Impacts of Expenditures for State Highway Improvements in Texas: Preliminary Findings	TX DOT	1991
TX	TX DOT	Phase I Corridors Capacity Enhancement		1998
TX	TX DOT	Economic Impact of Developments of Texas Truck System		
TX	TX DOT	Economic Impact of Highway Widening		1994–96
TX	TX DOT	Economic Assessment of the Proposed Improvement of US Highway 287 in Wichita Falls	Texas Transportation Institute	1991
USA	AASHTO	Effects of Highway Bypasses on Rural Communities & Small Urban Areas	Texas Transportation Institute	1995
USA	FHWA	Contributions of Highway Capital to Output and Productivity Growth in the U.S. Economy and Industries	NYU	1998
USA	FHWA	Highway Capital and Productivity Growth	NYU and Univ. of Cypress	1996
USA	NCHRP	Economic Effects of Restricting Left Turns	Cambridge Systematics	1998
USA	Eno Foundation	Background Paper: Productive Highway Capital Stocks, Policy Forum, Transportation Investment and New Insights from Economic Analysis	Eno Foundation	1999
VA	VA DOT	US-58 Corridor Improvements		1991
WA		Lessons from Eastern Washington: State Route Mainstreets, Bypass Routes and Economic Development in Small Towns	Washington State University	1994
WI	WISDOT	The Economic Impacts of Highway Bypasses on Communities: Summary; Technical Report	WISDOT	1998
WI	WISDOT	Economic Study for STH-29 Bypass: Chippewa County	WISDOT	1996
WI	WISDOT	A Study of New and Expanding Manufacturing Plants in Wisconsin during 1990–1996: Analysis of New and Expanding Manufacturing Plants along Wisconsin's Highway Transportation Corridors	WISDOT	1997
WI	WISDOT	Relationship of Highway Rehabilitation Projects and Economic Development	WISDOT	1996
WI	WISDOT	Impacts of Highway Facility Improvements on Travel & Regional Development	WISDOT	NA
WI	WISDOT	The Economic Impacts of Highway Businesses on Communities	WISDOT	1998
WI	WISDOT	Economic Development and the State Trunk Highway System	WISDOT	1998
WI	WISDOT	Durand U.S. Highway Relocation Alternatives Economic Impact Analysis	WISDOT	1999
WV	WV DOT	Mason City to Kanawha City feasibility study—Corridor Location Study		1990
WV	WV DOT	North-Central West Virginia Toll Road feasibility study		1989
WV	WV DOT	Regional TransPark Studies		1992–98

MULTIMODAL STUDIES

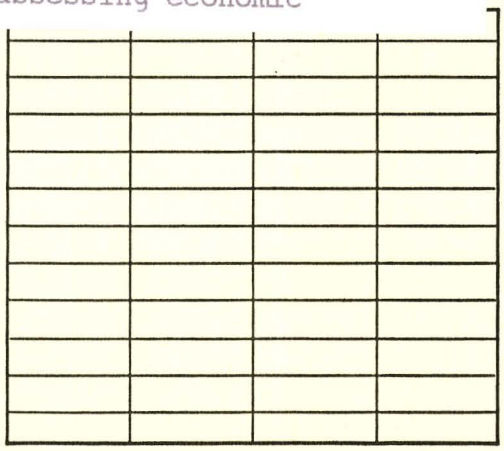
CA	Alameda Corridor TA	Alameda Corridor: A Project of National Significance	DMJM and Moffatt & Nichol	1997
FL	FL COC	Transportation Cornerstone Florida: Technical Report	Cambridge Systematics	1999
FL	FL Trans. Comm.	Transportation: An Investment in Florida's Future	FL Transportation Comm.	1996
GA	CSX Int.	Economic Impact Study of CSX Intermodal's New Atlanta Intermodal Terminal	Wilbur Smith Associates	1995
IA	NCHRP	Evaluation of Methods, Tools, and Techniques to Assess the Social and Economic Effects of Transportation Projects	Univ. of Iowa	NA
MD	MD DOT	US-301 Corridor Task Force—Multimodal transportation improvements		
MD	MD DOT	The Distribution Industry: An Engine for Maryland's Growth	Johns Hopkins Univ.	1996
ME	ME DOT	Strategic Passenger Transportation Plan		1997
ME	ME DOT	Integrated Freight Plan		1998
MN, WI	MN DOT, WI DOT	Economic Impact Analysis: St. Croix River Crossing	Economic Development ResearchGroup	1999
MT	MT DOT	TranPlan 21: Supporting Economic Development through the Transportation System: Policy Paper	Dye Management Group	NA

Multi-state		Economic Feasibility and Impact: I-35 Trade and Transportation Corridor	Wilbur Smith Associates	1999
Multi-state	SE Trans. Alliance	Latin America Trade and Transportation Study	Wilbur Smith Associates	NA
NJ	NJ TPA	TELUS: The Transportation, Economic, and Land-Use System, a State-of-the-Art Transportation Information System for the 21st Century	NJIT & Rutgers	1998
NWT	Northwest Territories DOT	Slave Province Transportation Corridor: Economic Impacts and Taxation Revenue	Conference Board of Canada	1994
OH	Mid-Ohio RPC	Summary Report: MORPC Inland Port III	Cambridge Systematics	1999
OR	OR DOT	Benchmarking in Oregon: Understanding the Benefits of Transportation Investment	OR DOT	NA
OR	OR DOT	OR DOT Immediate Opportunity Fund Policy Guidelines	OR DOT	NA
PA	Penn DOT	Cost Effectiveness: Survey of Business and Industry	Penn DOT	1988
UK, France		Modelling the Regional Economic Impacts of the Channel Tunnel		1994
USA	Eno Trans. Foundation	Economic Returns from Transportation Investment	Eno Transportation Foundation, Inc.	1996
USA	TCRP	Economic Impact Analysis of Transit Investments	Cambridge Systematics	1996
USA	TRF	Economic Impacts of Transportation Investments: The Case of Federal Express		1995
USA	Univ. of Cal.	Highways and Economic Productivity: Interpreting Recent Evidence	Univ. of CA Trans Center	1995
USA	FHWA	Metropolitan Planning Technical Report: Evaluation of Transportation Alternatives: Least-Cost Planning: Principles, Applications and Issues	ECONorthwest	1995
USA	NCHRP	Macroeconomic Analysis of the Linkages Between Transportation Investments and Economic Performance	TRB	1997
USA	TRB	Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project	Economic Development Research Group	NA
USA	TTI	Transportation and Manufacturing Productivity	Texas Trans. Institute	1993
VA	Greater Richmond COC	Impacts of Transportation Infrastructure Investments on the Greater Richmond Region	ICF Kaiser	NA
VA	VA DOT	I-73 Economic Impact Analysis		1995
WI	WISDOT	Claude Allouez Bridge Alternatives Analysis: Impacts on the Local Economy	WISDOT	1998
		RAIL STUDIES		
CA	CA Intercity HSRC	Economic Impact and Benefit/Cost of High Speed Rail for California	Economic Research Associates	1996
CA	San Diego AG	Economic Feasibility Study of the San Diego and Arizona Eastern Railway	San Diego AG	1996
ME	ME DOT	Rail Development to Eastport		1998
MN	MN DOT	MN Intermodal Rail/Truck facility study		1998
MO	MO DOT	Pemiscot County Port Authority—rail rehabilitation study		
NJ	NJ DOT	Midtown Direct Commuter Rail		NA
Multi-state	CONEG	CONEG High Speed Rail Regional Benefits Study	Parsons Brinckerhoff	1989
RI	RI DOT	Freight Rail Improvement Project		1998
WA	WA DOT	Washington State Freight Rail Plan	Wilbur Smith Associates	1998
		PUBLIC TRANSPORTATION STUDIES		
CA	Los Angeles MTA	Economic Impacts of the Long-Range Transportation Plan	Cambridge Systematics	1999
CA	San Diego AG	Economic Contributions of Public Transit in the San Diego Region	San Diego AG	1996
CA	UC Berkeley	Land Use and Development Impacts, "BART @ 20" Study		1995
CT	CT DOT	Griffin Line Corridor Study: Economic Impact Analysis	CT Center for Economic Analysis	1994

CT	Housatonic Area RTD	The Economic Impact of HART to the Housatonic Valley Region	Jack Faucett Associates	1997
GA	Atlanta Regional Commission	Social Benefits of Transit: Case Study of the Metropolitan Atlanta Rapid Transit Authority	Georgia Institute of Technology	NA
IN	IN TA	Economic Benefits of Transit Service	McDonald Transit Assoc.	NA
KY	KY DOT	TZ Transportation Tomorrow MIS/EIS for Rapid Transit Louisville		1999
MA	MBTA	Economic and Social Impacts of Orange Line Replacement Transit Service	Cambridge Systematics	1988
MN	MN DOT	Twin Cities' Metropolitan Commuter Rail Study	MN DOT	1998
MN	MN DOT	Light Rail Transit		1998
NJ	NJ DOT	Secaucus Transfer		NA
NJ	NJ DOT	Hudson Bergen Light Rail System		NA
NJ	NJ DOT	South Jersey Light Rail System		NA
NY	Rochester	Rochester Light Rail Transit Economic Development Feasibility Study: Executive Summary	Wilbur Smith Associates	1998
NY	NY MTA	Lasting Economic Benefits from Public Transit Investment: Phase II Report	Cambridge Systematics	NA
PA	PA Public Trans. Association	Act 3 Report Card	PA Public Transit Assoc.	NA
PA	Delaware Valley RPC	Final Report: Public Transportation Renewal as an Investment: The Economic Impacts of SEPTA on the Regional and State Economy	The Urban Institute & Cambridge Systematics	1991
RI	RI Public Transit Authority	Kennedy Plaza Project—Transit		1999
TX	VIA Metropolitan Transit	Estimating Important Transportation-Related Regional Economic Relationships in Bexar County, Texas		1999
USA	APTA	Public Transportation and the Nation's Economy	Cambridge Systematics & EDRG	1999
USA	Campaign for Efficient Pass. Trans.	Dollars and Sense: The Economic Case for Public Transportation in America	Aldaron, Inc.	1996
USA	FTA	Assessment of the Economic Impacts of Rural Public Transportation	Ecosometrics	NA
USA	TCRP	Economic Impact Analysis of Transit Investments: Guidebook for Practitioners	Cambridge Systematics	1998
		WATER TRANSPORTATION STUDIES		
FL	FL Ports FC	An Analysis of the Economic and Fiscal Impact of Florida's Seaports	MGT of America, Inc.	1999
HI	HI DOT	Economic Impact of Hawaii's Harbors	SMS	1997
HI	HI DOT	Statewide Cruise Facilities Study	HI DOT	1999
MD	MD Port Admin.	The Local and General Economic Impacts Generated by the Port of Baltimore	Martin O'Connell	1994
ME	Eastport Port Authority	Analysis of the Market Potential & Feasibility of New Port Development at Eastport	Booz-Allen & Hamilton	1990
ME	Portland COC	The Port of Portland: Its Value to the Region	Univ. of Maine	1993
CT	CT DOT	State Pier Transportation and Land-Use Study		1998
HI	HI DOT	Systemwide Analysis of Economic Impact of the Ports		1995
HI	HI DOT	Cruise ship facilities, Economic Impact		1998
MD	MD DOT	Channel dredging—various times		NA
ME	ME DOT	Sears Island Marine Dry Cargo Terminal		1992–95
ME	ME DOT	Eastport Cargo Port Development		1990
Multi-state		An Analysis of the Economic Impacts of the Tennessee–Tombigbee Waterway	Troy State University	1999
NJ	NJ DOT	The Portway Project in NE New Jersey might be an excellent case study—in progress		NA
RI	RI DOT	Newport marine terminal		1999

Note: NA = not available.

Abbreviations		
National Agencies and Organizations		
	AASHTO	American Association of State Highway and Transportation Officials
	APTA	American Public Transit Association
	FAA	Federal Aviation Administration
	FHWA	Federal Highway Administration
	FTA	Federal Transit Administration
	NCHRP	National Cooperative Highway Research Program
	TA	Transportation Association
	TCRP	Transit Cooperative Research Program
	TRB	Transportation Research Board
	TRF	Transportation Research Forum
State Agencies		
	DECD	Department of Economic and Community Development
	DNR	Department of Natural Resources
	DOR	Department of Roads
	DOT	Department of Transportation
	DOTD	Department of Transportation and Development
	HSRC	High Speed Rail Commission
	HWA	Highway Administration
	TC	Transportation Cabinet
	TPA	Transportation Planning Authority
Local and Regional Agencies		
	AG	Association of Governments
	ARC	Appalachian Regional Commission
	COC	Chamber of Commerce
	CONEG	Council of Northeast Governors
	COG	Council of Governments
	FC	Financing Commission
	RPC	Regional Planning Commission
	RTC	Regional Transit Commission
	RTD	Regional Transit District
	TA	Transportation Authority
Foreign Agencies		
	BTE	Bureau of Transport and Communications, Australia
	DWST	Department of Works, Services and Transportation, Labrador
	METL	Ministere des Transports et du Logement, France
	MTC	Ministry of Transport and Communications, Finland



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