2006-03-29

Assessing the Economic Impacts of Transportation Improvement Projects

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ASSESSING THE ECONOMIC IMPACTS OF TRANSPORTATION IMPROVEMENT PROJECTS

by

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A thesis submitted to the faculty of

Brigham Young University

in partial fulfillment of the requirements for the degree of

Master of Science

Department of Civil and Environmental Engineering

Brigham Young University

April 2006

BRIGHAM YOUNG UNIVERSITY

GRADUATE COMMITTEE APPROVAL

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ABSTRACT

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In that a transportation system can influence an economy for good or bad a system that enhances economic vitality becomes a crucial element in maintaining or developing economic prosperity. To provide a methodology to include economic development impacts of transportation improvement projects in the decision making process and the tools and alternatives available are here explored. Primary contributions of this document are results of a literature review, transportation professional and decision maker survey, economic modeling tool evaluation, and development of approach alternatives. The following thesis introduces the purpose and need for the given research, the procedure that was followed, the preliminary results, and a committee recommended action arrived upon after consideration of the research findings.

ACKNOWLEDGMENTS

I would like to thank my advisor, Dr. Grant Schultz, first for allowing me to join him in his research efforts even though I was out of the country during a crucial part of the research process. Additionally, I am indebted to him for his guidance through the processes of researching and writing this document and in countless other aspects of my graduate program. I would also like to thank Dr. Mitsuru Saito for his contributions and recommendations on this thesis work, and for his instruction and advisement in other projects and classes during my graduate program. Dr. Woodruff Miller, also member of my committee, has added valuable assistance in arriving at the finished work, for which I am grateful. I also add my thanks for his service as our Department Chair.

I would also like to thank all the members of the steering committee for their cooperation and collaboration in evaluating models and providing survey information and for their final recommendations.

Last but not least, I thank my family, who has supported my every step in these educational endeavors and other goals in life. They have established in me a desire to work hard and accomplish great things.

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1 Introduction

1.1 Background

Transportation planning is an important step for ensuring the vitality of the state of Utah. In the State of Utah Long Range Transportation Plan (Transportation 2030) it is recognized that vehicle miles of travel (VMT) will continue to grow as the population in the state increases (UDOT 2004). In response to this growth, the Utah Department of Transportation (UDOT) has committed themselves to providing "optimum levels of mobility on well-maintained, safe facilities" (UDOT 2004). To keep this commitment UDOT has developed four strategic goals to address the transportation needs of the future, namely: 1) take care of what we have, 2) make it work better, 3) improve safety, and 4) increase capacity (UDOT 2004). The common thread that ties these four goals together is the efficient use of transportation funding to provide for the needs of the system. Primarily when considering the fourth goal—increase capacity—funding availability generally places constraints on the extent of the capacity that can be increased. Projects should continually be identified to meet the demands placed on the system; however, not all projects will receive funding for construction. Those that are most critical and beneficial to the vitality of the transportation system should be selected. The consideration of these projects occurs in the planning process as part of the long-range plan (LRP). Although several aspects of each project should be considered in making this selection, one in particular, identified in Transportation 2030, is a directive originating from Title 23 of the United States

Code, as amended by the Transportation Equity Act for the 21st Century (TEA-21) (UDOT 2004); that is to:

> "Support the economic vitality of the United States, and the States, and metropolitan areas, especially by enabling global competitiveness, productivity and efficiency."

In allocating resources to address the previously mentioned four strategic goals, UDOT has established the following priorities: 1) preservation of existing infrastructure, 2) safety enhancements, 3) operation of the existing system, and 4) capacity enhancements (UDOT 2004). The transportation planning process is an important part of determining which projects should be funded to address these priorities. Economic vitality of the project itself, combined with the impacts of the project to the economy of the state as a whole should be considered when making important decisions on how to best allocate transportation funds. There was a need, therefore, to assess the economic impacts of transportation improvement projects and to investigate possible evaluation criteria and tools to incorporate economic evaluation criteria in the state's transportation planning process.

The purpose of this research was to assess the economic impacts of transportation improvement projects and to evaluate the tools available for incorporating possible economic evaluation metrics in the transportation planning process. This was to be completed by: 1) determining the state of the practice for transportation economic analysis, 2) establishing the criteria that should be considered in the economic analysis process, 3) evaluating the tools available to meet these needs, and 4) making recommendations on how to proceed to meet these objectives. The results of this project can be incorporated into the LRP process as another tool in the toolbox to evaluate mobility and systems analysis. This tool will provide direction and guidance to UDOT personnel on the prioritization of projects based on economic performance and analysis. The results of this research will be available for implementation in the planning process, providing an opportunity for increased efficiency in project selection using economics as one of the available selection metrics.

1.2 Report Organization

This report will include eight main body chapters: 1) Introduction; 2) Literature Review; 3) Background Analysis; 4) Survey Results; 5) Evaluation of the Tools; 6) Process Development; 7) Recommended Alternatives; and 8) Conclusions and Committee Recommended Actions.

Chapter 2 involves the completion of a comprehensive literature review on aspects related to the economic impacts of transportation projects. The primary areas of focus for the literature review included, but were not limited to: 1) exploring the link between transportation and a vital economy; 2) historical perspective of economic analyses; 3) today's broader economic analysis; 4) results of an economic impact analysis; 5) reasons for economic analyses; 6) guidelines and methods of including economics in the planning process; 7) specific state practices; and 8) common available tools. The purpose of the literature review was to establish the basis for the analysis, to identify research tools and resources that may contribute to this study to avoid overlooking and/or unnecessarily duplicating information, and to summarize the tools that are available for economic analysis of transportation projects.

Chapter 3 provides a presentation of lessons learned, what data are still needed, and an introduction of the plan to collect the required data. Utah's current economic development plans and economic wellbeing is presented. From this point the chapter proceeds to the data collections and interviews task. The primary purpose of this task was to summarize and define the expectations of decision makers in the state of Utah when considering the economic impact of transportation planning projects. This purpose was accomplished through the establishment of the steering committee. The steering committee is introduced in this chapter as a cross section of UDOT planning and administrative personnel, as well as members of the Transportation Commission. Information gathered from steering committee meetings, interviews, and surveys are presented as well. The primary output in this chapter is: 1) consensus on the criteria to consider for the economic analysis of transportation projects; 2) a summary of the models currently available to the State and their application to transportation planning; and 3) a direction on how to proceed most effectively in the economic model evaluation phase of the project.

Chapter 4 is also tied to the data collection task and was specifically dedicated to presenting information gathered from three national surveys: 1) a survey conducted by Glen Weisbrod of Economic Development Research Group (EDR Group) published in the National Cooperative Highway Research Program (NCHRP) Synthesis Report 290 in the year 2000 (Weisbrod 2000); 2) a survey conducted in the fall of 2004 by the United States Government and Accountability Office (GAO) (GAO 2005); and finally 3) a BYU/UDOT cooperative survey.

Chapter 5 is comprised of model summaries and evaluations of several modeling tools to provide a third party review to evaluate the economic analysis tools identified in the research utilizing the criteria established to answer questions such as: 1) What does the model do? 2) How will the model interface with the State's planning analysis tools? 3) What is the output of the model? 4) What questions will the model answer? 5) How will the results of the model be accepted?

Chapter 6 pools the information gained and separately analyzes the different analysis types. These analyses are used to formulate a series of possible approaches for a total selection process. Specifically the presentation will focus on three potential packages: 1) AASHTO patterned user impact analysis; 2) static modeling or short term economic impact analysis; 3) dynamic econometric modeling or long term economic impact analysis; and 4) how to incorporate the results of these analyses into the entire selection process.

Chapter 7 includes alternative methods or programs of how to incorporate economic development aspects into funding decisions for transportation projects.

Chapter 8, the final chapter in this report completes the project tasks by arriving at a final recommended approach. The steering committee's total recommendation process is reviewed with specific focus on how the economic criteria will be considered in the larger context.

2 Literature Review

The literature review provided the researchers with a broader understanding of the state of economic impact analyses of transportation projects; namely, how the economics and transportation tie together, the history of economics analysis and how it looks today, why providing this analysis is important, and what tools are available. The chosen transportation improvements in review are new capacity enhancement roadway projects.

The dependent relationship of economics and the transportation system is certain; however, that relationship is not easily quantified. This is because the dynamics of economic vitality and efficient transportation are complex in and of themselves. Consequently the degree of interaction is often not clear due to a number of potentially exogenous factors. Transportation systems present a complex range of intermodal usage, policy, and operations management; and while all types of transportation infrastructure, policy, and respective management are connected to the economy in a similar way in that they serve to improve or hinder the connection between elements of the economy. Appreciating the full diversity of transportation systems, including water, air, rail, and road, is beyond the scope of this review.

The topics introduced in the literature review go from broad to specific, in an attempt to first gain the "big picture" perspective then delve into specifics. The review is structured to tie together in a meaningful way the broad and yet not fully established knowledge on the before mentioned subject. After learning why an Economic Impact Analysis (EIA) is important and how it can benefit transportation agencies the current state of the practice was reviewed. The procedures vary greatly between states and finding some consensus of best practices is a current effort of governmental and private research groups. Part of the inconsistency in current practice stems from the numerous modeling options available to transportation agencies. Some of these models—those more widely used, such as Regional Economic Models, Inc., (REMI®), Highway Economic Requirement System (HERS), and Regional Input-Output Modeling System (RIMS)—are introduced and considered briefly here in the current review; however, specific application possibilities will be more extensively discussed in Chapter 5.

2.1 Exploring the Link between Transportation and a Vital Economy

An economy is traditionally thought of as consisting of distinct parts, for example material, labor, equipment, and market. Economic vitality requires these elements to be present and interconnected. The interconnectivity aspect is satisfied foremost through the transportation sector. Efficient transportation systems will positively impact the economy, while deficient systems, slowing the connection between the economic sectors, will cause missed opportunities and lower production capabilities.

The economic impacts of transportation, for good or bad, will transfer throughout the economy. Dr. Jean-Paul Rodrigue suggests economic impacts come in two varieties (Rodrigue 2005):

- Direct impacts related to accessibility and mobility changes where transport enables larger markets and time and cost savings.
- Indirect impacts related to the economic multiplier effect where the price of commodities drop and/or their variety increases

The fundamental activity added to an economy by transportation, that is the ability to get from one place to another, called mobility, is required by passengers, freight, and information.

Geographic regions or even segments of an economy with greater mobility are thought of as having a greater chance for development. This being the case, mobility is felt to be a reliable indicator of development as societies modernize (Rodrigue 2005).

With continually increasing demands on transportation, its services have created an industry of its own that can be assessed on a macroeconomic and microeconomic level. It has been found that at the macroeconomic level (the influence on the economy as a whole) transportation and subsequent mobility is linked to productivity, employment, and income. Some researchers have found that in many developed countries, transportation accounts between 6 and 12 percent of the Gross Domestic Product (GDP) (Rodrigue 2005). On the microeconomic level (the influence on specific segments of the economy) transportation is linked to producer, consumer, and production costs. At this level, because some industries are more or less dependent on transportation than others, the economic impact will vary. Of total manufacturing expenditure per unit of output, about 4 percent is transportation related. With households, this increases to between 10 and 15 percent (Rodrigue 2005). The primary benefits come in the form of flows of resources of capital and labor. Firms can cut cost by having access to cheaper raw material and labor if they can connect them to manufacturing and the market. Current trends in business operation tend toward cutting inventory costs through “just in time” delivery. This requires reliable and efficient transportation.

There are also direct and indirect socioeconomic impacts from transportation improvements; however, they prove harder to measure. Sometimes selection of improvement projects can propagate a gap between those with and those without the resources to improve their own mobility. Rodrigue called this a mobility gap (Rodrigue 2005). Mobility gaps are a result of many transportation improvements being limited in their direct impact to a certain region of users. This may occur as projects that benefit higher revenue businesses and higher wage earners show higher total benefit. Essentially mobility gaps associate lack of mobility with lower income, and the reverse of higher mobility with higher income. Land value, while responsive to improved accessibility, is also influenced by factors such as noise and air pollution. In urban regions, for example, about 50 percent of all air pollution emanates from automobile traffic (Rodrigue 2005). Thus, new capacity projects that bring positive impacts may also pose direct negative impacts in the form of noise and air pollution.

2.2 The History of Economic Analysis

As explained in the Federal Highway Administration (FHWA) *Economic Analysis Primer*, the application of economics to transportation improvements is not a new concept. Published information on road user benefit analysis some 50 years ago shows that methods and procedures for highway appraisal have been well understood for decades (FHWA 2003a). With the significant advancements in computer technology and subsequent ability to create extensive models the economic analysis capabilities have improved tremendously. Additionally, the National Environmental Policy Act (NEPA) as of 1969 has been requiring economic impact evaluation as part of their environmental impact statement, specified as, "fulfill the social, *economic*, and other requirements of present and future generations of Americans" (NEPA 1969). Traditional benefit cost analysis (BCA) has been the major effort to satisfy this broad requirement.

A typical BCA will essentially establish a ratio of user savings to agency cost requiring the ratio to be greater that 1.0. In other words the analyst will divide the value of improved travel time, safety, and vehicle operating cost savings, with the cost of construction and other cost of making the improvement. BCAs have been effective at evaluating the economic efficiency impacts of user costs and are good for comparing alternatives in the project selection process. However, current project evaluations are transitioning towards a wider analysis of economic benefits; wider in that it attempts to measure the forecasted regional interaction of industry, household, and land use. BCA typically does not track how direct benefits of user costs translate to indirect effects on the economy such as changes in employment, wages, business sales, or land use. A broader EIA that monitors direct and subsequent indirect impacts is dependent on constantly developing knowledge of the relationship between transportation and elements of the regional economy.

2.3 Today's Broader Economic Impact Analysis

FHWA defines an EIA as the "study of the way in which the direct benefits and cost of highway projects (such as travel time savings) affect the local, regional, or national economy" (FHWA 2003a). HLB Decision Economics Inc., in a project for San Diego Association of Governments estimating the economic impacts of border delays entering and exiting Mexico, defined EIA as "the study of the effect of a change in demand (spending) for goods and services on the level of economic activity in a given area, as measured by business output (sales), employment (jobs), personal income, and tax revenue" (HLB 2004). This is not an effort to satisfy the earlier requirements of the NEPA of 1969 but in a larger measure designed to answer directives in TEA-21, specifically to "support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency" (USDOT 1998). When transportation is supporting economic vitality it is expected that the analysis will reflect impacts of growth or development. The terms growth and development are sometimes understood differently. Economic growth can be categorized as quantitative in nature, while economic development refers to a qualitative or structural change. For example, economic development could include measures of human health, environmental quality, or equity. Economic growth would be reflected in GDP and other metrics that will be discussed later (Victoria 2005). Economic impacts could then be identified as growth or development improvements considering population change. However, inasmuch as both are satisfying the needs of the region it may be an inconsequential determination.

The economic impacts analyzed are direct, indirect, induced, and construction impacts. Each of these impacts is discussed in the following sections.

2.3.1 Direct Impacts

Direct impacts or *user costs* are benefits encountered by the facility user. For example, note the costs incurred by a furniture manufacturer that delivers. The longer it takes to deliver, the more money they must invest. With reduction in travel time the store becomes more efficient and thus saves money. User costs are calculated in travel time, safety (e.g. reduction of costs due to reduction in crashes), and vehicle operating costs (e.g. wear and tear cost) (Kaliski and Weisbrod 1998).

2.3.2 Indirect Impacts

Indirect impacts are those benefits or costs transferred subsequently to an individual or business through change in wage or price of the product. For example, as the furniture delivery is faster, the size of the market is increased, the costs to the company are reduced, and subsequently, the cost of the furniture can be reduced in price and the manufacturer can sell more goods. The manufacturer in turn buys more raw materials from the supplier, who can also deliver faster and cheaper. The supplier with more business consequently hires more workers. These new positions created and wages paid in order to accommodate increased sales demand are indirect impacts of the transportation improvement. These impacts are calculated through inter-industry multipliers or values that relate the output of one industry to that of another (Kaliski and Weisbrod 1998).

2.3.3 Induced Impacts

Induced impacts, as summarized by HLB Decision Economics, are changes in regional business output, employment, income, and tax revenue that are the result of personal (household) spending for goods and services; including employees of the directly impacted firms as well as those firms impacted indirectly (HLB 2004).

2.3.4 Construction Impacts

Construction impacts can be both direct and indirect. As the furniture manufacturer experienced a shock in demand with lower pricing due to lower production costs, likewise the construction industry experiences a shock in demand due to spending on large transportation projects. The direct impacts are those jobs created in the construction and design industries. These are not necessarily users of the facility, incurring user costs, but are still benefited by the direct capital expenditure of the project in a measurable way. Indirect impacts are those measured in industries otherwise integrated with construction, again to be calculated through inter-industry multipliers. The full economic impact from construction however is not counted towards economic growth. Because much of the funding for transportation projects is from the state, which received their revenue from taxes, the expenditure represents merely a redistribution of money. However, economic growth has been attributed to impacts from federal contributions (Perlich 2004). In the Transit Cooperative Research Program (TCRP) Report 35 these growth inducing economic impacts are called generative impacts (TCRP 1998). Such economic impacts of Federal spending in the Wasatch Front have been forecast in research conducted by Pamela Perlich, published in the *Utah Economic and Business Review* (Perlich 2004).

2.4 Metrics of Economic Impact Analysis

The EIA metrics are typically viewed in terms of (Weisbrod 2000):

- Total employment (jobs created),
- Personal income (including wages),
- Value added (gross regional product),
- Business output (sales volume),
- Property values, or
- Tax revenue.

Tax revenue is more correctly considered a fiscal impact rather than an economic impact but it is still a popular metric (Weisbrod 2000). It is important to also note these are differentiated from social impacts, such as health, recreation, and noise or air pollution. Dollar values could be assigned to these benefits as they may affect one's "willingness to pay;" however, these values are difficult to determine and may be left out of an EIA.

The following sections provide explanations of the various measures of economic impacts and their different interpretations with the exception of tax revenue.

2.4.1 Total Employment

Total employment or additional jobs created by economic growth is a popular measure because it is easier to comprehend than other measures. Limitations to a job count, however, are that this metric does not necessarily indicate the quality of the employment opportunities and they cannot be easily compared to public expenditures to attract those jobs (Weisbrod 2000).

2.4.2 Personal Income

Personal income is a reasonable measure of the personal income benefit of a project as long as nearly all of the affected workers live in the study area. However, it is still an under-estimate of the true impact, insofar as there is also some net business income (profit) generated that is distributed in other ways (e.g., reinvestments, and dividends) (Weisbrod 2000).

2.4.3 Value Added

Value added or Gross Regional Product (GRP) reflects a broader impact, essentially adding wage income and corporate profit in the study area. In today's more national and even global economy, where income and profit generated in the area does not necessarily stay in the area, value added may be an over-estimate. Thus, while value added impacts may be a more appropriate measure of overall economic activity, personal income is preferred as a more conservative measure of income benefits to residents of the area (Weisbrod 2000).

2.4.4 Business Output

Business output or sales is the broadest and largest measure of economic activity, as it generates the largest numbers. This measure of gross business revenue breaks down into costs of materials and labor as well as net income or profit. Similar to value added impact measurements, business output does not indicate if the economic activity generates high or low local returns (Weisbrod 2000).

2.4.5 Property Values

Property values are a reflection of income and wealth. However, there are circumstances in which change in property values may have no net change in personal wealth. In the case when a rise in property values in a community is a direct consequence of the rise in personal income or investment of business profits, no net change in the overall wealth takes place. If this is occurring then it would be double counting to add property values to personal income. Similarly, if property values go up in one community and down in another, there may be redistribution of wealth and again the net change is zero (Weisbrod 2000).

Additional yet comparable measures used in the Indiana Department of Transportation (INDOT) Major Corridor Investment-Benefit Analysis System (MCIBAS) developed by Cambridge Systematics, INDOT, and EDR Group for Indiana's Long Range Plan are business expansion and business attraction. These are defined as (Kaliski and Weisbrod 1998):

- Business expansion refers to the long-term economic effects of reducing highway related costs for businesses. Business cost savings can improve the relative cost competitiveness of areas businesses and hence their ability to expand and grow.
- Business attraction refers to long-term economic effects on industrial operations beyond those associated with travel cost savings. These include effects such as more efficient inventory and logistics management, implementation of just-in-time processes, customer market expansion and associated scale economies, and access to a broader (and more competitively priced) set of suppliers.

From the above descriptions it becomes apparent that many of the economic impact measures overlap and thus take careful note must be taken not to double-count, exaggerating the overall impact of a given project. Even though measures are not added in a summary calculation, each provides a different perspective and information giving a more complete evaluation of the total impact.

2.5 Why an Economic Analysis

The impacts described previously can be important to decision makers, planners, and the public. This additional data describes not only direct but indirect impacts and distributional effects, which are not provided by a traditional BCA. The FHWA *Economic Analysis Primer*, which is a broader review of transportation economics (not limited to EIAs), reports a number of benefits from using economic analyses (FHWA 2003a). A few of these benefits that could result specifically from an EIA include (FHWA 2003a):

- Best Return on Investment. Economic analysis can help in planning and implementing a transportation program with the best rate of return of any given budget or it can be used to help determine optimal program budget.
- Understanding Complex Projects. In a time of growing public scrutiny of new and costly road projects, highway agencies and other decision makers need to understand the true benefits of these projects, as well as the effects that such projects will have on regional economies. This information is often very helpful for informing the environmental assessment process.
- Documentation of Decision Process. The discipline of quantifying and valuing the benefits and costs of highway projects also provides excellent documentation to explain the decision process to the Legislature and the public.

In demonstration to potential sponsors of the project it is expected that federal and state funds will come easier when clear economic gains can be validated through established analysis methodologies.

Economic repercussions of transportation improvements are complex and with growing public scrutiny excellent documentation of the decision process is needed. An EIA will help both the decision maker and the public understand the results and decision through proper documentation.

Furthermore, an EIA can indicate not only how big of an impact can be expected but it can be used to project how and where the impact will be felt—what geographic regions and what demographic groups. In part, the impetus of the original NEPA requirements was to achieve greater environmental justice and social equality; distribution impacts will be most helpful in telling how well we are accomplishing those goals. For example, does a new transportation project pose negative impacts for low-income residents while middle or upper income tiers enjoy the primary improvement? Attracting residential and business growth to one region may mean downturns for another. By projecting indirect effects both the community leaders and public will better appreciate how distribution or indirect "trickling down" of economic benefits will occur among stakeholders.

A broad response to the question of why conduct an Economic Analysis is given in the next three subsections which discuss: 1) an EIAs association with answering TEA-21 directives; 2) the potential of EIAs to influence economic development; and 3) the concept of monitoring the economy's performance as a whole through what is called the bucket analogy.

2.5.1 Answering TEA-21 Directives

Although there are no federal requirements to conduct EIAs for highway projects, TEA-21 provides directives that serve as helpful guides for monitoring the potential economic benefits. As outlined previously, transportation agencies can be held accountable to "support the economic vitality of the United States, and the States, and metropolitan areas, especially by enabling global competitiveness, productivity, and efficiency" (USDOT 1998).

- Competitiveness is reflected in business attraction and business expansion, or in other words job growth.
- Productivity is reflected in business output and value added (e.g., GDP).
- Efficiency is reflected in business user costs (as separated from personal trip user costs).

2.5.2 Economic Development for Distressed Regions

While development is welcome in any economy, it is in distressed communities that these impacts are most important to manage and encourage. Distressed communities are typically defined as those with long standing below average performance, such as unemployment. It becomes the goal of community leaders to encourage positive changes in the economy and more often these leaders are looking to transportation improvements as one such positive spur to the economy.

Likewise, rural regions are also often a focus of economic growth efforts. It must be remembered, however, that primary elements of an economy, such as materials, labor, equipment, and market must be present for transportation infrastructure to aid growth and development. In economic development goals it is desirable to connect the vital parts of an economy. This may mean connecting labor and manufacturing or material and market, for example, transporting agricultural goods to stores or ensuring there is transportation for low-income residents to entry-level jobs (Community 2006).

2.5.3 The Bucket Analogy

Economic vitality may be compared to the level of water in a bucket. Exports and federal spending, or any inflow of outside money, is like pouring water into the bucket. Imports and spending money outside the region is taking water out of the bucket. There are also leaks in the bucket, or lost opportunities that can be caused by, among other things, inefficiencies in the transportation system; for example high user costs. By reducing delay and inefficiencies the leaks are tightened and less water is lost through the cracks (Kinsley 1997).

Not all of the before mentioned metrics can be applied to the bucket analogy; however, the concept is helpful in understanding the impacts of local versus federal government spending. This concept is demonstrated further in the *Utah Economic and Business Review* report, "Economic and Demographic Impacts of Federally Financed Transportation Projects" (Perlich 2004). Local government spending, because it is a source internal to the region, does not add to the water level. This is considered a redistributive impact, merely stirring the water around to different areas. However, local spending can help to shrink the holes in the bucket through improving efficiency. By population increase the size of the bucket grows, whether the water level rises or not depends on the productivity of the new population.

In summary, the following reasons, though not exhaustive, may be given for conducting an economic impact analysis:

- To forecast for the stakeholders and decision makers the specific regional economic consequences of a transportation improvement.
- To assist the sponsors of the project to determine projections of return on investment in terms of change in GDP, wages, jobs, industry output, and potential tax contribution.
- To aid the decision-maker in tailoring economic development to distressed regions.
- To explain the decision making process clearly documented with quantified benefits to the legislature and the public.

2.6 Current Options for Incorporating Economics in the Planning Process

The incorporation of economics into the transportation planning process is significantly varied across the nation. There seems to be no one best practice for either performing the EIA or how to include the measures into project selection. This is not to say the current practices are not performing well but rather individual agencies are custom developing programs to serve more unique or specific needs and desires.

This section reviews first, the general types of economic development programs that represent those in practice in various regions throughout the nation. These programs are then reviewed in greater detail on a state-by-state basis. Individual state programs show a trend towards customizing the general types of programs to the needs of each state.

2.6.1 Types of Economic Development Programs

From a national summary of state economic development highway programs prepared for the FHWA, EDR Group categorizes those states that are incorporating economic impacts into transportation planning into four general programs (Weisbrod and Gupta 2005): 1) funding programs for local access roads; 2) funding programs for inter-city connector routes; 3) policies recognizing economic development as a factor in funding decisions; 4) no formal economic development highway policies or programs.

2.6.1.1 Funding Programs for Local Access Roads

These are formal programs with dedicated state funding for investment in local connector routes that provide access from intercity highways to local business districts or industrial parks. These programs generally involve formal application processes with eligibility requirements covering: 1) private sector investment, 2) local government co-funding, and 3) cooperation with state economic development departments. Currently, 19 states have formal state programs of this type. The Appalachian Regional Commission’s Local Roads program also provides a mechanism for 13 states to co-fund local road access projects. In addition, three states have set-aside funding sources for local road or highway projects that are intended to support economic development goals, though they do not have formal programs in place (Weisbrod and Gupta 2005).

2.6.1.2 Funding Programs for Inter-City Connector Routes

These are formal programs with dedicated state funding for investment in highway routes that improve access from isolated rural and economically depressed parts of the state to the major highway routes and larger economic market centers. This can include 1) single state highway system enhancements and 2) multi-state highway systems. Currently, four states have single state programs. In addition, 13 states effectively offer this type of program through the multi-state Appalachian Development Highway Program, of which five were not counted in previous categories (Weisbrod and Gupta 2005).

2.6.1.3 Policies Recognizing Economic Development as a Factor in Funding

Some states lack dedicated funding of roads for economic development purposes, but do formally recognize economic development as a criterion in highway decision-making. This can include the Statewide Transportation Improvement Program (STIP) selection process and benefit-cost assessment criteria. Currently, 13 states have formal policies of this type, including 11 states that were not counted in previous categories. Another three states are in the process of setting up such policies (Weisbrod and Gupta 2005).

2.6.1.4 No Formal Economic Development Highway Policies or Programs

Currently, 11 states have no formal programs or policies for funding road investment for economic development. Among them, three are in the process of setting up formal economic development highway investment policies, and another three have set-aside funding for economic development road or highway projects although they do not have formal programs in place (Weisbrod and Gupta 2005).

Specific examples of these programs as carried out in individual state transportation agencies will be discussed in more detail in following sections. The main differences to note here are in having dedicated state funds, which allow smaller economic development oriented projects versus including economic impacts simply as criteria in project selection. The first method generates new project ideas and proposals and allows for co-funding from private investment. The contribution of private companies that have the most to gain from a particular capacity improvement is somewhat like assessing a traffic impact fee or more equitably dividing the costs among those receiving the benefits. Without dedicated state funds the economic impact criterion is applied to a list of projects that have already met certain state requirements. These projects are most likely large in scale and the economic analysis will serve as additional evaluation forecasting a clearer picture of the total impact of the project. This again is different from directing the project and spending specifically towards economic development, which usually occurs on a smaller scale (Weisbrod and Gupta 2005).

2.6.2 State Specific Practices

Recent efforts have been made to identify the state-of-the-practice for incorporating economics into transportation planning. Research is still progressing but there is a significant amount of important information collected and presented. In the first part (Tasks A,B) of the EDR Group's report, *Overview of the State Economic Development Highway Programs,* individual state programs are reviewed (Weisbrod and Gupta 2004). The following section presents representative information as published in the named report—a more complete list of individual state practices can be found in Appendix A. Other data was compiled by the authors.

2.6.2.1 Alabama Department of Transportation

Program Name: Industrial Access Program.

Objective: To provide public access to new or expanding industries in the state.

Program Requirements: The industry must be new or it must be an existing industry that is expanding and creating new jobs with new industry investment. There is no minimum new job requirement or industry investment requirement. However, the Authority looks at the number of jobs created, the industry investment, the willingness of a local sponsoring governmental agency to provide some matching funds (matching is not a requirement) versus the amount of Industrial Access funds being requested.

Funding: The program is funded with $12 million from the Transportation Department's budget. Any interest earned on funds not yet distributed is added to the account. It is a reimbursement program with the state paying monthly estimates after work is performed. The state approves plans and allows the local sponsoring agency to issue a contract for construction of the facility either directly or through the state. There is no minimum or maximum funding amount for projects; they just have to compete with other projects throughout the state.

Industrial Development Access Program Projects FY 2002: The state's total amounted to $10,110,900, with 3,166 jobs created, and $439,410,000 private capital investment (Weisbrod and Gupta 2004).

2.6.2.2 Illinois Department of Transportation

Program Name: The Economic Development Program (EDP).

Objective: To assist highway improvement projects that are needed to provide access to new or existing industrial, distribution, warehousing or tourism developments.

Program Requirements: Include a 50 percent local match funding and job creation and retention condition. However, commercial and retail establishments are not eligible.

Funding: In the FY 1990-1994, the Highway Program included $27.5 million in funds for the EDP, of which $10.5 million was available to local units of government for highway improvements to support economic development. Fifty percent match funding from the local government or developer is required and a commitment to locate in the area from the business/industry involved. In FY 1995-1999, the funding was extended with an additional $5 million annually, and in FY 2000, 2001 and 2002, the program funds doubled to $10 million. In FY 2002, EDP funds of $14.5 million were committed. Historically, the expended amounts on projects have exceeded the budgeted annual funds and sourced through other program funds.

Economic Development Program Projects FY 2002: Funds totaled $14,560,412 (Weisbrod and Gupta 2004).

2.6.2.3 Indiana Department of Transportation

Program Name: Major Corridor Investment Benefit Analysis System (MCIBAS).

Objective: To assess the relative costs and benefits of proposed major highway corridor projects on Indiana businesses and residents. The economic analysis of the INDOT Statewide Long Range Transportation Plan is based on INDOT's MCIBAS, an economic analysis tool used by INDOT. Please note this is an economic analysis model and not an economic development program like the other program discussed in this section.

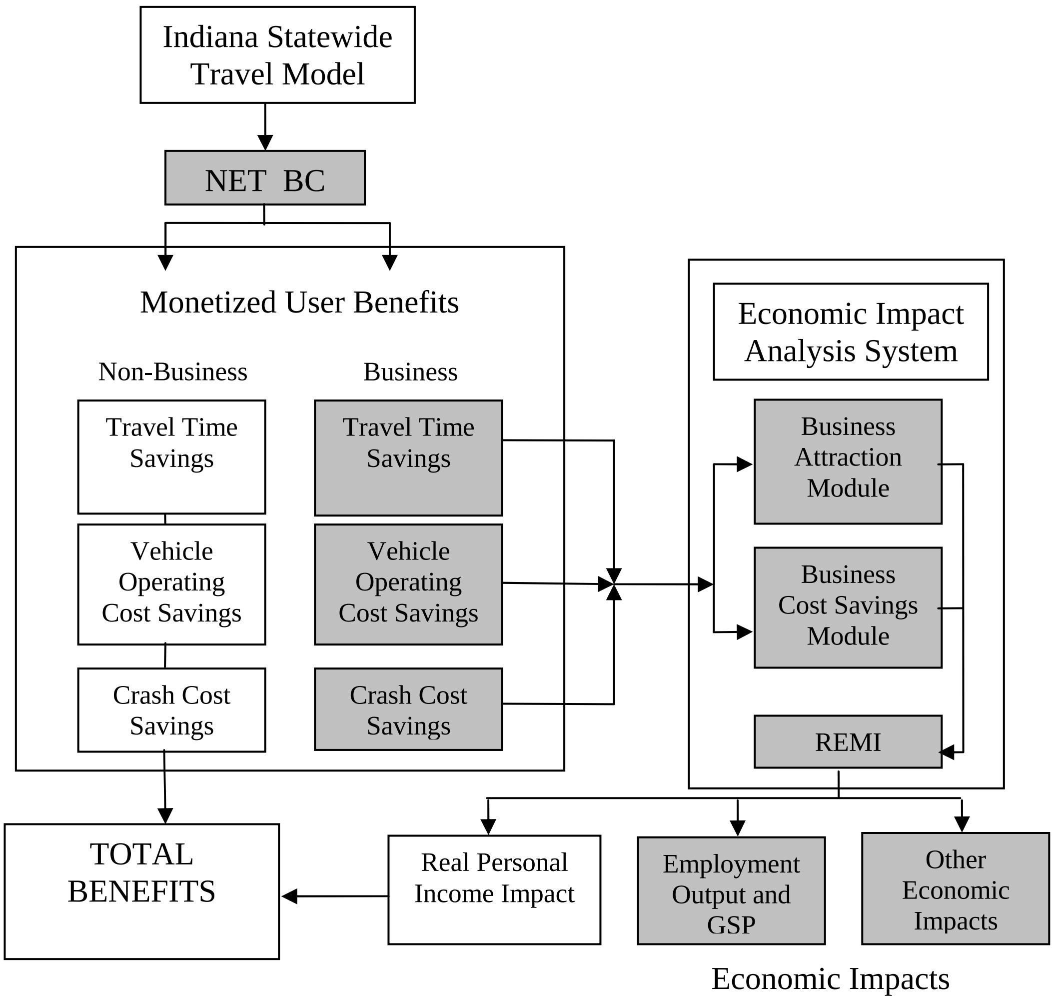


Figure 2-1 MCIBAS flowchart of user benefits (Kaliski and Weisbrod 1998).

Program Requirements: 1) Indiana Statewide Traffic Demand Model (ISTDM) – a statewide traffic network assignment model predicts the direct effects of the highway system improvement on traffic patterns, levels, and speeds, and estimates aggregate measures of system wide VMT and vehicle-hours of travel (VHT). 2) State "personalized" User BCA program called NET_BC. NET_BC is a post-processor program that reads ISTDM results and translates the predicted traffic changes into estimates of the dollar value of user benefits in travel time, vehicle operating costs, and safety. 3) EIA System using three components: business cost savings, business attraction; and the Policy Insight of Regional Economic Models, Inc. (REMI®). A flowchart of the EIA System utilized by INDOT is provided in Figure 2-1.

Some of Indiana's transportation impacts that are recorded are: user impacts—the clearest direct impact benefiting through real time, cost, and safety; economic impacts—benefits to the economy (how the money flows back into the or out of the pocket of those in the state); and societal impacts—non-monetary. Indiana uses 7 percent as a discount rate whereas a more accurate assessment is 4 percent so Indiana is being conservative (Kaliski and Weisbrod 1998).

2.6.2.4 Iowa Department of Transportation

Program Name: The Revitalize Iowa's Sound Economy Fund (RISE) Program

Objective: To promote economic development in Iowa through construction or improvement of roads, streets, and railroads.

Program Requirements: Two types of projects are funded under the RISE Program: 1) immediate opportunity projects that are related to an immediate non-speculative opportunity for permanent job creation or retention and 2) local development projects that support local economic development, but do not require an immediate commitment of funds. The fund is designed to target value-added activities, give maximum economic benefits, emphasize community involvement and initiative, and address situations requiring an immediate response and commitment of funds. Rail projects are also eligible, but not included in the project list. Since it's beginning, RISE has assisted in creating and retaining more than 26,365 jobs.

Funding: Funded from 1.55-cent-per-gallon motor fuel tax, RISE receives approximately $30 million annually. Based on the Code of Iowa, 32.2 percent of the funding is spent on city streets, 3.2 percent on secondary roads, and 64.5 percent on primary roads. The local development and immediate opportunity projects are funded by the 32.2 percent of the funding spent on city streets.

Revitalize Iowa's Sound Economy Projects FY 2002: Iowa's total state funding amounted to $15,991,402, with private sector capital investment of $218,334,582 and total RISE Funds under 32.2 percent of the total funding of $30 million (Weisbrod and Gupta 2004).

2.6.2.5 Massachusetts Executive Office of Transportation and Construction

Program Name and Organization: Public Works Economic Development (PWED) Grant Program was created in the 1981 Transportation Bond Act.

Objective: To fund infrastructure improvement projects associated with local or city government's economic development efforts that would enhance the economic competitiveness of the State.

Program Requirements: The Secretary of Transportation, in consultation with the Secretary of Economic Affairs and the Secretary of Communities and Development, reviews and evaluates project selection. The projects are judged on the following criteria: 1) jobs to be created or retained as a direct result of the proposed projects; 2) unemployment statistics for the community or region; 3) equalized property value per capita in the community as compared to the state average; 4) average annual wage of jobs created or retained as compared to the average annual state wage; 5) ratio of public investment to total private investment; and 6) an estimate of future economic benefits that may result from the proposed project and the private sector investment related to the project. The requested grant amount should not exceed $1 million on a given project unless it demonstrates significant regional benefits.

Funding: From 1988 to 2003, approximately $198 million has been authorized for the PWED Program in Massachusetts, of which $149 million has been awarded to cities and towns in support of projects that enhance their efforts to attract businesses and promote job growth. One of the most recent apportionments, Chapter 246 of the Acts of 2002, included $66 million in funding for the PWED Grant Program (which covers a multi-year award period). The PWED Grant Projects FY 2002, totaled at $17,171,440 (Weisbrod and Gupta 2004).

2.6.2.6 Michigan Department of Transportation

Program Name: Target Industry Development category of the Transportation Economic Development Fund (TEDF).

Objective: To fund highway, road, and street improvements necessary to support the State's economic growth and competitiveness, accessibility to industries, and economic development.

Program Requirements: The fund, administered through the Office of Economic Development and Enhancement, selects projects based on the local economic significance of the private-sector investment need, job creation plan, and the urgency to complete the work. The TEDF authorizes funding to those transportation projects in the Target Development category that: 1) relate to one or more of the target industries like agriculture or food processing, tourism, forestry, high technology research, manufacturing, mining, office centers of 50,000 square feet or more in size; 2) will create or retain permanent jobs; 3) is immediate and non speculative; and 4) increase the tax base of the local area and impacts the local economy. In addition, eligible TEDF projects must satisfy a minimum of 20 percent or more of local match funding.

Funding: The TEDF Program is funded through three formulas and two grant programs. In FY 2002, $19.9 million were granted for the Target Industry Development category. The TEDF Projects FY 2002 total funds were $11,724,216 (In FY 2002, $19.9 million were granted for the Target Industry Development category of which $11.7 million were spent on projects) (Weisbrod and Gupta 2004).

2.6.2.7 Missouri Department of Transportation

Two different programs of the Missouri Department of Transportation (MoDOT) are explained in this section. The first is an economic development program and the second a prioritization process.

Program Name: The Economic Development Program.

Objective: To provide a method of funding for transportation projects that will significantly impact the economic development in a given area.

Program Requirements: The projects considered must meet the following guidelines: 1) be a part of the state highway system; 2) be compatible with MoDOT

Long-Range Transportation Plan; 3) possess funds from various other local government or private sources; and 4) have a written commitment from a corporation or Missouri Department of Economic Development (MoDED) that construction by MoDOT will significantly impact the firm's decision to expand, continue, or locate their operations in Missouri.

Major Projects: System Expansion
New major roadway, new bridge and roadway expansion projects

Prioritization Process

Major Projects:
System Expansion
11/04/2003

This process does not apply in TMA areas

Access to Opportunity
Weight: 5%

Vehicle Ownership	75 pts
Eliminate Bike/Ped Barriers	25 pts
Total	**100 pts**

Congestion Relief
Weight: 30%

Level of Service	40 pts
Daily Usage	30 pts
Functional Classification	30 pts
Total	**100 pts**

Economic Competitiveness
Weight: 15%

Strategic Economic Corridor	40 pts
Level of Economic Distress	30 pts
Supports Regional Economic Development Plans	30 pts
Total	**100 pts**

Efficient Movement of Freight
Weight: 5%

Truck Volume	60 pts
Freight Bottlenecks	20 pts
Intermodal Freight Connectivity	20 pts
Total	**100 pts**

Quality of Communities
Weight: 5%

Complies with Local/Regional Land-Use Plans	50 pts
Connectivity Between Cities/Regions	50 pts
Total	**100 pts**

Environmental Protection
Weight: 5%

Environmental Impact	100 pts
Total	**100 pts**

Safety
Weight: 30%

Safety Index	80 pts
Safety Concern	20 pts
Total	**100 pts**

Taking Care of the System
Weight: 5%

Bridge Condition (of bridge(s) to be replaced/rehabbed)	40 pts
Pavement Condition (of lanes to be replaced/rehabbed)	40 pts
Substandard Roadway Features	20 pts
Total	**100 pts**

- **The glossary explains how each factor is scored.**
- **Because this is a statewide process, there is no flexibilty in investment goal weight.**

Figure 2-2 Missouri major projects: system expansion scoring system (Missouri 2004).

Funding: Projects are funded through various sources, including the $15 million annual Cost Sharing/Economic Development Fund, a limited amount of MoDOT District Office Regional Funds, or a limited amount of District's Safety Funds (Weisbrod and Gupta 2004).

Program Name: Major Projects: System Expansion (Prioritization Process) (Missouri 2004).

Objective: The scoring system is part of the state's transportation planning prioritization process. Within this process are separate groupings of projects: 1) physical system condition needs; 2) functional needs; 3) taking care of the system projects; 4) safety projects; 5) regional and emerging needs projects; and 6) major projects: system expansion. Each of these groupings has its own scoring system with various assigned weighting methods. The major projects: system expansion process is designed to prioritize new major roadway, new bridge and roadway expansion projects. A summary of the system expansion scoring system is provided in Figure 2-2 (Missouri 2004).

2.6.2.8 New York Department of Transportation

Program Name: The Industrial Access Program.

Objective: To provide funding for the creation or improvement of highway, bridge, and rail infrastructure that facilitate access to the State's industrial, manufacturing, and research and development facilities (Note: retail facilities are not eligible under the program).

Program Requirements: Project applications, submitted through an eligible sponsor, must show projected job retention and projected job creation, and include a commitment letter from the business(es) stating their intentions regarding jobs and private investments over a specified time period. All projects must result in job creation and/or job retention within the State. Award structure is 60 percent grant and 40 percent interest free loan repayable over five years. For any single industrial access project, costs shall not exceed $1,000,000 of State Industrial Access Program funds or 20 percent of any annual appropriation, whichever is greater, except in the case of Stewart Airport facilities related to industrial access.

Funding: The Industrial Access Program is funded annually through appropriations in the state budget. From 1985 through 1999, the program received $5.0 million annually. With the FY 2000-2001, the funding was boosted to $25 million. However, in the FY 2002-2003, the funding was reduced to $15 million due to the economy. The Industrial Access Projects state fund for FY 2002-2003 was $9,900,000, with $477,000,000 private sector capital investment, and 11,520 jobs created (Weisbrod and Gupta 2004).

2.6.2.9 Ohio Department of Transportation

Program Name: Transportation Review Advisory Council (TRAC).

Objective: To improve Ohio's state and federal transportation network. TRAC was established to make decisions for major statewide and regional transportation investments. Documentation written by TRAC includes the principles for selecting the scoring criteria and how the criteria are used to score projects. It also contains scoring tables and protocols on how the process will be conducted. Please note that this is a program to consider economic development in its ranking system and not like the economic development program as the other state programs described in this section.

Program Requirements: Major new capacity projects must cost the Ohio Department of Transportation (DOT) more than $5 million to invoke the action of TRAC and must do one or more of the following: 1) increase mobility, 2) provide connectivity, 3) increase the accessibility of a region for economic development, 4) increase the capacity of a transportation facility, or 5) reduce congestion. This definition includes all new interchanges proposed for economic development or local access, any significant interchange modifications, by-passes, general purpose lane additions, intermodal facilities, major transit facilities, passenger rail facilities, or Intelligent Transportation Systems (ITS).

The TRAC may choose to participate in the funding of non-traditional projects that cannot be scored. Examples of non-traditional projects include ITS, shared ride facilities, modal hubs, freight rail infrastructure and other facilities that improve the operation of the state's transportation system.

Goal	Factors	Maximum Score
Transportation Efficiency	Average Daily Traffic – Volume of traffic on a daily average	20
	Volume to Capacity Ratio – A measure of a highway's congestion	20
	Roadway Classification – A measure of a highway's importance	5
	Macro Corridor Completion – Does the project contribute to the completion of a Macro Corridor?	10
Safety	Crash Rate – Number of crash per 1 million mile of travel during 3 year period.	15
Transportation points account for at least 70 % of a projects base score		**70**
Economic Development	Job Creation – The level of non-retail jobs the project creates.	10
	Job Retention – Evidence that the job will retain existing jobs.	5
	Economic Distress – Points based upon the severity of the unemployment rate of the country.	5
	Cost Effectiveness of Investment – A ratio of the cost of the jobs created and investment attracted. Determined by dividing the cost to the Ohio for the transportation project by the number of jobs created.	5
	Level of Investment – The level of private sector, non-retail capital attracted to Ohio because of the project.	5
Economic Development Points account for up to 30% of a projects base score		**30**
Additional Points		
Funding	Public/Private/Local Participation – Dose this project leverage additional fund which allow state fund to be augmented?	15
Unique Multi-Modal Impacts	Does this project have some unique multi-modal impact?	5
Urban Revitalization	Does this project provide direct access to cap zone areas or Brownfield site?	10
Total possible Points including Transportation, Economic Development and additional categories		**130**

Figure 2-3 Ohio TRAC scoring system (Ohio 2003).

The TRAC has nine members and is chaired by the Director of the Ohio DOT. Six additional members are appointed by the Governor and one each by the speaker of the Ohio House of Representatives and the president of the Ohio Senate. By law, the

TRAC is to hold up to six public hearings annually. The TRAC scoring process is illustrated in Figure 2-3. Each category has a unique algorithm for assessing an appropriate score. The details on the algorithms are available in the literature (Ohio 2003).

2.6.2.10 Tennessee Department of Transportation

Program Name: Industrial Access Roads Program.

Objective: To provide access to industrial areas and to facilitate the development and expansion of industry in the State of Tennessee.

Program Requirements: The Tennessee DOT undertakes industrial highway construction proposals meeting the industrial highway statute requirements from cities and counties. Once the industrial highway construction is completed, it is the responsibility of the local government to maintain the industrial highway. However, if the project is inefficiently maintained, Tennessee DOT can take over the maintenance and cost, and withholds all funds otherwise allocable to the city and/or county until the project is restored to its proper condition.

Funding: The State Legislature appropriates funding each year when it approves the Tennessee DOT budget. For the last three years, the Legislature has funded the program at $10,800,000 annually. In 2002, due to revenue shortfalls, $5,000,000 has been withdrawn from the program (Weisbrod and Gupta 2004).

2.6.2.11 Washington Department of Transportation

Program Name: The Rural Economic Vitality (REV) Program.

Objective: To provide funds for transportation capital investments that benefit economic development in the rural areas.

Program Requirements: The Community Economic Revitalization Board authorizes REV projects; however state highway projects are authorized by the Transportation Commission, while Washington State DOT Highways and Local Programs staff administers the grant program. Rural counties and state community empowered zones are considered the eligible areas for REV projects. Eligible projects include transportation improvements of state highways; county roads; city streets; job creation and retention by industrial, commercial, or tourism industry businesses; freight mobility improvements; and private facility developments.

Funding: Nearly $68 million in federal TEA-21 resources has been invested in 44 projects from 1999 to 2001. The REV projects are expected to leverage over $64 million in other funding (Weisbrod and Gupta 2004).

2.6.2.12 Wisconsin Department of Transportation

Two different programs of the Wisconsin DOT are explained in this section. The first is an economic assistance program and the second a highway prioritization process.

Program Name: The Transportation Economic Assistance (TEA) Program.

Objective: To attract and retain non-speculative business firms and create or retain jobs in the State.

Program Requirements: The TEA Program provides 50 percent funding grants, ranging between $30,000-$1 million, to eligible communities or private businesses for projects that are necessary to help attract employers to Wisconsin, or encourage businesses and industries to remain and expand in the State. Grants are for completion of transportation infrastructure improvements, such as railroad segments, roads, airport runways, or harbor improvements. Job creation is an explicit requirement for these grants, and applications are ranked based on cost per job promised ($5000 maximum), as well as the local unemployment rate and benefits to regional transportation. Since September 1987, the TEA Program has funded $56.2 million, awarded $53.3 million in grants, and created 54,101 jobs.

Funding: For FY 2002-2003 funding, the TEA Program is funded at $7.25 million from the state segregated funds and another $7.25 million from the local matching funds (Weisbrod and Gupta 2004).

Program Name: Wisconsin Highway Majors program.

Objective: To set forth the process and criteria used by the DOT to numerically evaluate projects considered for enumeration. This process for evaluating candidate major highway projects is used to advise the transportation projects commission. This establishes a minimum score that a project shall meet or exceed in order to be eligible for recommendation to the transportation projects commission. Please note that this is not an economic development program but is a project raking procedure that involves the effect of economic development among other typical factors.

Program Requirements: Candidate projects must receive a minimum score from the evaluation presented in Figure 2-4. Actual weighted percents may be slightly different than those shown in this figure, for example, the percent allocated for Economic Measure is actually 37.5 percent, instead of the rounded value of 40 percent shown in Figure 2-4 (Wisconsin 1999).

2.7 Understanding the Analysis Method

Understanding the type of analysis that is referred to in a BCA and EIA is essential to choosing the correct method. Any potential tool for incorporating economics into the planning process is in some sense a BCA; weighing the benefits versus the costs of the project. The difference in the possible tool options is to what extent are benefits and costs measured. For example will the BCA simply measure direct impacts or will it include broader indirect economic impacts? Even among these two methods there are differing levels of investigation that can be conducted.

In the presentation of the possible tool packages the two terms that will be used to distinguish between the two before mentioned methods are *user impact analysis* and *economic impact analysis*. User impact analysis (UIA) is a traditional BCA considering only clear direct impacts benefiting real time, cost, and safety. EIA is a BCA including those benefits to the economy, specifically how the money flows back into or out of the pockets of those in the state (Kaliski and Weisbrod1998). EIAs may also include societal or non-monetary impacts.

The FHWA *Economic Analysis Primer* suggests that the best method and tools for any given project depends on the scale, complexity, and controversy of the project (FHWA 2003a). The FHWA Primer discusses both relatively simple and advanced methods of performing an EIA. The basic methods of EIA are categorized as survey studies, market studies, and comparable case studies. The advanced methods of EIA include econometric analysis requiring economic models of regional productivity.

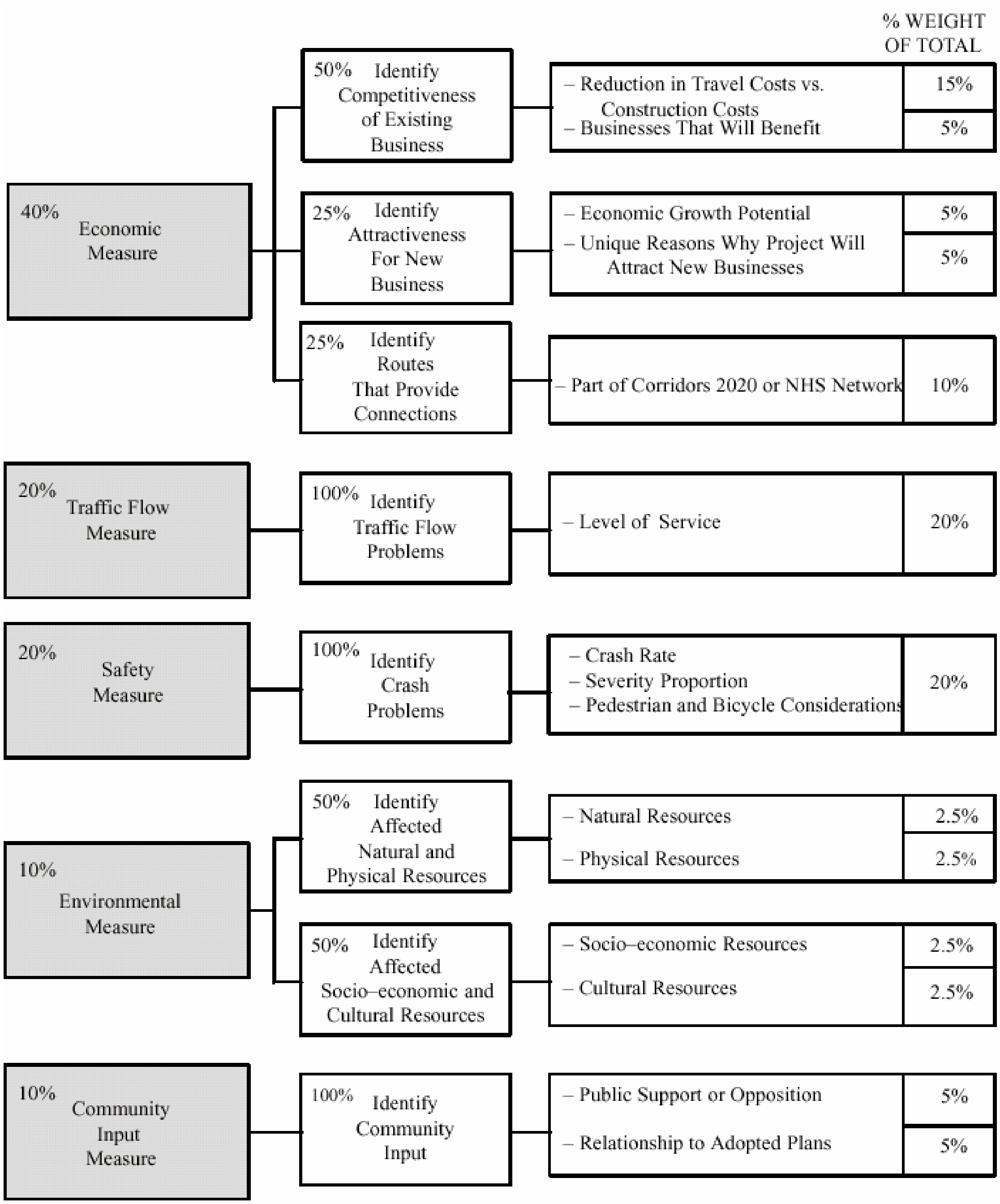


Figure 2-4 Wisconsin highway majors scoring system (Wisconsin 1999).

These models attempt to quantify the effects on the market from "shockwaves" created through transportation capacity projects. An economic model will measure or forecast the economic growth or capture productivity benefits (FHWA 2003a).

Economic benefits are tracked through what is called an input-output (I-O) matrix, a key component of economic models. This matrix contains dependency relationships between industries, meaning how a change in demand in one industry will affect another. When expenditures are made in one industry the earnings are then supplied in turn to another industry. I-O modeling is used to measure the effects of how the change in one industry affects another. The inter-industry relationship is called a multiplier. In this way the direct impacts are carried into indirect impacts throughout the economy. Inasmuch as the multiplier values will change from region to region, the I-O tables should be customized to the specific region and regional multipliers can be formed from surveys of businesses to observe who they buy from or sell to. Similar multipliers are created associating the industry to economic outputs such as employment, wages, and productivity or sales. Thus an I-O system is a structure to analyze economic impacts that requires industry specific expenditures and generates industry specific outputs (Bureau 2005).

Economic models are further categorized as static or dynamic models. Static models are those models that predict economic impacts for the relatively short term. The model in effect follows a single shockwave through the economy. This is much simpler than a dynamic or econometric model because dynamic systems models not only follow the response of the first shockwave on the economy but continue to analyze the changes in the economy over the long term as the demand may alter the size and characteristics of the economy (Weisbrod 1990).

A number of static and dynamic models for economic analyses are currently available. The following sections define the models and provide examples of those models currently in use throughout the country.

2.7.1 Static Models

A static model is often considered sketch planning and is favorable for agencies that may not have the resources to make analyses using expensive long-range models. These simpler analyses use readily available socioeconomic, land use, traffic congestion, economic multipliers, and other data to serve as predictive models. The data can be compiled into a spreadsheet tool to calculate the desired data. The accuracy of these models is typically limited to a length of time less than one year (Weisbrod 1990).

A number of static models are available on the market today. Several of these models will be discussed in the following sections including: RIMS II; IMPLAN; STEAM.

2.7.1.1 Regional Input-Output Modeling System, RIMS II

In the 1970s the Bureau of Economic Analysis (BEA) developed the Regional Industrial Multiplier System or RIMS as a method for estimating regional I-O multipliers. This original methodology has been improved upon and the current framework is now known as RIMS II. RIMS II is based on I-O tables composed of industry multipliers taken from the BEA handbook. In 1997 the third edition, and most recent, BEA handbook was published. The BEA has two data sources: 1) a national I-O table, including nearly 500 U.S. industries; and 2) regional accounts, which adjust the national industry and trading patterns (Bureau 2005).

On the BEA Regional Economic Accounts website, a brief description of the system explains the potential uses for RIMS II and its advantages. One such advantage from using RIMS II stated in the website is "that multipliers can be estimated for any region composed of one or more counties and for any industry, or group of industries in the national I-O table" (Bureau 2005). However, RIMS II impact studies are primarily suited for small changes to the economy. Research has shown that estimates from RIMS II versus other more expensive surveys forecast similar magnitudes for a short term analysis.   The majority of RIMS industry specific multipliers as compared to other regional survey-based multipliers are less than 10 percent different. These advantages are further summarized in list form in Chapter 5 of this report. RIMS II is used widely in both the public and private sectors including the U.S. Nuclear Regulatory Commission, the U.S. Department of Housing and Urban Development, and in studies of opening or closing of military bases (Bureau 2005).

The basic user requirements of RIMS II are as follows (Bureau 2005):

- Spending by category consistent with the industry classification used in RIMS II (the more accurate the classification the more accurate the forecast),
- Adjust the expenditure to 1997 dollars,
- Choose the appropriate region and associated multipliers, and
- Separate the project into phases if necessary.

Multi-year spending should be separated into annual phases. Likewise, distinct phases should be created if transportation improvements can be separated into construction and operations.

Disadvantages to using RIMS II (also listed in Chapter 5) are shared with any "static" I-O model. For example, RIMS II accounting does not accommodate for changes in prices and wages. Because larger, long-term projects often induce changes in price and wage, RIMS II is generally limited to short term forecasting. Also the multipliers are based on annual data so it is customary to assume that the impacts occur in one year. RIMS II does not offer comparisons to the base case (no project) or other alternatives. To compare multiple projects by economic impact, each calculation would need to be done individually (Bureau 2005).

2.7.1.2 IMPLAN

Minnesota IMPLAN Group (MIG), Inc. developed the current version of IMPLAN Professional version 2.0 in 1999 (Minnesota 2005). IMPLAN is an I-O accounting system that describes commodity flows and operates on a windows file management system. Much like RIMS II, IMPLAN utilizes industry specific I-O multipliers to model the change of output of each and every regional industry caused by a one dollar change in any other given industry. "The IMPLAN system was designed to serve three functions: 1) data retrieval, 2) data reduction and model development, and 3) impact analysis" (Minnesota 2005). Working database multipliers are first at the national level and then break down into sector activity for demand, payments, industry output and employment for each county in the U.S. These databases are updated annually.

Through IMPLAN the user develops a user-defined multiplier table to create the accounting matrix. These can be altered by the user if additional information concerning components such as production functions, trade flows, etc. is known. Custom impact analysis can be derived by entering final demand changes (Minnesota 2005).

There are two construct models in the IMPLAN model: 1) descriptive and 2) predictive. Descriptive describes the transfers of money between the industries and institutions. Predictive model is the set of I-O multipliers which predict the total regional activity based on a change in consumption. To create an impact analysis the newly created set of multipliers are applied to the industry specific expenditures (Minnesota 2005).

Five different sets of multipliers are estimated for the five measures of regional economic activity: 1) total industry output, 2) personal income, 3) total income, 4) value added, and 5) employment. Each set of multipliers then comes with four types of multipliers (Minnesota 2005):

- Type I – the direct effect, plus the indirect effect divided by the direct effect;
- Type II – induced effects resulting from household expenditures from new labor income, (personal consumption expenditures, PCE);
- Type SAM – direct, indirect, and induced effects where the induced effect is based on the Social Account Matrix; accounting for social security and income tax leakage, institution savings, and commuting; and
- Type III – Forrest Service based multipliers.

The results present industry output, per-capita personal consumption, labor income, employee compensation, proprietor income, other property type income, and employment (Minnesota 2005).

2.7.1.3 Surface Transportation Efficiency Analysis Model, STEAM

In 1995, the FHWA developed a corridor sketch planning tool called the Sketch Planning Analysis Spreadsheet Model (SPASM) to assist planners in developing the type of economic efficiency and other evaluative information for comparing cross-modal and demand management strategies (DeCorla-Souza and Hunt 2005). This model had several shortcomings, however, so to allow for more detail in the corridor analysis and to facilitate system wide planning FHWA expanded upon the SPASM methodology and developed the Surface Transportation Efficiency Analysis Model (STEAM). Both models came about in direct response to the Intermodal Surface Transportation Efficiency Act (ISTEA) and the need to assess multimodal alternatives and demand management strategies. STEAM helps state and regional agencies estimate the benefits, costs, and environmental impacts for a wide range of transportation investments and policies. STEAM is used primarily in analyzing discrete, large regional projects (DeCorla-Souza and Hunt 2005).

Inputs in STEAM can be directly transferred from four-step travel demand models or other software, such as FHWA's travel demand model. Some capabilities include:

- Post-processing traffic assignment outputs to more accurately estimate travel speeds.
- Performing risk analysis to clearly describe level of uncertainty in results (probability of benefit-cost ratio)
- Producing estimates of system wide impact including impact of pollution, energy, noise, etc.

The primary objectives of STEAM are to provide a framework for estimating impacts of multimodal transportation alternatives and assessing their overall merits.

Highly flexible, STEAM provides default analysis for seven modes at weekday travel or separate peak inputs. The modes include: 1) auto; 2) truck; 3) carpool; 4) local bus; 5) express bus; 6) light rail transit; and 7) heavy rail transit (DeCorla-Souza and Hunt 2005).

In a Portland I-5 freight study (FHWA 2005), STEAM was used to calculate user benefits based on the difference between the base case and each alternative investment strategy. STEAM was run using inputs provided by the Portland travel demand model, Metro, and the default STEAM parameters for value of time, fuel consumption rates, crash rates, etc. Metro also provided local data to override these defaults in some cases. The STEAM results used in the study included monetary equivalents for the change in four user benefit components: 1) travel time, 2) crashes, 3) non-fuel operating costs, and 4) fuel costs. STEAM generated an estimate for each component for each of the three peak periods and each commodity/vehicle type. These results were then converted into 24-hour values to estimate overall benefits (FHWA 2005).

In-vehicle travel time savings, the value of time to vehicle occupants was obtained from the U.S. Department of Transportation in the stated Portland study. The value of time was expanded to include value per vehicle and value of inventory. The values of travel time used in the Portland study are summarized in Table 2-1 (FHWA 2005).

STEAM calculated the change in vehicle travel time by running trips from Metro's trip tables through a software designed to analyze multimodal networks—called EMME/2 (EMME is a bilingual acronym for Équilibre Multimodal, Multimodal Equilibrium) (EMME/2 2006)—comparing the base network results to those of each alternative network. Total travel time is based on the speed and distance traveled by each trip through the EMME/2 network, summed for all trips. Congested speeds and link distances come directly from EMME/2, and STEAM determines the minimum time path.

Table 2-1 Sample Assignment of Value to One Hour of Travel Time (FHWA 2005).

	Auto	6-Tire	3-4 Axle	4-Axle	5-Axle
Business Travel					
In-Vehicle Value per Person	N/A	$16.50	$16.50	$16.50	$16.50
Avg. Vehicle Occupancy	N/A	1.05	1.00	1.12	1.12
Value per Vehicle	N/A	$2.65	$7.16	$6.41	$6.16
Value of Inventory	-	-	-	$0.60	$0.60
Personal Travel					
In-Vehicle Value per Person	$8.50	-	-	-	-
Avg. Vehicle Occupancy	1.67	-	-	-	-
Avg. Value per Vehicle	$10.17	$19.98	$23.66	$25.49	$25.24
Avg. Value per Person	$8.50	$19.02	$23.66	$22.76	$22.54

Vehicle operating costs in STEAM are a combination of two components: 1) fuel costs and 2) non-fuel costs. Fuel costs depend on both speed and VMT. STEAM uses a series of fuel consumption rates at different speeds in addition to average fuel cost as key inputs to this calculation. For each trip, STEAM sums the cost of fuel used on each and every link of the trip, based on the distance of each link and the congested speed on that link. Non-fuel costs are VMT-dependent costs associated with operating a vehicle. These costs account for oil consumption and maintenance costs. STEAM simply multiplies a cost factor by the VMT of each trip, summing all trips for total non-fuel costs (FHWA 2005).

STEAM determines crash costs based on VMT and the facility-based crash rate. For each trip, the product of the length, crash rate, and crash cost on each link is added up for all links on a trip and for all trips. Costs per crash are provided for fatal, injury, and property damage only crashes (FHWA 2005).

2.7.2 Dynamic Models

Dynamic models are designed to simulate effects of factors that change the relative costs and competitive position of businesses in an area, as can occur from changes in occupation wage rates, population and labor force rates, energy and transportation costs, cost of capital, etc. For example, "the REMI® model estimates the future economic profile of a region based on national forecasts of industry growth, changing technology, and its own estimates of the shifting competitive position of each industry in a given region compared to that industry elsewhere in the country" (REMI 2006).

A few dynamic models are available on the market today. Two of these models will be discussed in the following sections including REMI® and HERS. More detailed results of the evaluation of these two models will be provided in Chapter 5. A third type of dynamic model, only briefly discussed here because it is not widely used, is a transportation land use economic model.

2.7.2.1 Regional Economic Models, Inc. (REMI®)

REMI® models predict economic and demographic effects of policy initiatives and generate long-term forecasts. These models are *Policy Insight*®, *TranSight*™, and *DevSight* (REMI 2006). REMI® Policy Insight is designed to offer economic impacts of regional policies; REMI® TranSight™ is specific to economic impacts of transportation improvements, while REMI® DevSight is an economic-development database. UDOT's needs are primarily limited to transportation improvements and thus REMI® TranSight™ is the model of interest, however most TranSight™ functions can be duplicated by supplementing Policy Insight® modeling program because the core of Transight™ is Policy Insight® (REMI 2005).

REMI® TranSight™, with its largely unparalleled modeling capabilities, has been used in projects throughout the country. There are few other options for calculating dynamic economic effects to the extent of REMI® software. REMI® can forecast impacts for a period of 41 years in to the future using advanced statistical techniques, called econometrics, which enable forecasting of indirect effects on the regional economy. This requires an iterative process of calculations as each industry's altered demand influences the demand of another and another. The whole of the economic impact reports demographic effects such as change in population and labor force; along with productivity effects such as GRP, business output, wages, employment, etc. These changes are reported by year specific to industry (REMI 2005).

TranSight™ software comes with region specific data in its Economic Demographic Forecasting Simulation (EDFS) model that has 23, 70, or 169 industrial sectors embedded as multipliers from Standard Industrial Classification (SIC) or North American Industry Classification System (NAICS). The calculations function similar to I-O models in that the REMI® model requires inputs specific to industry; such as VMT, VHT, emissions, safety, and fuel demand; and outputs economic effects. The difference simply is forecasts of I-O models are static or limited to short term forecasts (Weisbrod 1990).

REMI® TranSight™ is compatible with several travel demand models, among them is TP+, the transportation planning model that the Wasatch Front Regional Council uses. Calculated user benefits are entered into a transportation cost matrix to translate measures such as time savings to money savings. This is done outside of REMI® with region specific translation multipliers to add value to the network users. It is best if the market sector of the network users is known as well as the commodity flow type. For example, what percentage of passenger cars are on personal travel, home bound work, freight, or other commodity flows?

There are many software programs that translate user benefits to dollar amounts. As in the Portland, Oregon example, STEAM was used as the front end processor to prepare data for input into REMI®. Portland's study involved four basic steps: 1) determine the travel impacts of each alternative investment program, using Portland Metro's regional travel demand model (EMME/2); 2) estimate the direct user benefits for each program using STEAM; 3) project the economic benefits that flow from the direct user benefits using the REMI model; and 4) calculate the benefit cost ratio for each alternative (FHWA 2005).

REMI® can incorporate other project specific data such as construction, operations, and other financial spending directly for infrastructure improvements.

These input data again must be industry specific. In a report by Pamela Perlich at the University of Utah's *Utah Economic and Business Review* on "Economic and Demographic Impacts of Federally Financed Transportation Infrastructure on the Wasatch Front" (Perlich 2004), REMI® is used to analyze disaggregate impacts of federal and local government spending. User benefits were not included in the study. Because federal funds are considered new or outside money the impacts derived from their spending will cause economic growth. Local government spending, while not increasing the size of the economy to grow, is designed to incur generative impacts and redistributive impacts.

To model the effect of federal aid expected by the Wasatch Front for transportation infrastructure improvements, first the researchers found the amount of money that would actually be spent in the state. In other words, the out-of-state expenditures of specialized equipment or construction materials represent leakages out of the regional economy, reducing the total spending and subsequent economic impact. Next, the duration of the improvement program was expected to last 27 years so the funding was distributed throughout that time period and input into the REMI® model. Due to the long-term nature of the project it was expected that the majority of the labor force already are or would become permanent residents of the region, avoiding additional leaks in the economy by sending paychecks out of state. An output of REMI® reported in Perlich's analysis was the population impacts generated by the federal expenditures. The model forecasted the population count from 2004 to 2030 in four year age groups, respective to gender. The employment impact outputs also reported year by year details respective to industry throughout the same time period.   Two other featured outputs were Gross State Product and Personal Income (Perlich 2004).

2.7.2.2 Highway Economic Requirement System, HERS

The Highway Economic Requirements System (HERS) model has been developed by the FHWA as a project selection tool. The primary purpose of the model is to predict when and where there will be deficiencies and what alternative is best. A state version (HERS-ST) was created with the idea that this same tool would be beneficial for state DOTs. In 1998 Oregon and Indiana began to utilize the HERS-ST version to produce estimates for future highway investment required to maintain or improve system condition and performance (FHWA 2002).

HERS is an economic based tool to identify deficiencies and prioritize candidate projects. The economic aspect of HERS refers to the modeling of supply and demand from exogenous (external to the highway) and endogenous (dependent on the highway, such as speed) input data. This principle ideally helps assess capacity service and pavement preservation.

HERS has three major functions: 1) project the future condition and performance of states' highway system, 2) assess whether highway improvements are warranted, and 3) select appropriate improvements using benefit cost analysis.

Cambridge Systematics consulted with FHWA, the Oregon DOT, and the Indiana DOT in their setup and modifications of HERS_ST. Specific modifications made, as reported on Cambridge Systematics web page, state that Oregon HERS was expanded to (Cambridge 2005b):

- Evaluate the effectiveness of state-specified improvements in addition to those recommended by HERS, and
- Generate output tables that enabled review of planned improvements and their impact over time according to state-specified classifications.

Indiana's HERS-ST was customized to support their MCIBAS program, incorporating the ability to (Cambridge 2005b):

- Use data in Indiana's road inventory file, and output from the pavement management system,
- Estimate when pavements should be improved,
- Improve accuracy of cost forecasts by employing state-specific costs for highway improvements, and
- Display output from HERS in the Indiana DOT GIS.

The main advantage to the state modification is that the state analyst can override or add local details for a more accurate model (GAO 2001).

2.7.2.3 Transportation, Land Use, Economic Model

Tied closely to the economic impacts from transportation are the land use impacts. Just as models have been created to forecast economic responses so have models been created to forecast land use changes. There are only a few models currently being used in the practice of transportation land use planning. These are highly complicated software programs requiring experienced modelers. Utah transportation professionals are currently gaining experience with one such model, UrbanSim, which is currently undergoing peer-review by WFRC. In the March 2004 WFRC Resolution, WFRC staff felt "that continuing to develop and understand UrbanSim, with the intent to overcome known deficiencies and use the model as a tool in developing official forecasts, is the most prudent course of action for the following reasons (WFRC 2005):

- Our current land-use forecasting process needs improvement to remain consistent with the evolving state-of-the-practice in this area. Analytical methods become subject to challenge when they do not keep up with advancing state-of-the-practice or are not capable of addressing policy questions. UrbanSim puts us with the industry leaders.
- UrbanSim is one tool that would be extremely valuable, if functioning properly, in developing a regional transportation plan that is consistent with local plans.
- The ability to consider and explore analytically the effects of land-use on transportation and the effects of transportation on land-use is an ability this region needs in looking towards the future.
- Successful implementation of UrbanSim affords WFRC technical staff the opportunity to make state-of-the-art improvements to the region's travel demand models, making them more defensible and more useful."

An exciting option provided by UrbanSim is the forecasting where the economic impacts take place. If REMI® or any other economic impact model indicates a certain number of jobs created and certain immigration to the region, UrbanSim can provide an estimate on whether they will actually fit in that region and what the land use impacts will be (Brown 2005).

2.7.3 Procedure for Analysis

With different methods for analyzing economic impacts and different models to carry out the analysis an attempt to give suggestions and establish guidelines to the industry was made. In the October 1997 Transportation Research Circular number 477, *Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for your Project* (Weisbrod and Weisbrod 1997), the following guidelines were given as a suggested method to maximize benefits of public investment and recognize both positive negative economic impacts.

Typical steps for assessing economic impact include (Weisbrod and Weisbrod 1997):

1. Identify type of project. General types of impacts or projects that could be considered are: direct user, direct economic (business), indirect and induced, construction and maintenance spending. Essentially it should be asked: Who are we serving? What physical changes occur? Why?
2. Identify purpose of the analysis. What do we want to find and why? Is it information for public education? Is it information for decision makers and which ones?
3. Select base case and alternative. What is our datum for comparison? What other alternatives do we have?
4. Select geographic study area. Where will the economic impacts be considered external, or out of the region of influence of the project?
5. Select time period. The time period should reflect the time in which the benefit and costs are incurred; this may be past, present, or future conditions. Note that often the costs are incurred before the benefits, and

when comparing the cost and benefit, make certain to do it in terms of discounted net present value.

6. Select impact measure. The measurable inputs and outputs are: user benefits (time, cost, safety), growth of economy, land development / values, fiscal impacts, non economic or social benefits (community, pride, quality of life).
7. Select appropriate analysis method. Would a transportation system model, economic models, or direct measurement techniques be best? Transportation system models are those models that measure travel times and cost. They can be though full simulation or by sketch planning (spreadsheet calculations). Economic models include static I-O models, which are good for spending management but have the disadvantage of no change over time, wages or other values, and also dynamic or Macroeconomic models.
8. Apply data to calculate economic impact, such as: value of time savings, value of safety saving, operating cost savings, discount rate (4-8 percent; Corps of Engineers uses 4 percent, British Columbia Ministry of Transportation uses 8 percent)
9. Present results. Is it single year benefit or overtime? What is the present value?

2.8 Chapter Summary

The literature review was completed to provided the researchers with a broader understanding of the state of economic impact analyses of transportation projects; namely, how the economics and transportation tie together, the history of economics analysis and how it looks today, why providing this analysis is important, and what tools are available.

It was learned that the work of quantifying in economic terms the impact induced by a transportation project that increases capacity is a complicated task, yet of significant interest to transportation decision makers and all stakeholders. One aspect of the process that increases the complexity is the variety of types of economic tools and their respective complexity. From reviewing state practices across the nation it was learned that application is not uniform. Goals of each state are different and therefore the economic analysis programs are custom fit to meet those goals. The state of the practice is ad hoc implementation of programs and tools.

A primary difference noted in this review is the scale of the projects funded by the state. This is apparent in states choosing to focus efforts on smaller economic development oriented projects versus including economic impacts as criteria in the selection of larger projects that also have merit in other areas. Other differences can be seen in both large and small project EIAs and the modeling tools used. The tools range from basic I-O spreadsheets to high priced custom made econometric software models. Another question is to what extent should impact analysis be done: is measuring direct impacts enough or should indirect and induced impacts also be included and if so which ones? What metrics should be considered? Is tourism important? What type of job creation should be counted? What about, GRP, income, property values, tax revenue? Even after locally agreeing upon these criteria it must be determined how important economics is in the big picture of the transportation system? Do these projects deserve earmarked funding? These questions and more must be taken under consideration in Utah's current situation to be introduced in Chapter 3.

3 Background Analysis

The primary purpose of this chapter is to summarize the economic situation set before decision makers in the state of Utah when considering the economic impact of transportation planning projects and to identify their expectations for a prioritization process. This purpose was accomplished in three steps. First, through more regional specific research of the State of Utah the current economic development plans and economic well-being were ascertained. Second, UDOT's goals and project prioritization was reviewed. Third, a summary and definition of the expectations of decision makers in the state were established. The first step was accomplished through consultation with the Governor's Office of Planning and Budget (GOPB). The second step was completed through a review of UDOT literature. The third step was accomplished through the establishment of the steering committee, which includes a cross section of UDOT planning and administrative personnel, and Transportation Commission members.

This chapter will first outline generally Utah's economy and methodologies employed to model it, second review the UDOT LRP and other priorities, and third describe the formation and participation of the steering committee.

3.1 Utah's Economy

To understand the current economy of Utah and where transportation can contribute, three general topics were researched: 1) demographic information in Utah, 2) models that have been used in the past to monitor economic development, and

3) UDOT specific project prioritization goals. Each of these topics will be address in the following sections.

3.1.1 Demographic Information on Utah

Utah's official population estimate for 2004 was 2.47 million, a 2.3 percent increase from the previous year. The state is ranked seventh in the nation in population growth rate with 1.6 percent compared with the national average of 1.0 percent. The U.S. Census Bureau classifies Utah as the youngest state with a median age of 27.5, as compared with the national average of 35.9 (Economic 2005).

Utah is experiencing drastic increases in population and associated education needs. The Utah Department of Education estimated that a nearly ten-fold increase in new students entering Utah's schools is expected in the next 10 years. This intense boom is thought to be the result of the "echo boom," or the grandchildren of the baby boomer generation (Huntsman 2005).

In addition to increases in population and school children, economic diversity is also escalating. Whereas ten years ago 10 percent of Utah was classified as ethnic minority, nearly 15 percent are so today (UDOT 2004). While this change brings its associated benefits, there are associated needs for resources.

Population increases stimulate increasing need for improvements to roadways and transportation infrastructure. In order to provide means of travel at a satisfactory level, transportation systems must be improved along with the increases in population. Furthermore, the amount of travel in the State of Utah is growing at a faster rate than that of population growth (UDOT 2004). Increasing population and associated demand for transportation systems to accommodate desired travel have implications in both quality of life and economic growth; the state's economy is affected by both population changes and transportation projects designed to meet the associated needs of such.

3.1.2 Past Use of Models

With an estimate of future needs and conditions that may exist, decision-makers can better determine the distribution of funds and resources. The state of Utah has been using such economic models for many years (GOPB 2003).

Utah Process Economic and Demographic Model (UPED) initialized in the 1970s, yields projections from mathematical models. Before this time, studies were performed by the University of Utah's Bureau of Economic and Business Research (BEBR) which were instrumental in providing a basis for the structure of future long-term projections, including those of UPED (Economic 2004).

From its inception, UPED was not intended to be the state's official model. Over time and progression and improvements to UPED, however, was ultimately accepted as the official model that was used to provide statewide projections that were used by many agencies within the state (Economic 2004). Initially the Regional Economic Model (REM) developed by the Center for Business and Economic Research of BYU was to be used. However, when REM was completed, the model was too dissimilar from what was needed by the state and the model was abandoned (Economic 2004). This abandonment further solidified the state's need for a model that would provide characteristics that matched the needs of the state. Such a model was found in UPED.

UPED had a population component along with an economic employment model which made projections of a population of age, sex, and employment by industry. The model was based on an underlying assumption that demand for exportable goods is what coerces regional growth or decline (Economic 2004). The Demographic and Economic Analysis (DEA) Section of the GOPB was responsible for UPED's modeling and projections (Economic 2004).

While UPED was the primary demographic-economic model in use, all state agencies and local governments used UPED simultaneously in planning. This coordination provided consistency in different entities' forecasting. In addition to being a useful tool providing continuity, UPED proved to consistently provide fairly accurate projections when compared to actual cases (Economic 2004).

Despite the associated benefits and accompanying programs that were in place, UPED was replaced after nearly 30 years of significant use by the REMI® Policy Insight®, model discussed previously in Chapter 2. This transition occurred in 2002. The UPED model required extensive time, talent, and finances in further development and maintenance (Economic 2004). These requirements were outweighed by a commercially packaged product's benefits. Furthermore, REMI® provided a model that was produced and supported by a commercial firm, rather than one that was maintained locally and whose logistics were understood by a few (Economic 2004).

REMI® is widely used around the country and its projections have likewise been broadly accepted. Utah's GOPB is able to generate long-term projections using many REMI® models. The GOPB has a model for the state as a whole, a multi-region model that incorporates all 29 counties of the state, and single models for each county individually (Economic 2004). With these means of obtaining information from the models, analysts are better suited to make accurate projections.

3.2 Utah's Project Prioritization

The Utah Transportation 2030, State of Utah LRP includes four strategic goals to help meet the Department's mission statement of "Quality Transportation Today," "Better Transportation Tomorrow," and "Work[ing] to Connect Communities" (UDOT 2004). These goals are: 1) take care of what we have, 2) make it work better, 3) improve safety, and 4) increase capacity (UDOT 2004). All four goals are equally important in meeting the needs and fulfilling the mission statement of the Department.

The first goal listed, "take care of what we have," includes the preservation of existing facilities, such as pavement and bridges (UDOT 2004). The second goal, "make it work better," incorporates the strategies of ITS, access management, and transportation demand management (TDM) in the prioritization process. ITS deals with the use of technology to inform individuals of roadway and traffic conditions (e.g., Utah CommuterLink) to aid in transportation decisions. Access management involves improving roadway system flow and safety by reducing dangers or "side friction" that access points such as driveways, on-street parking, and turning movements can cause. In addition, access management deals with improving medians and acceleration/deceleration lanes which can improve the visual appeal and safety of the roadway. TDM includes a number of policies and procedures with the intent of reducing travel demand, thus lowering overall VMT in Utah. This includes encouraging travel partnering such as carpools through the use of high occupancy vehicle (HOV) lanes, increased utilization of existing roadways through the use of reversible lanes, and multimodal transportation use. The next goal listed in the LRP is catered towards improving safety through the use of various safety-enhancing programs. Each of these programs has as its goal the improvement of safety in areas related to transportation and traffic. The final goal listed is to increase capacity. Capacity enhancement projects are important, especially when considering the continual increase in Utah's population and the more rapid increase in overall travel demand (i.e., increased VMT) (UDOT 2004).

While the four goals discussed previously work together to improve the transportation system of Utah, budget constraints often limit the extent to which they can be realized. As a result, funding recommendations are made to the Transportation Commission using the following priorities (UDOT 2004):

- Preservation of existing infrastructure,
- Safety enhancements,
- Operation of the existing system, and
- Capacity enhancements.

These follow closely the strategic goals discussed previously. It is noted that capacity enhancements are last in this list. The LRP notes that capacity enhancement projects are generally considered after the other three goals are addressed (UDOT 2004). Currently UDOT is devoted to focusing on the most efficient mix of ITS, access management, and TDM along with additional capacity enhancement projects as funding and need are apparent. Therefore, funding those projects that are most critical and beneficial to the vitality of the transportation system is both fiscally responsible and necessary to ensure the state's economic competitiveness.

After a general ranking of projects is completed, recommendations on project selection are provided by UDOT to the Transportation Commission. These recommendations in the urban areas include input from the local Metropolitan Planning Organization (MPO). An array of factors with set weights has been developed concurrently with this research to aid in this selection process. These include factors such as total average daily traffic (ADT), truck ADT, volume to capacity (v/c) ratios, functional class, growth potential, safety, and so forth. In addition to the traffic related factors, the question of when and how to incorporate an economic development related factor in this ranking procedure was addressed in this study.

3.3 Initial Utah Transportation Professional and Decision Maker Guidance

To evaluate the economic development impacts of transportation projects and to determine how to include these impacts in the decision making process, a steering committee was created to gather expectations of transportation professionals and decision makers regarding economic development impacts. The steering committee included a cross section of experienced professionals consisting of representatives from the Transportation Commission (two representatives), UDOT (seven representatives), MPOs (two representatives), and academia (three professors, a graduate, and undergraduate student). The members of the committee were:

- Carlos Braceras, UDOT Deputy Director
- Ahmad Jaber, UDOT Systems & Program Development Director
- Max Ditlevsen, UDOT Program Development
- John Quick, UDOT Planning Director
- Kevin Nichol, UDOT Planning
- Tim Boschert, UDOT Planning
- Linda Hull, UDOT Legislative Affairs
- Ken Warnick, Utah Transportation Commission
- Bevan Wilson, Utah Transportation Commission

- Chuck Chappell, Wasatch Front Regional Council (WFRC)
- Scott Festin, WFRC
- Darrell Cook, Mountainland Association of Governments (MAG)
- Dan Nelson, MAG
- Andrew Jackson, MAG
- Grant Schultz, BYU
- Mitsuru Saito, BYU
- Andrew Stewart, BYU
- Clark Siler, BYU
- Mark Burris, Texas A&M University

During the steering committee meetings it was emphasized that the inclusion of economic criteria in the planning process seeks in part to satisfy the 2005 General Session Senate Bill 25, which "requires the Transportation Commission, in consultation with the department, to develop a written prioritization process for the selection of new transportation capacity projects" (Senate 2005). This mandate allows the Department an opportunity to develop a tool to evaluate capacity projects. This tool can be used to rank projects using transportation metrics, while the economic component of the tool may be used to shuffle top priority projects. It was determined in the steering committee meetings that the preference of the committee members was to include economic criterion as a second tier evaluation applied to an initial short list of projects. This recommendation was made to the Transportation Commission in the July 19, 2005 Transportation Commission meeting and was subsequently approved (UDOT 2005). The weight that the economic criteria would have in this second tier evaluation was evaluated to best meet the needs of the process. To help in this process, opinions of other DOTs that incorporate economic analyses in their planning process were gathered to begin to assess what would be an appropriate weight.

3.4 Chapter Summary

This chapter summarizes the economic situation set before decision makers in the state of Utah when considering the economic impact of transportation planning projects and briefly indicates their expectations of a prioritization process. As more information would aid the decision makers in their tasks the steering committee was formed by which they could collectively decide precisely what the information was needed. Consequently the steering committee was interested in knowing what factors should make up an economic evaluation and what weight they should have in the final decision, a series of surveys were created for three specific audiences: 1) Utah decision makers, including the Transportation Commission; 2) Utah transportation professionals; and 3) national transportation professionals. The responses to this survey as well as the previously conducted GAO and NCHRP surveys are presented in Chapter 4.

4 Considerations of Economic Development in Project Selection: Findings from the Survey Results

To ascertain the state of the practice in assessing the economic impacts of transportation improvement projects from throughout the nation, the research group benefited from two previously completed surveys: the NCHRP Synthesis 290 (Weisbrod 2000) and a report to the Congressional Committee by the United States GAO (GAO 2005). The research team also completed an independent survey of both local and national transportation planners and decision makers to gain an independent perspective of the importance of transportation projects. From the data collected researchers developed a better understanding of how many transportation agencies incorporate economic criteria, how often it is incorporated, and what weight it is given in a project selection process.

The NCHRP and GAO surveys revealed that the majority of DOTs throughout the nation were somewhat sporadic in their efforts to regularly assess the economic development impacts in the transportation decision making process. As a result, when the final survey was administered by BYU for UDOT, several of the respondents were somewhat unclear on how to respond because they did not include economic development impacts in their process. Those that were contacted about their participation indicated this frustration in how to respond. Those who did respond to the survey, however, provided enlightenment on the possible weighting and tools for economic development impact inclusion in the transportation decision making process.

The following sections provide a summary of the NCHRP Synthesis 290 Report, the GAO Report, and the BYU/UDOT survey, respectively.

4.1 Summary of NCHRP Synthesis 290

NCHRP Synthesis Report 290 was completed in June 2000 by Glen Weisbrod of the Economic Development Group, Inc. (Weisbrod 2000). The purpose of this report was to survey government agencies and summarize the state of the practice in assessing economic development impacts from transportation investments. The survey respondents included 36 state transportation agencies, eight metropolitan planning organizations, and seven Canadian Provinces. The scope of this survey includes not only roadway transportation, but also air, water, and rail. In the following summary, where possible, roadway data has been separated and subsequently noted in the document when exclusively represented.

The following sections summarize a series of questions posed to the survey respondents with the results tabulated in an effort to ease in understanding the concepts analyzed.

4.1.1 Question Topics and Results

The first question posed to the survey respondents addressed the percent of agencies assessing the value of transportation project impacts or benefits. The specific question asked was "How often does your agency evaluate the value of impacts or benefits associated with transportation projects or programs?" (Weisbrod 2000) The results of this question are provided in Figure 4-1. The results indicated that nearly all (95 percent) have at some point assessed the value of road impacts and less than half (45 percent) regularly asses such impacts.

The next question addressed the purposes for assessing the value of project or program impacts. The specific question asked was, "What were the primary motivations for assessing those impacts or benefits?"(Weisbrod 2000) The results are provided in Figure 4-2 indicating that the primary motivation for assessing project value or program impact are for BCA, project planning, to rank alternative, and to provide public information. It is important to note that the statistics presented in this figure are for highway analyses only.

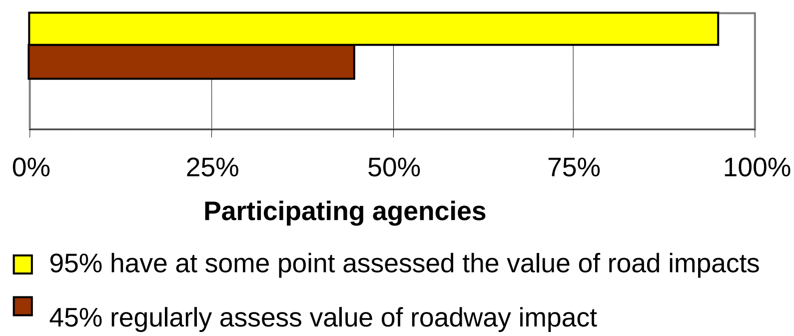


Figure 4-1 Percent of agencies assessing the value of transportation project impacts or benefits (Weisbrod 2000, Figure 4, page 34).

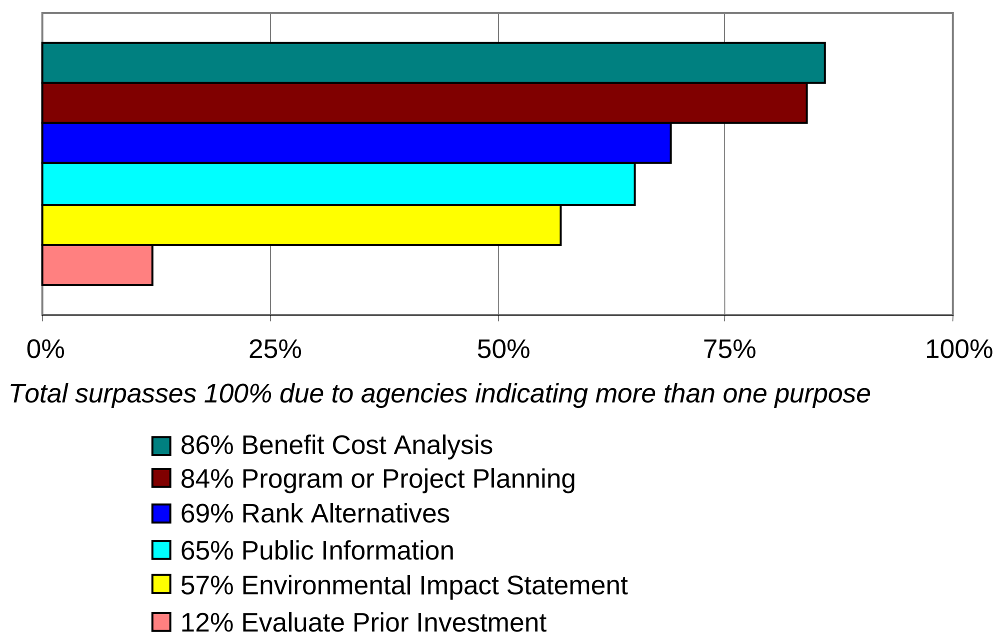


Figure 4-2 Purposes for assessing the value of project or program impacts (Weisbrod 2000, Table 2, page 34).

To determine the use of alternative economic indicators of project impact in the past, the following question was asked "What measure have you used in the past, to represent economic value of projects (or programs) to the public or to decision-makers?"(Weisbrod 2000) The results of this analysis are provided in Figure 4-3.

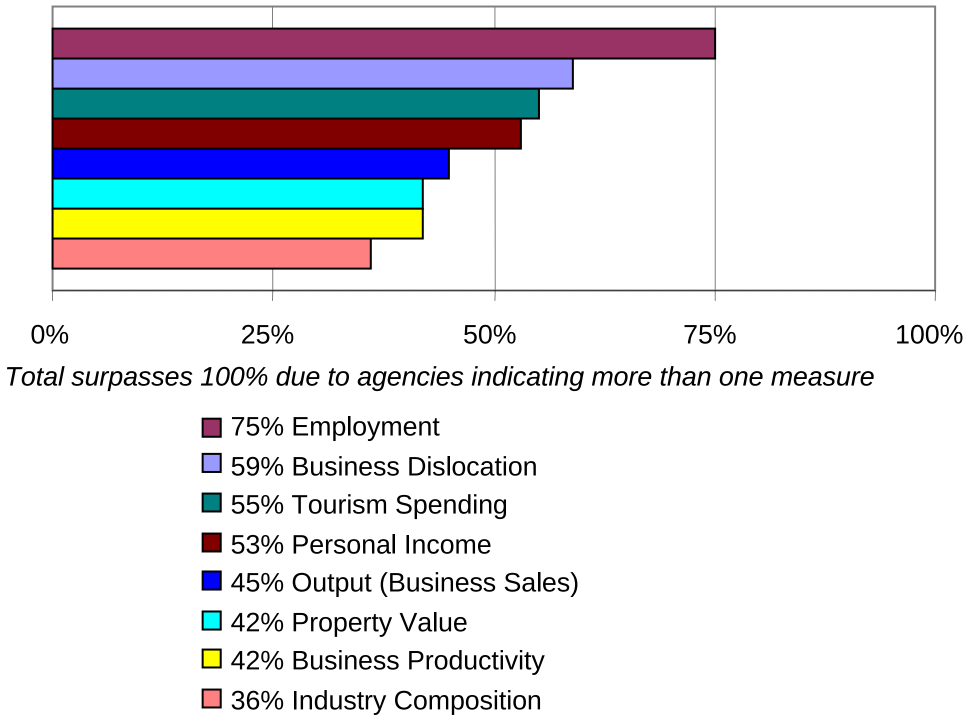


Figure 4-3 Use of alternative economic indicators of project impact in the past (Weisbrod 2000, Figure 3, page 12).

To address the use of economic development as a project justification or project evaluation criteria the authors asked, “Is economic development impact analysis a regular component of your agency’s project evaluation procedures?” (Weisbrod 2000) The results are presented in Figure 4-4 with only 30 percent indicating economic development as standard project evaluation.

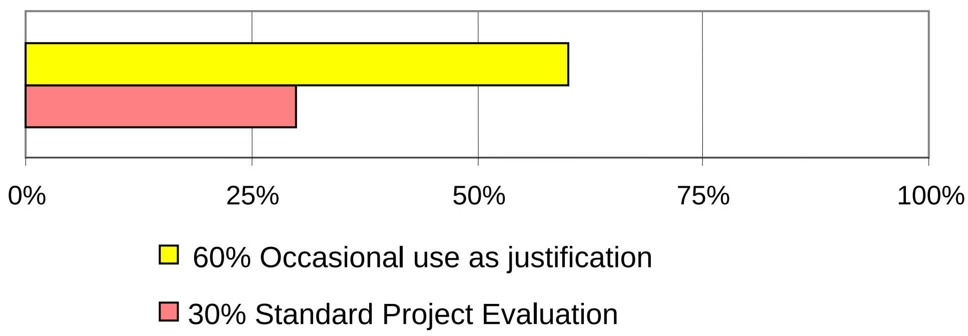
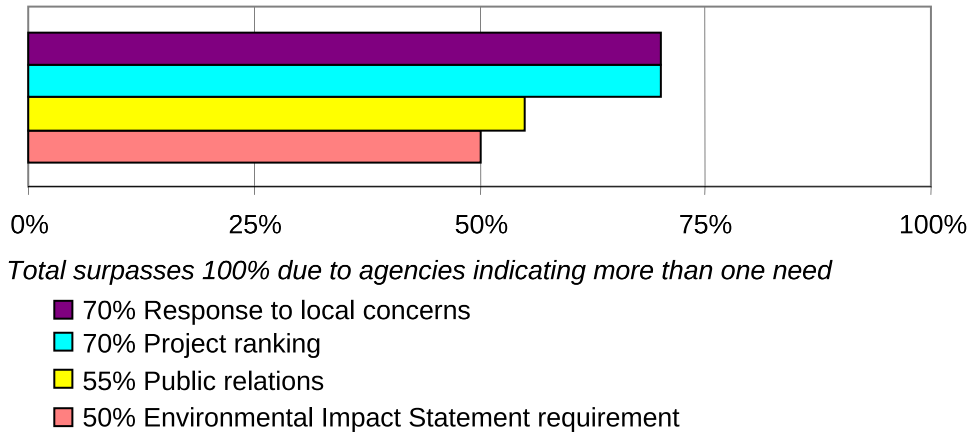


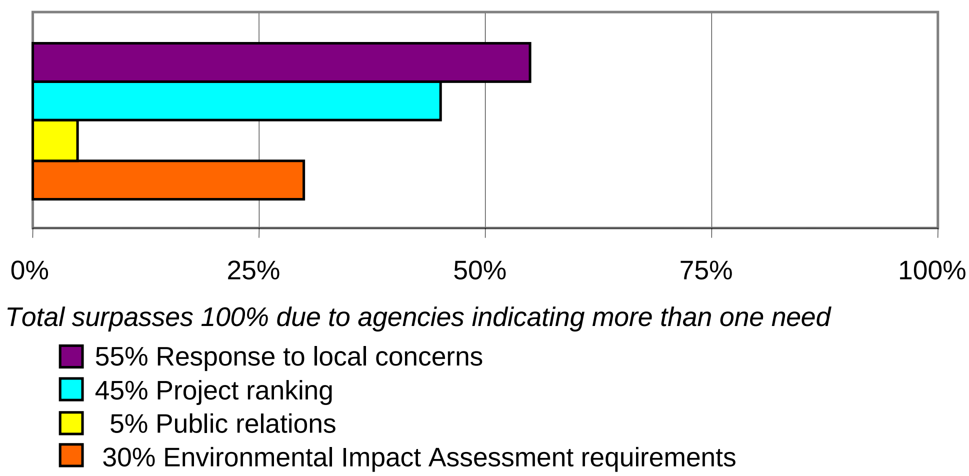
Figure 4-4 Use of economic development as a project justification or project evaluation criteria (Weisbrod 2000, Figure 7, page 36).

The motivation for specifically studying economic development impacts was addressed in the following question, "What needs motivated the specific study of economic development impacts?" (Weisbrod 2000) The results are illustrated in Figure 4-5 (a) for participating US states and in Figure 4-5 (b) for participating Canadian provinces. Among US states it is apparent that often there is more than one need motivating analyses. Canadian provinces may be more goal specific. The needs most frequently motivating analysis are responses to local concerns and projects rankings.

To address the most popular economic development impact measures the authors asked, "What measure have you used in the past, or would consider using in the future to represent economic value of projects (or programs)? Which measures appear to be of most importance for communicating findings on economic impacts to the public? To decision-makers?" (Weisbrod 2000) The results of this survey question are provided in Figure 4-6 (a) for those most frequent use in past studies, in Figure 4-6 (b) for those of most interest for potential future studies, in Figure 4-6 (c) for those most useful for public information, and in Figure 4-6 (d) for those most important for the decision maker. These percentages reflect a portion of all agencies which have conducted a study of economic development impacts. The impact on employment was rated highest in each category.

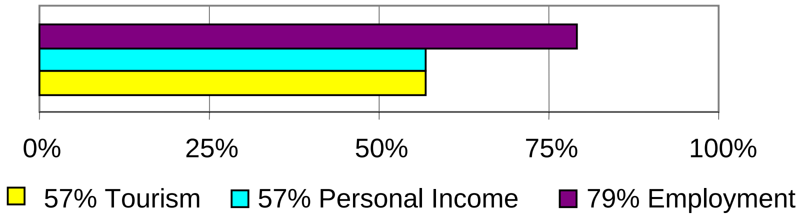


(a) Participating US States

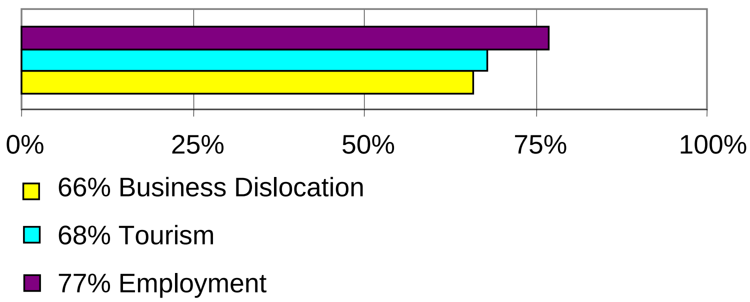


(b) Participating Canadian Provinces

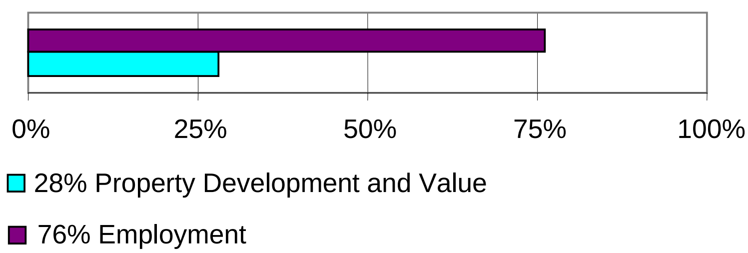
Figure 4-5 Motivation for specifically studying economic development impacts (Weisbrod 2000, Figure 6, page 35).



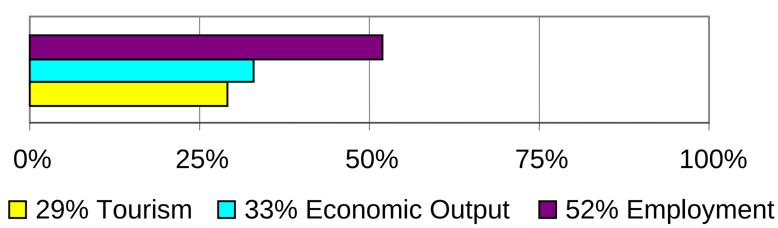
(a) Most Frequent in Past Studies



(b) Most interest for Potential Future Studies



(c) Most Useful for Public Information



(d) Most Important for Decision Makers

Figure 4-6 Most popular economic development impact measures (Weisbrod 2000, page 37).

The analysis tools used for assessing economic development impacts was also addressed in the study. The question asked of the survey participants was, “What analysis tools or methods were used?” (Weisbrod 2000) The results of this survey question are provided in Figure 4-7. These results indicate that the majority of respondents use direct surveys or interview with less that half using macro-economic simulation modes (e.g., REMI®) and economic market studies.

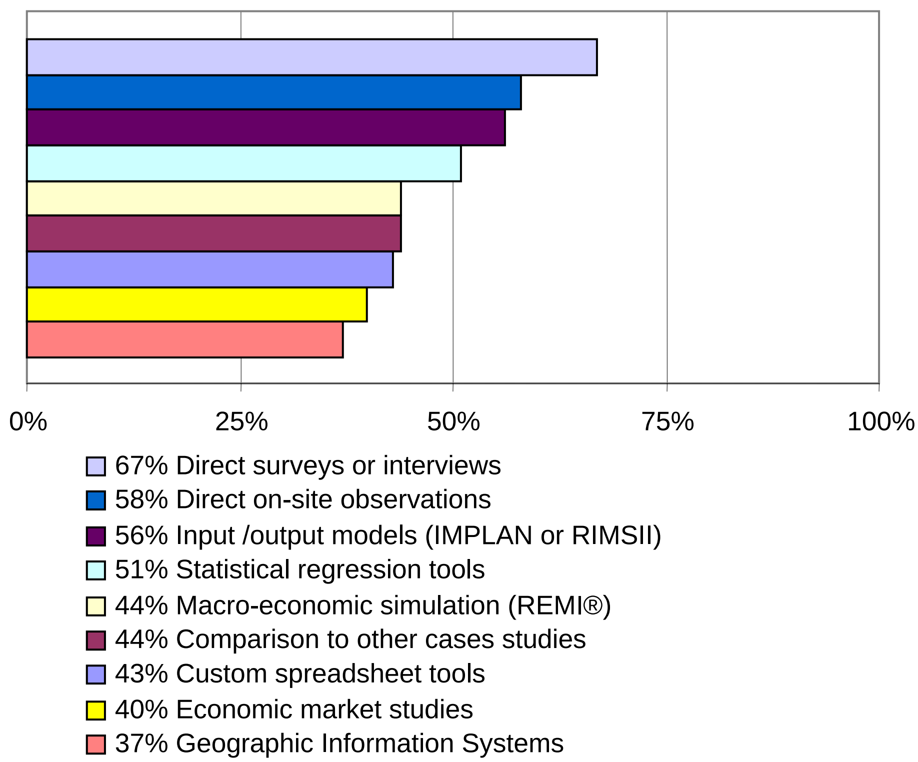


Figure 4-7 Analysis tools used for assessing economic development impacts (Weisbrod 2000, Table 4, page 39).

The final question to be summarized here addressed the primary individuals conducting economic development impact analyses by asking the following question, “Who were the primary individuals conducting the economic development impact analysis?” (Weisbrod 2000) The results are provided in Figure 4-8. All respondent indicating they had at some point used an outside contractor, 75 percent use in-house planners or engineers, only 25 percent use in-house economists, while 15 percent use other in-house staff for other analyses.

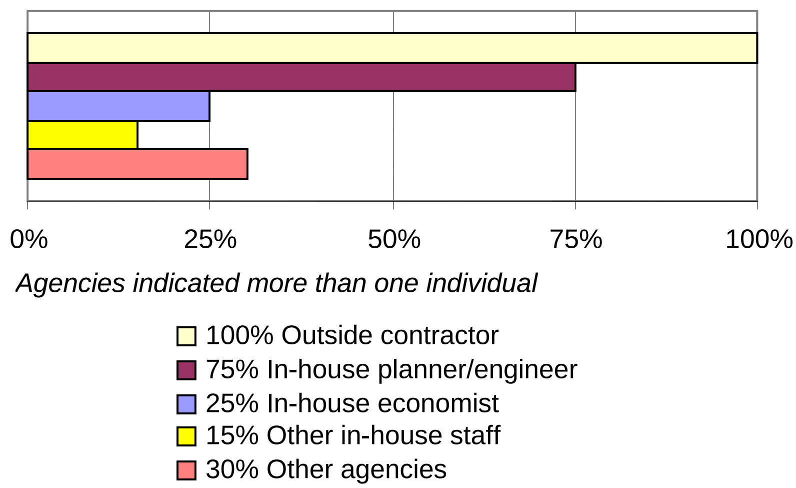


Figure 4-8 Primary individuals conducting economic development impact analysis, by job classification (Weisbrod 2000, Figure 8, page 40).

4.1.2 Conclusions

Overall conclusions made by this report indicate that "it is clear that there is now a high level of recognition of the role of economic development impacts in transportation planning" (Weisbrod 2000). Furthermore 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" (Weisbrod 2000).

Other lessons learned from this report are summarized as follows (Weisbrod 2000):

- EIA is never seen as a substitute for user impacts.
- While confusion remains about how agencies should select among economic impacts and the meaning of “economic impacts” or “economic development impacts,” evaluations are most frequently measured in terms of changes in associated employment (jobs), income (wages), and business output (sales) within some region.
- The type of analysis conducted depends on the purpose of the analysis (e.g., decision-making, planning and/or regulatory review, public education, etc.).
- Most agencies conduct detailed studies of economic development impacts only when warranted by specific needs, the most common motivation being a response to local concerns.
- Among transportation planning agencies, EIA was most common among Canadian provinces, somewhat less common among U.S. states, and least common among MPOs.
- Some of the cited problems with existing procedures for assessing economic development impacts included: results not accepted universally; inadequate data; complexity of analysis methods; and inexperience of agency staff (Canadian provinces appear to have a higher rate of conducting economic development studies using their own staff economists).
- Several agencies also noted that further economic development associated with transportation projects is not always welcome, particularly in congested metropolitan areas as well as other high density regions.

4.2 Summary of the GAO Report

The GAO survey was conducted from August through October 2004 (GAO 2005). In this study, transportation agencies were contacted via telephone and e-mail to solicit responses on the inclusion of economic impacts in the decision making process. Overall, 43 of the 50 state DOTs responded to the survey and 20 of 28 transit agencies. A primary lesson learned from the survey is that EIAs are done more for transit than for highway projects, due mostly to federal "New Start" requirements. The data gathered from transit agencies will not be reported here, however, as the purpose of this study is to evaluate highway data. It is important to note that those highway projects discussed in this survey are capacity adding projects only.

The following sections summarize a series of questions posed to the survey respondent with results tabulated in an effect to ease in understanding the concepts analyzed.

4.2.1 Question Topics and Results

The authors of the survey wanted to determine how frequently agencies complete three specific analyses: 1) cost-effectiveness analysis, 2) cost-benefit analysis, and 3) economic impact analysis.

To determine how frequently agencies conduct a cost effective analysis for capacity-adding projects the question was posed, "How often does your agency complete a *Cost-Effectiveness Analysis* when evaluating alternatives for proposed highway capacity-adding projects?" (GAO 2005). The results are summarized in Table 4-1. The data are presented in percentages [%] of total respondents. Nearly half of all agencies surveyed indicate that they never or almost never complete such an analysis.

Table 4-1 Frequency of Agencies Completing a Cost-Effectiveness Analysis (GAO 2005, Appendix II, Question 2, page 57)

Never or almost never	Less than half of the time	About half of the time	More than half of the time	Always or almost always	Don't know	Total (%)
48	18	7	7	20	0	100

To determine how frequently agencies conduct a BCA for capacity-adding projects the authors asked, "How often does your agency complete a *Cost-Benefit Analysis* [or BCA] when evaluating alternatives for proposed highway capacity-adding projects?" (GAO 2005) Table 4-2 summarizes these findings. While more agencies report completion of a BCA than the cost-effectiveness analysis the majority conduct a BCA less than half of the time to never.

Table 4-2 Frequency of Agencies Completing a BCA (GAO 2005, Appendix II, Question 3, page 58)

Never or almost never	Less than half of the time	About half of the time	More than half of the time	Always or almost always	Don't know	Total (%)
30	33	7	12	18	0	100

The third question posed in this set to determine the frequency of completion of respective analyses for proposed highway capacity-adding projects was "How often does your agency complete an *Economic Impact Analysis* when evaluating alternatives for proposed highway capacity-adding projects?" (GAO 2005). Of the three analyses, agencies reported completing EIA most infrequently. The results are summarized below in Table 4-3.

Table 4-3 Frequency of Agencies Completing an EIA (GAO 2005, Appendix II, Question 3, page 58)

Never or almost never	Less than half of the time	About half of the time	More than half of the time	Always or almost always	Don't know	Total (%)
33	40	10	12	5	0	100

The three analyses above are compared with each other according to how many agencies completed the given analysis more or less than half the time and the results are illustrated in Figure 4-9.

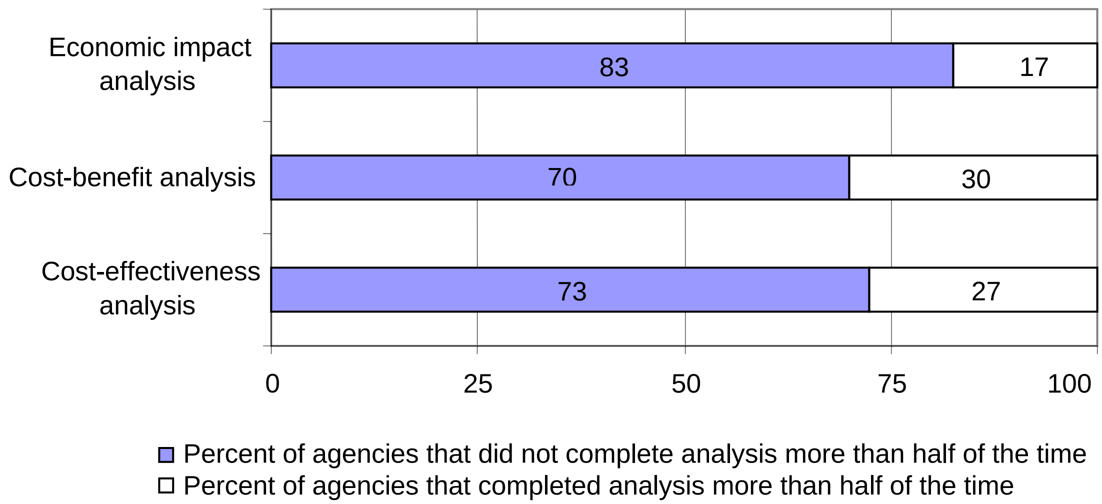


Figure 4-9 Summary of survey responses of frequency of completion of economic analyses (GAO 2005, Appendix II, Questions 2-4, pages 57, 58).

The next subject of question to the authors of the survey was how important the results of these analyses were in project selection among possible alternatives. The first question on this topic was posed “Typically, how much importance would you say that cost-effectiveness has in your decision to recommend a project from among its various alternatives?” (GAO 2005). Similar to the previous tables the results are reported in percentages of total respondents. The majority indicate a moderate to great importance placed on a cost effectiveness analysis. These results are summarized in Table 4-4.

Table 4-4 Importance of Cost Effectiveness in Project Recommendation (GAO 2005, Appendix II, Question 6, page 59)

Very little or no importance	Little importance	Moderate importance	Great importance	Very great importance	No basis to judge	Total
7	7	33	46	2	5	100

The next question concerned the importance of the BCA. The question asked was, "Typically, how much importance would you say that the ratio of benefits to costs has in your decision to recommend a project from among its various alternatives?" (GAO 2005). The findings are presented in Table 4-5. From the percentages reported it is evident that a greater importance is placed on a BCA than a cost effectiveness analysis.

Table 4-5 Importance of the Ratio of Benefits to Costs in Project Recommendation (GAO 2005, Appendix II, Question 7, page 59)

Very little or no importance	Little importance	Moderate importance	Great importance	Very great importance	No basis to judge	Total
5	12	51	18	0	14	100

To determine the importance of an EIA the surveyed included this question, "Typically, how much importance would you say that economic impacts have in your decision to recommend a project from among its various alternatives?" (GAO 2005). Table 4-6 summarizes the results. With 77 percent of all responding agencies indicating great to moderate importance of economic impacts, the EIA proves to be the most important of three analyses.

Table 4-6 Importance of Economic Impacts in Project Recommendation (GAO 2005, Appendix II, Question 7, page 59)

Very little or no importance	Little importance	Moderate importance	Great importance	Very great importance	No basis to judge	Total (%)
5	16	58	19	0	2	100

The following series of questions were posed in an effort to determine other sources that influence the recommendation of a project from among its alternatives. The format of the question continues by questioning the degree of importance of various possible impacts. The first of this group is, "Typically, how much importance would you say that *political support and public opinion* have in your decision to recommend a project form among its various alternatives?" (GAO 2005). The results are summarized in Table 4-7. Political support and public opinion were considered to be of moderate importance or higher with a majority indicating these impacts to be of great to very great importance.

Table 4-7 Importance of Political Support and Public Opinion in Project Recommendation (GAO 2005, Appendix II, Question 9, page 60)

Very little or no importance	Little importance	Moderate importance	Great importance	Very great importance	No basis to judge	Total (%)
0	0	21	58	21	0	100

The next question concerned the range of social impacts felt on the community. The question was asked, "Typically, how much importance would you say that the distribution of impacts across social groups has in your decision to recommend a project from among its various alternatives?" (GAO 2005). The results are shown in Table 4-8. Agencies indicate they are less concerned with how the impacts will be distributed across social divides as 53 percent selected moderate importance.

Table 4-8 Importance of the Distribution of Impacts Across Social Groups in Project Recommendation (GAO 2005, Appendix II, Question 10, page 60)

Very little or no importance	Little importance	Moderate importance	Great importance	Very great importance	No basis to judge	Total (%)
7	7	53	28	5	0	100

The influence of the availability of funding and from whom it is distributed is the subject of the next three questions. First, with respect to federal funding, it was asked, "Typically, how much importance would you say that the availability of federal matching funds has in your decision to recommend a project from among its various alternatives?" (GAO 2005). Agencies had a more polarized response to this question with over 20 percent indicating very little to little importance and 53 percent indicating very to great importance as summarized in Table 4-9.

Table 4-9 Importance of the Availability of Federal Matching Funds in Project Recommendation (GAO 2005, Appendix II, Question 11, page 60)

Very little or no importance	Little importance	Moderate importance	Great importance	Very great importance	No basis to judge	Total (%)
9	12	23	35	18	3	100

The next question seeks to assess the importance of state funds in choosing from among alternatives. The question was posed, "Typically, how much importance would you say that the availability of state funds has in your decision to recommend a project from among its various alternatives?" (GAO 2005). The responses are shown in Table 4-10. State funding is more important than federal funding according to these respondents with 65 percent indicating great to very great importance.

Table 4-10 Importance of the Availability of State Funds in Project Recommendation (GAO 2005, Appendix II, Question 12, page 61)

Very little or no importance	Little importance	Moderate importance	Great importance	Very great importance	No basis to judge	Total (%)
3	9	23	44	21	0	100

The last question of this series about the source of funding assesses the role of local funding. The survey asks, "Typically, how much importance would you say that the availability of local funds has in your decision to recommend a project from among its various alternatives?" (GAO 2005). This source of funding carries decidedly less importance in choosing projects in responding agencies; 25 percent indicating great to very great importance and 21 percent indicating very little to no importance. The results are shown in Table 4-11.

Table 4-11 Importance of the Availability of Local Funds in Project Recommendation (GAO 2005, Appendix II, Question 13, page 61)

Very little or no importance	Little importance	Moderate importance	Great importance	Very great importance	No basis to judge	Total (%)
21	9	42	16	9	3	100

To determine if transportation agencies were measuring outcomes of chosen projects it was asked, "During the past 10 years, did your agency typically analyze individual highway capacity-adding projects to determine in retrospect whether specific proposed outcomes were achieved?" (GAO 2005). The majority, nearly 60 percent indicated that they were not typically analyzing completed projects. The responses are summarized in Table 4-12.

Table 4-12 Completion of a Retrospective Analyses to Determine the Achievement of Proposed Outcomes (GAO 2005, Appendix II, Question 15, page 61)

Yes	No	Don't know	Total (%)
37	58	5	100

Those survey questions regarding the level of importance in project recommendation are further summarized in Figure 4-10. The illustration specifically compares the degree to which the various factors have great or very great importance in the decision to recommend capacity-adding projects. The factor of largest importance was indicated to be political support and public opinion. The availability of state and federal funds were second and third, respectively. Two of the three; economic analyses, BCA, and EIA, were tied for having the lowest level of importance in this decision.

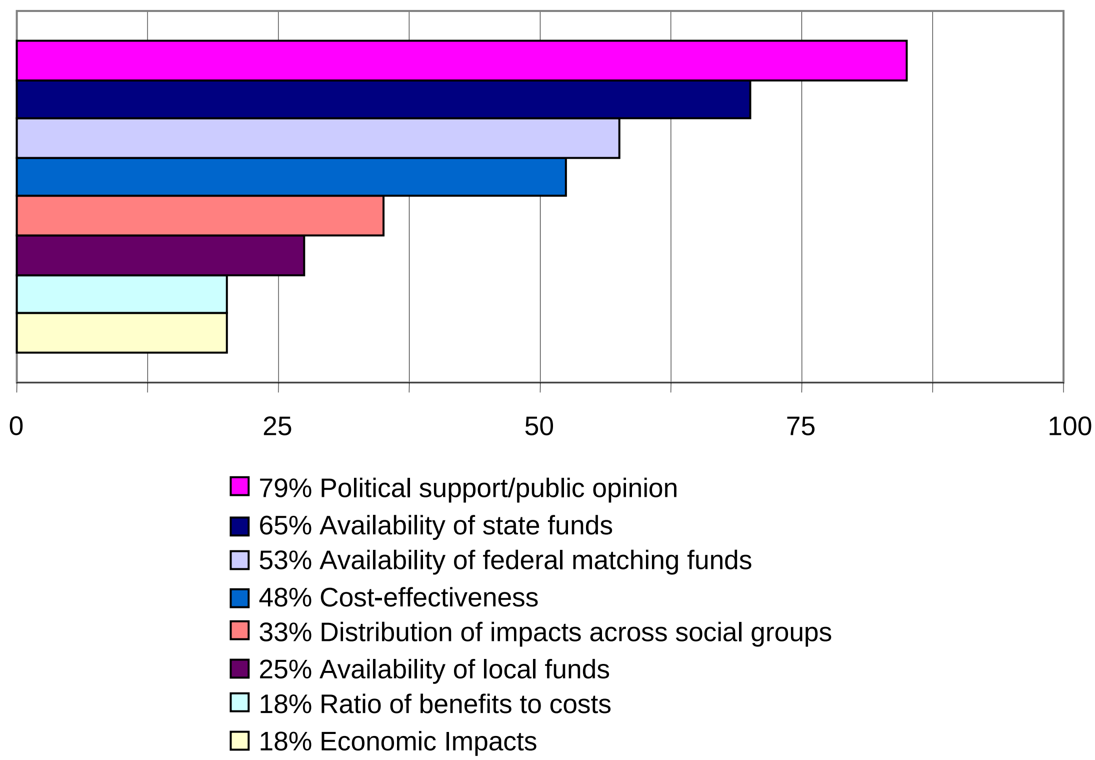


Figure 4-10 Summary of State DOTs' survey responses of factors of great to very great importance in the decision to recommend a highway capacity project (GAO 2005, adapted from Figure 3, page 28).

4.2.2 Conclusions

A sampling of the responses provide by those surveyed yield the following summary of lessons learned (GAO 2005).

- If formal economic analyses are used, they tend to be completed more often for transit projects than for highway projects primarily because of the federal "New Starts" requirements for transit projects.
- Officials surveyed indicated that they considered a project's potential benefits and costs when ranking project alternatives but often did not use formal economic analyses to systematically examine the potential benefits and costs.

- Survey responses indicated that a number of factors, such as public support or the availability of funding, shape transportation investment decisions.
- Respondents indicated that the decision to select an alternative is often based on indirect benefits that were not quantified in any systematic manner, such as desirable changes in land use or increasing economic development.

Even if steps are taken to improve the analytic information available to decision makers, overarching issues, such as the structure of the federal highway and transit programs, will affect the extent to which this information is used. Nevertheless, the increased use of economic analysis, such as a BCA, could improve the information available, and ultimately lead to better-informed transportation investment decision making.

- One set of challenges involves limitations in the methods themselves—for example, limitations in the ability of forecasting models to anticipate changes in traveler behavior or changes in land use.
- Another set of challenges involves sources of error that can be introduced into BCA calculations, such as omitting some benefits or double-counting benefits as they filter through the economy.

4.3 Summary of the BYU/UDOT Survey

BYU, in conjunction with UDOT and the project steering committee, prepared and sent out a survey to transportation professionals and transportation decision makers to assess the state-of-the-practice for including economic development impacts in the transportation decision making process. The following information summarizes the results of this survey including a summary of the rate of return for the survey followed by a discussion on each of the primary sections of the survey and their results.

A copy of the transportation professional survey is provided in Appendix B, while a copy of the transportation decision maker survey is provided in Appendix C.

4.3.1 General Summary

To determine how well the respondents represent the whole population of transportation professionals and decision makers in the nation and within Utah a record was kept of the number of respondents and where they were from. The rate of return statistic also may indicate the level of knowledge about the survey topic in that agency; many responded they could not complete the survey because they did not have any experience with this subject. In total there were 149 surveys received by various agencies, 93 outside the state of Utah and 56 to agencies within the state. The overall rate of return was 23 percent (35 of 149) among nationwide surveys with percentage varying in Utah among different organizations. The data on survey response statistics is summarized in Table 4-13.

4.3.2 Summary of Survey Response on the Weight of Economic Impact

The project steering committee felt it was important to determine how much influence does estimating economic impacts have, or particularly what discrete weight is it assigned. This response could be either the current weight that the agency is now using or the weight they think it should carry. The results of the 17 non-Utah responses are summarized in Table 4-14. The percentages assigned range from a high of 40 to a low of 9 percent with no significant agreement. Six of the respondents, who do consider economic criteria in the selection process, did not set a predetermined weight.

Table 4-13 Summary of Survey Response Statistics

Survey Group	Total Sent	Returned Undeliverable	Net Number Sent	Number of Responses	Rate of Return
National Transportation Professional	104	11	93	20	22%
Utah Decision Maker					
Utah Transportation Commissioner	7		7	6	86%
Other	33	5	28	2	7%
Utah Transportation Professional					
Wasatch Front Regional Council	10		10	2	20%
Mountainland Association of Governments	2		2	0	0%
Utah Department of Transportation	6		6	3	50%
Utah Transit Authority	2		2	1	50%
Dixie Association of Governments	1		1	1	100%
total	165	16	149	35	23%

Table 4-14 Results of Non-Utah Transportation Professional Responses

Weight of Economic Impact	**# Responses**
40%	1
20%	2
16.6%	1
12%	1
10%	2
9%	1
Economic criteria included in the selection process with no set weight	6
Economic criteria not included presently but possibilities are being considered	3
Not Applicable	3
Total	*20*

The results of the 7 Utah transportation professional responses are summarized in Table 4-15. These responses were received from UDOT, the Utah Transit Authority (UTA), WFRC, and the Dixie Association of Governments. The weight of economic impacts in determining project importance in Utah indicates a stronger consensus ranging from 10 to 15 percent.

Table 4-15 Results of Utah Transportation Professional Responses

Weight of Economic Impact	**# Responses**
15%	2
10%	3
No criteria at present but weight being considered	2
Total	*7*

Similar to the transportation professional survey, the first three questions in the decision maker survey investigated trends of opinions of decision makers regarding the importance of economic impact criteria in project selection. The results of the eight Utah responses are summarized in Table 4-16. Reponses were received from the Transportation Commissioners, Ogden City, and Salt Lake County. The decision maker responses show a wider and lower percentage range placed upon economic impacts.

Table 4-16 Results of Utah Transportation Decision Maker Responses

Weight of Economic Impact	**# Responses**
20%	1
10%	3
8%	1
7%	1
4%	1
Should be considered but no specific weight suggested	1
Total	*8*

The previous three tables of results are combined in Table 4-17 as a summary of the weight of economic impact analysis in project selection process from the first three questions for survey respondents nationwide and within Utah, for both transportation professional and transportation decision maker.

Table 4-17 Summary of Opinions of Weights to be Placed on Economic Development

Survey Group	Recommended or Current Weight of Economic Impact Analysis in Selection Process			
	> 10%	10%	< 10%	No set weight
National Transportation Professional	36%	14%	7%	43%
Utah Commissioner and Decision Maker	13%	38%	38%	13%
Utah Transportation Professional	29%	43%	0%	29%

4.3.3 Summary of the Transportation Decision Maker Survey

The transportation decision maker survey was sent to 35 Utah decision makers, of which eight responded, including six Utah Transportation Commissioners. Questions in the decision maker survey solicited factors taken into consideration by decision makers when selecting a transportation capacity-adding project. A general question first asked which factors should be included in an EIA. Four common factors of interest to Utah decision makers emerged and are illustrated in Figure 4-11 with respective percentages of total responses. Job creation was felt important by all respondents and job retention, tax revenue, and location of the jobs were the next leading factors.

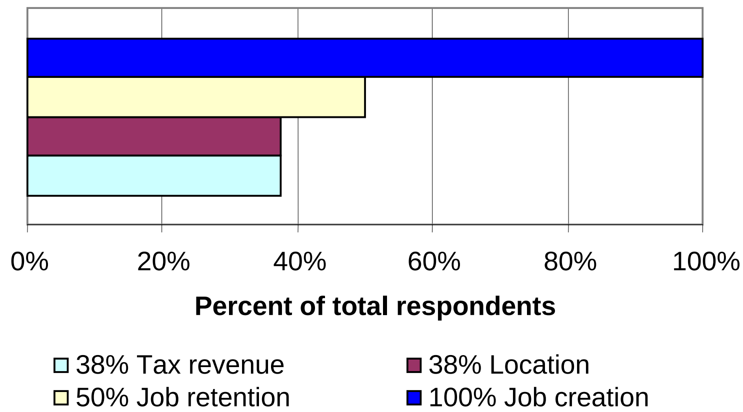


Figure 4-11 Factors that should be included in an economic input analysis.

The next question posed was, "What economic impacts would be most beneficial to you as the decision maker?" The responses showed no consensus among particular measures or metrics. Results showed a range of interests in broader, more complex issues. Those economic impacts of interest to the Utah decision makers are listed below.

- Balance between job creation & infrastructure costs.
- Help with financing improvements.
- Location – is there already a traffic problem.
- Commitment of funding from those who want to move the project forward.
- Cost per mile, cost per passenger trip, increase in # of jobs, reduction in time for commuting, reduction in time for transporting goods.
- Jobs, taxes, quality of life (safety).
- A transportation project should ensure the viability of an existing industry. New industries need to show evidence of success and/or provide part of the funding for a new project.
- Number of new jobs.
- Blight reduction.
- Type of transportation need.
- Job creation.

To determine what the decision maker felt was of interest to the public, the question was asked, “What factors of economic development impacts would the public be most interested in?” More consensus was found in the results from this questions as illustrated in Figure 4-12. Job creation was indicated to be of greatest interest to the public followed by commute time, location, environmental impact, and wage.

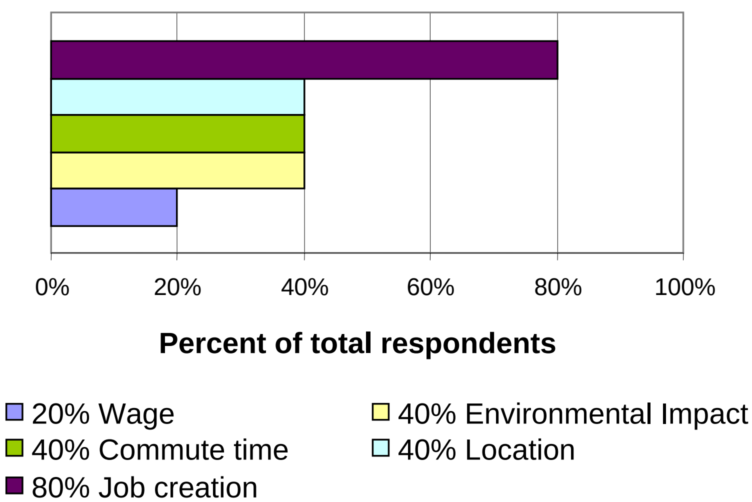


Figure 4-12 Factors of economic development impacts of interest to the public.

The next question probed opinions and requested suggestions of the decision makers. It was asked, “How do we measure quality of life and apply this in the analysis?” A recurring suggestion was to look at how the economy impacts families. Possible impacts on the family included time, money, and stress. A complete summary of the responses is as follows:

- Base it on the amount of time we are willing to spend in our cars – this is the hard question!
- By bringing these projects forward prior to the five year STIP. This will give the planners adequate time to evaluate.
- Reduction in travel time for employees provides more time to be at home.

- More jobs reduce unemployment which allows more income for families.
- Soliciting public input. Observe similar projects in other areas and in other states.
- Environmental impacts (noise, air, water).
- Social impacts.
- Does it relieve stress? Quality in long term for families.

4.3.4 Summary of the Transportation Professional Survey

Survey responses came from 27 transportation professionals, 20 of which work in agencies outside of Utah. Because there was already an established knowledge of the state of economic analysis within Utah the data below will primarily represent the national survey; figures which illustrate only national data will thus be indicated. To gather best practices of EIAs the project steering committee desired to determine the specific composition of other agency's EIAs. This survey therefore posed questions of greater detail concerning conducting an EIA.

One of the questions posed in the survey was, "What factors are considered in your agencies economic development score?" The responses are listed below with the number of times the response was provided is indicated in parentheses after each response.

- Job Creation (5).
- Business competitive factors, travel times, reliability (5).
- Level of economic distress (3).
- Industry type activity (3).
- Support strategic economic corridor (2).
- Tax Revenue (2).
- Location (2).
- Capital investments (2).
- Supports regional plans (1).
- Community Support (1).

- Local Financial Contribution (1).
- State Economic Development Support (1).
- Encouraging tourism (1).
- Rehabilitation of Brownfield sites (1).
- Employment income (1).
- Quality of job (1).
- Export versus local service industry (1).
- Compliance to air quality (1).

To determine the size of projects commonly subjected to an EIA, the question was asked: "What level of investment, if any, has been used as a cutoff value for including economic impacts as selection criteria in the transportation planning process?" Because UDOT requires that a project cost at least $5 million to warrant and EIA the results were categorized to show agreement with UDOT or the contrary. The results indicate that 67 percent of agencies maintain the $5 million investment level, indicating while this is not a stated limit it is general practice. The results are summarized in Figure 4-13.

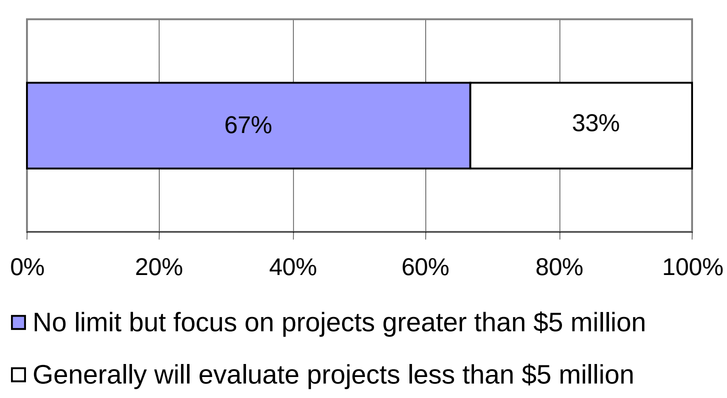


Figure 4-13 Typical investment level for projects subjected to an EIA.

To determine if outside agencies are included in conducting an EIA, the question was asked, "If economic development impacts are included in your decision making process, are other agencies utilized to aid in the economic analysis process (e.g., Office of Planning and Budget, Economic Development Office, etc.)?" Results indicate that the majority of transportation agencies (78 percent) are utilizing other agencies resources. The data are illustrated in Figure 4-14.

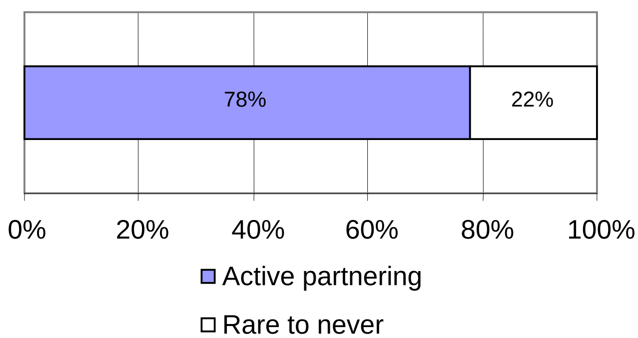


Figure 4-14 Non-transportation agency utilization in completing EIAs.

To determine the common tools used to in an EIA, the question was asked, "What tools have been used by your agency in the past for analyzing economic development impacts (e.g., input-output models, simulation models, other economic models)?" Figure 4-15 illustrates the resulting data. REMI and MicroBENCOST were the most commonly used tools reported at 38 percent each.

To determine relative costs willingly incurred through external consulting the question was posed, "How much of your agencies total budget is dedicated to external consulting required to complete an economic impact analysis?" The results are illustrated in Figure 4-16. The majority of agencies spend 0 percent of total agency budget on external consulting.

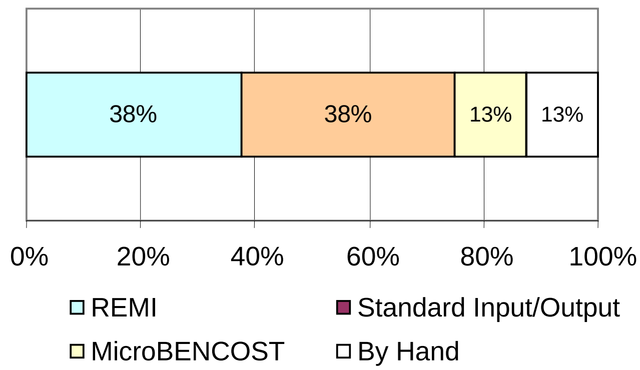


Figure 4-15 Tools used for analyzing economic development impacts.

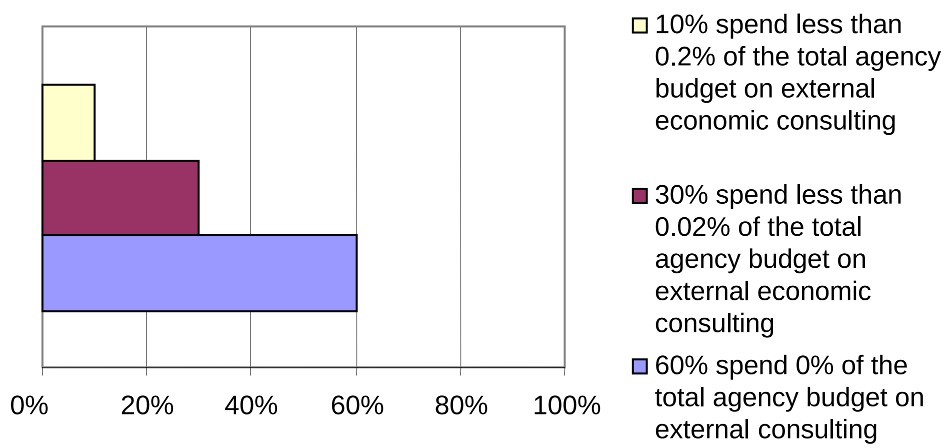


Figure 4-16 External consulting investments for economic impact analyses.

To determine the level of in-house investment in terms of specialized employees required to complete an EIA the question was asked, "How much consulting or in-house labor has been required to include economic development impacts in the decision making process?" The data is illustrated below in Figure 4-17. Respondents indicate that 0 to 0.5 full time equivalents are most common.

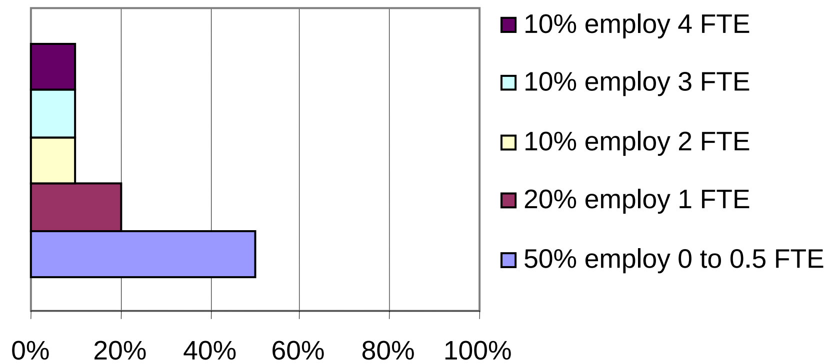


Figure 4-17 Full time equivalent in-house specialists required to complete EIAs.

4.4 Chapter Summary

The summary of the three surveys offers substantial fundamental information of the state of the practice of assessing economic impacts of transportation improvement projects. The research was benefited by work sponsored by two large government organizations, the GAO and the NCHRP. This wealth of knowledge has been added to by the BYU/UDOT survey conducted by the researchers. While each survey result made possible a better understanding of practices throughout the nation the specific goals of the BYU/UDOT survey were to ascertain how many transportation agencies incorporate economic criteria, how often it is incorporated, and what weight it is given in a project selection process.

From the collected data a better understanding was gained in terms of the number of transportation agencies that incorporate economic criteria, how often economic criteria is incorporated in the process, and the weight that is given to economic criteria in the overall project selection process. The results of all three studies indicated that throughout the United States and Canada there has been relatively sporadic use of economic investment analyses. Although the level of recognition of the role of economic development impacts and the level of sophistication in this analysis is increasing, the overall trend is still towards the completion of economic development studies in direct response to specific needs, primarily those of concerned residents with regard to specific projects.

5 Evaluation of Economic Development Tools

This chapter is an evaluation of tools for possible implementation by UDOT. The evaluation consists of general discussion of the tool, often including a flowchart of the process proceeding from inputs to outputs, followed by lists of advantages and disadvantages. The tools include software packages, I-O calculators, and external consulting groups. The chapter begins with an evaluation of the powerful software programs starting with REMI®, HERS, HEAT, and STEAM, with less powerful I-O software programs RIMS II and IMPLAN. Following the software evaluation is a review of the American Association of State Highway and Transportation Officials (AASHTO) recommended procedures and a look at two outside consulting groups; InterPlan, and the GOPB.

5.1 Regional Economic Models, Inc. (REMI®)

REMI® is a leading economic modeling package with established users throughout the United States and Europe. REMI® representatives travel throughout the country giving free workshops and training on the programs applications and its latest updates (REMI 2006).

As discussed previously in Chapter 2, REMI® provides two primary modeling packages Policy Insight® and TranSight™. A short summary of each package is provided here with Figure 5-1 illustrating a basic data modeling flowchart for the respective programs (REMI 2006):

- Policy Insight®: A macroeconomic forecasting model that shows the total economic, demographic and fiscal effects of policy initiatives on local regions. The GOPB uses Policy Insight® for their economic forecasting.
- TranSight™: A model that integrates the REMI® Policy Insight® model with transport planning and travel demand models to show the total economic, demographic, and fiscal effects of transportation infrastructure projects.

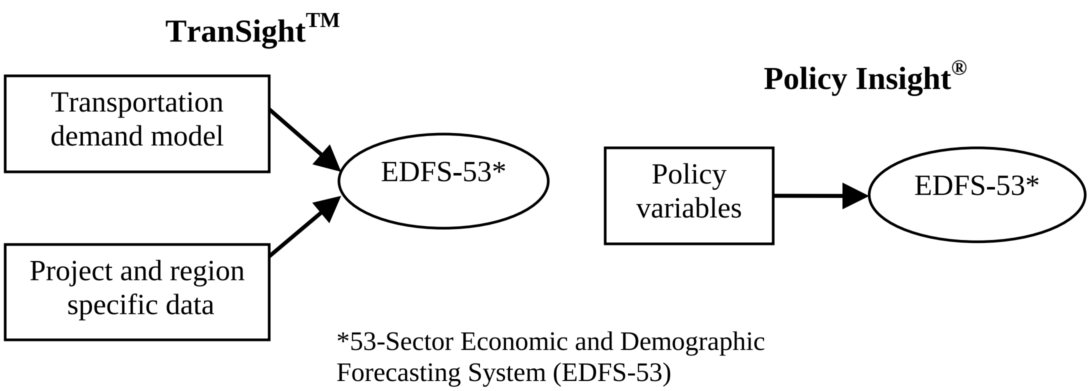


Figure 5-1 Two primary modeling packages in REMI® (REMI 2006).

REMI® uses advanced statistical techniques, called econometrics, which enable forecasting of indirect effects on the regional economy. This requires an iterative process of calculations as each industry's altered demand influences the demand of another and another. The economic impact reports (outputs) demographic effects such as change in population and labor force; along with productivity effects such as GRP, business output, wages, employment, etc. These changes are reported by year specific to industry (REMI 2005).

TranSight™ considers effects of VMT, VHT, emissions, safety, and fuel demand as these are inputs to the modeling. TranSight™ shows as output: 1) employment by industry, 2) output by industry, 3) wage rates and personal income, 4) population by demographic group, and 5) GRP (REMI 2005). A flowchart of inputs and outputs of Transight™ is provided in Figure 5-2.

Advantages to the REMI® TranSight™ software are its largely unparalleled modeling capabilities and its proven acceptance in projects throughout the country. There are few other options for calculating dynamic economic effects to the extent of REMI® software. REMI® can forecast impacts for a period of 41 years in to the future and has also been used for retro-analysis to measure past impacts to the economy from previous improvements.

REMI® TranSight™ integrates key aspects of several economic modeling tools and can be tailored to use outputs from a variety of commercially-available or custom travel demand models, including TP+, the travel demand model used by WFRC and MAG.

Possible disadvantages of TranSight™ may be seen in the potential for specious output. TranSight™ has the ability to supply vast and specific outputs associated with a variety of inputs that may correspond to increased error. Other models are also oftentimes used to compound the input information (STEAM, HERS, TP+, others). While this may be beneficial in obtaining the required parameters of input, there may be additional error associated with relying on many models/programs. The output of one program used as input in another may compound any inherent errors.

REMI® TranSight™ is a well-defined and trusted model for measuring economic effects of transportation projects as it is used in conjunction with REMI® Policy Insight®. The nature of the inputs is such that a trained economist is recommended to either create or decipher the inputs from other sources. This presents a potential training/staffing problem for UDOT if personnel are not currently qualified for such.

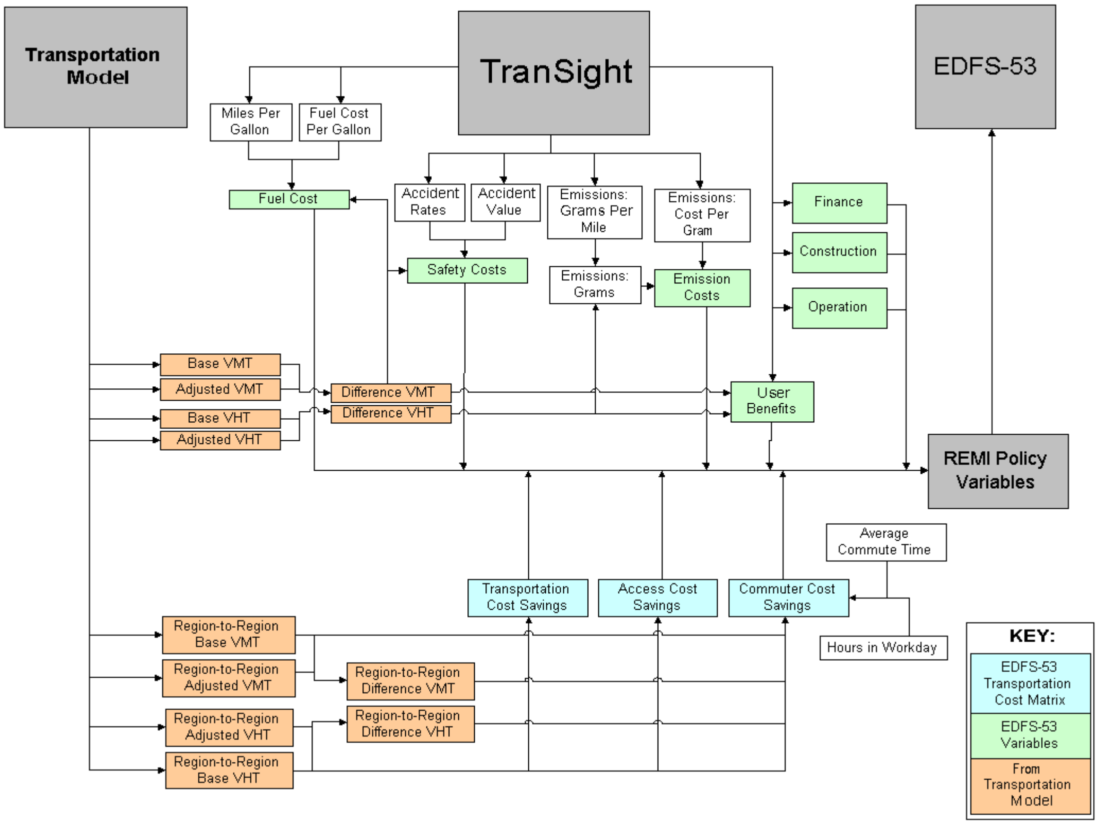


Figure 5-2 REMI® TranSight™ Structure (REMI 2005).

5.2 Highway Economic Analysis Tool, HEAT

In 2001, the Montana Department of Transportation (MDT) was given the charge of assessing the potential economic benefit of transportation projects (Wornum et al. 2005). The specific charge provided to MDT was to evaluate the economic impact of reconfiguring major two-lane highways in the state to four-lane highways. The charge was directed by the Reconfiguration Study Steering Committee (RSSC), composed of private business owners, mayors, economic development officials, and senior MDT and FHWA officials. Cambridge Systematics was retained by the RSSC in March 2002 to develop a software tool that would evaluate the economic benefits and costs of proposed highway projects. The objectives to accomplish included the following (Wornum et al.2005):

- Identify which transportation investments will benefit specific Montana industries.
- Provide MDT with an analytical toolbox to evaluate economic development impacts of transportation improvements.
- Apply the analytical toolbox to quantify the economic impacts of transportation improvement scenarios as part of MDTs planning process.

The toolbox developed to accomplish the objectives of the study was the Highway Economic Analysis Tool (HEAT) with the following objectives (Wornum et al. 2005):

- Quantify the economic impacts of transportation improvement scenarios.
- Identify which transportation investments will benefit specific industries.
- Provide MDT with a comprehensive, robust, and easy-to-use tool for benefit-cost analysis of transportation improvements.
- Integrate HEAT into MDTs Planning and Programming Process (P^3), environmental clearance, and economic development.

To accomplish the goals and objectives of the project, an industry-based perspective was taken for the analysis to ensure that transportation investments achieve their intended benefit, while avoiding using transportation investment to solve non-transportation problems. The perspective bores into the mantra: "build it and they will come," by first determining who "they" are. It then evaluates the performance of each industry likely to benefit from the investments while filtering out those industries that have little or no dependence on transportation to be successful (Wornum et al. 2005).

The primary modules in the model are as follows (Wornum et al. 2005):

- Roadway Network Model: Developed within a GIS framework to establish the network.
- Travel Performance Impacts: Include traditional metrics such as travel time savings and reductions in operating costs, as well as measures of accessibility to markets and reliability.
- Commodity Flows: Database of commodity flows and trucks grouped into seven commodity categories that allow HEAT to measure which commodities are affected by highway improvements.
- Industry Analysis: Includes the estimation of three types of direct economic benefits: 1) reductions in the cost of doing business based on the size of each industry and its dependence on trucking; 2) net business attraction/retention based on market accessibility factors and industry profile assessments; and 3) visitor spending effects on the economy. These direct industry impacts are then used as inputs to a regional economic simulation model of the Montana economy.
- Transportation Economic Benefit: The results of the industry analysis module are used to determine the total transportation economic benefit. HEAT incorporates a five region economic impact model developed by REMI® to estimate total economic impacts on GRP, employment, and personal income.
- Cost Estimation: This tool provides a consistent method of estimating the capital and operating costs of highway improvements throughout the state.
- Benefit-Cost Analysis: The final module used to compare economic benefits and costs to help prioritize projects.

These modules and their sequential flow to arrive at the final BCA is illustrated in Figure 5-3.

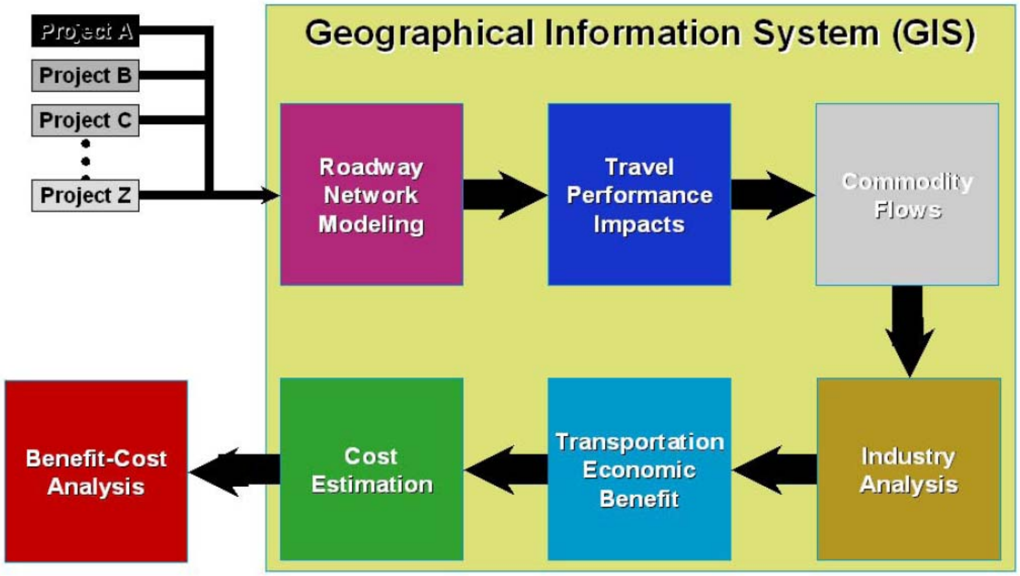


Figure 5-3 HEAT flowchart (Wornum et al. 2005).

It was found that under particular conditions, roadway investments may generate significant economic benefits. These are listed as (Wornum et al. 2005):

- High volumes of travel,
- Opportunity for diversion to a faster route,
- Connecting centers of trade,
- Improving access to labor,
- Enhancing access to manufacturing centers,
- Improving access of agricultural centers to markets,
- Providing access between raw materials and value-added manufacturing, and
- Enhancing access to tourist activity.

Advantages to HEAT come particularly due to its custom-fit creation. HEAT is a sophisticated program that provides a statewide or regional analysis of transportation improvements in areas where a regional transportation model is not available. HEAT provides an interface with a number of modules to provide a full economic evaluation of transportation improvements. While HEAT is specific to the state of Montana, a similar program could be developed for any other state, including Utah.

Some possible limitations to HEAT may stem from the systems complexity. HEAT was developed to be run in conjunction with the MDT P^3 process. Cambridge Systematics has indicated that a possible weakness of the model is that it is subject to misuse and misunderstanding if used out of context with P^3. The input to the model also has the potential for increased error due to its complexity. The nature of the inputs to the model is such that a trained economist is recommended to run the model successfully. This presents a potential training/staffing problem for UDOT if personnel are not currently qualified for such analysis. At the time of this study, MDT was trying to find a capable economist to run their HEAT model (Wornum et al. 2005).

5.3 Highway Economic Requirement System-State Version, HERS-ST

HERS-ST has been developed by the FHWA as an economic-based project selection tool (Mooney and Gabler 2005). HERS-ST is a program-level BCA package whose main objective is to predict when and where deficiencies in the transportation system will exist and what alternative is best given candidate projects to choose from. HERS-ST considers potential projects and determines the economic attractiveness of a project and then selects projects based on which correspond to the greatest rate of return by employing an incremental BCA. The model constructs a benefit-cost ratio (BCR) for each candidate improvement. This ratio is the sum of user, agency, and external benefits divided by the capital cost of the improvement. In addition, HERS-ST can be used to compute state budget requests and to identify areas that need additional funding. However, the HERS-ST economic analyses does not consider interactions (e.g. in terms of traffic flow) of individual projects compared to one another, nor with the state highway network at large (Mooney and Gabler 2005).

The economic aspect of HERS-ST refers to the modeling of supply and demand from entered exogenous (external to the highway) and endogenous (dependent on the highway, such as speed) data. This principle ideally helps assess capacity service and pavement preservation (FHWA 2002).

The specific benefits evaluated in the HERS-ST model are: 1) benefits to highway users in terms of travel time, operating costs, and safety benefits; 2) benefits to highway agencies, including maintenance costs and the overall "residual value" of an improvement at the end of the analysis period; and 3) external benefits including the effect of vehicle emissions (FHWA 2002).

There are three analyses performed by HERS-ST. First is "Constraint by Funds," which seeks to maximize the net present value of the benefits of improvements subject to specified constraints on funds available during each funding period. Second is "Constraint by Performance," which seeks to minimize the cost of improvements necessary to achieve specified goals for the performance of the highway system at the end of each funding period. Third is "BCR," which seeks to implement all improvements with incremental BCR greater than an assigned threshold value (e.g., 1.0). These three analyses execute three major functions: 1) project the future condition and performance of state highway systems; 2) assess whether highway improvements are warranted; and 3) select appropriate improvements using BCA (FHWA 2002).

Input for HERS-ST is in Highway Performance Monitoring System (HPMS) format. HPMS is a highway information system that is used on a national level (FHWA 2003b). This system includes data on the extent, condition, performance, use, and operating characteristics of the nation's highways. HPMS is typically used to support decision processes that are based on data within the FHWA, the United States Department of Transportation (USDOT), and the Congress. A program for creating HPMS data is included in HERS-ST software (FHWA 2003b).

HERS-ST can be used to implement multi-year forecasting under the assumption that users will be interested in a 20 year time period (typically made up of four 5 year funding periods). Therefore, users can set the number of years, funding periods, and years per funding period; thus providing more realistic forecasting as the project is portioned according to project specifics. HERS-ST initially analyzes a roadway infrastructure (and provides output for the initial analysis) and then performs a series of runs defined by the user. HERS-ST will typically traverse through four cycles (or funding periods) of analysis, performing multiple analyses within each funding period, considering many options for roadway section (FHWA 2002).

Some advantages of HERS-ST come because of it customized nature; it is designed specifically for State DOTs. State analyst can override or add local details for a more accurate model. There are many other advantages as well. At the time this report was written, 16 states were using the software and nine others were interested in implementation. The wide usage results in multiple experiences to draw from. HERS-ST is a user-friendly, Windows based graphical user interface program and the input and output can be viewed using a built-in GIS viewer. HERS-ST is flexible; all or part of a highway system can be evaluated. It produces customized reports and graphs of results. The output can also be used to supply input for REMI® TranSight™. Another advantage is its ability to answer such questions as (FHWA 2002):

- What level of capital expenditure is justified on the grounds of benefit-cost?
- What user cost level will result from a given stream of investment?
- What investment level is required to achieve a certain level of performance?
- What is the cost, over 20 years, of correcting all existing and accruing highway deficiencies?

HERS-ST likewise has its limitations. To compensate the FHWA recommends using other tools in conjunction with this software. HERS-ST considers only the roadway network and does not include bridges and railroad crossings (a feature including bridge and rail networks is under design and review) (FHWA 2002). Other limitations arise because HERS-ST uses a limited amount of site-specific data its economic assessment of any given project may be high or low with regard to net present value. Additionally, HERS-ST cannot reflect changes in one part of the system due to changes in another (i.e., it is not a true dynamic model) (FHWA 2002).

5.4 Surface Transportation Efficiency Analysis Model, STEAM

As discussed in greater detail Chapter 2 of this report, FHWA developed a corridor model to assist planners in developing the type of economic efficiency and other evaluative information for comparing cross-modal and demand management strategies (SPASM). The FHWA expanded upon the SPASM methodology and developed STEAM (Gabler 2005). Both models came about in direct response to the ISTEA and the need to assess multimodal alternatives and demand management strategies. STEAM helps state and regional agencies estimate the benefits, costs, and environmental impacts for a wide range of transportation investments and policies. STEAM is used primarily in analyzing discrete, large regional projects.

The inputs for STEAM come directly from four-step travel demand models (e.g., TP+). Inputs include (DeCorla-Souza and Hunt 2005):

- Person trip table and vehicle trip table,
- Travel time and cost matrices skimmed from transit and highway networks, and
- Loaded highway networks from traffic assignment.

STEAM computes the net value of mobility and safety benefits of transportation projects, thus capturing the network traffic effects caused by projects. In addition, STEAM can be used to compare projects in different transportation modes (auto, truck, local bus, express bus, light-rail, and heavy rail), providing highly flexible analyses.

The benefits of STEAM are varied. STEAM computes post-processing of traffic assignment outputs to more accurately estimate travel speeds under congested conditions. It performs a risk analysis to clearly describe level of uncertainty in results (probability of benefit-cost ratio). STEAM also produces estimates of system wide impact including non-monetized impact of pollution, energy, noise, etc (DeCorla-Souza and Hunt 2005).

Outputs from the economic analysis procedure of STEAM include user benefits, revenue transfers, external cost changes, and public agency costs (DeCorla-Souza and Hunt 2005). These benefits are each described below.

- User Benefits: Benefits include savings in user costs such as travel time costs, vehicle operating costs and out-of-pocket costs for fares, parking (if paid by the user), fuel taxes, and tolls. User benefits also include the portion of crash costs that are perceived by the traveler and taken into account in travel decisions.
- Revenue Transfers: STEAM calculates changes in revenues occurring as a result of changes in fares, tolls, and other out-of-pocket costs paid by transportation system users. The transfers are calculated at the zonal interchange level.
- External Cost Changes: Four types of external costs are quantified by STEAM including: 1) crash costs, 2) noise damage, 3) pollution, and 4) greenhouse gas emissions. Additional external costs not specifically computed by STEAM are also taken into account.
- Public Agency Costs: This includes all costs borne by highway and transit agencies. Capital costs and annual highway operation and maintenance costs must be input directly by the user. For construction costs, STEAM projects out to the year of opening of the facility the value of capital costs assumed to be incurred at the mid-point of construction, and then annualizes this cost based on the facility life.

The results of this analysis are used to generate a BCR for the project under evaluation (DeCorla-Souza and Hunt 2005).

STEAM consists of four modules. These modules are described next and their interaction is illustrated in Figure 5-4 (DeCorla-Souza and Hunt 2005). The first module is a user interface module, used to interface with the user and provide on-line help. Next is a network analysis module, which reads files containing traffic data to produce zone-to-zone travel times and distances based on minimum time paths through the network. This data is input into the trip table analysis module, which produces estimates of user benefits based on a comparison of Base Case and Improvement Case travel times and out-of-pocket costs. The last step is the evaluation summary module, which calculates net present worth (NPW) and a BCR for the improvement under consideration (DeCorla-Souza and Hunt 2005).

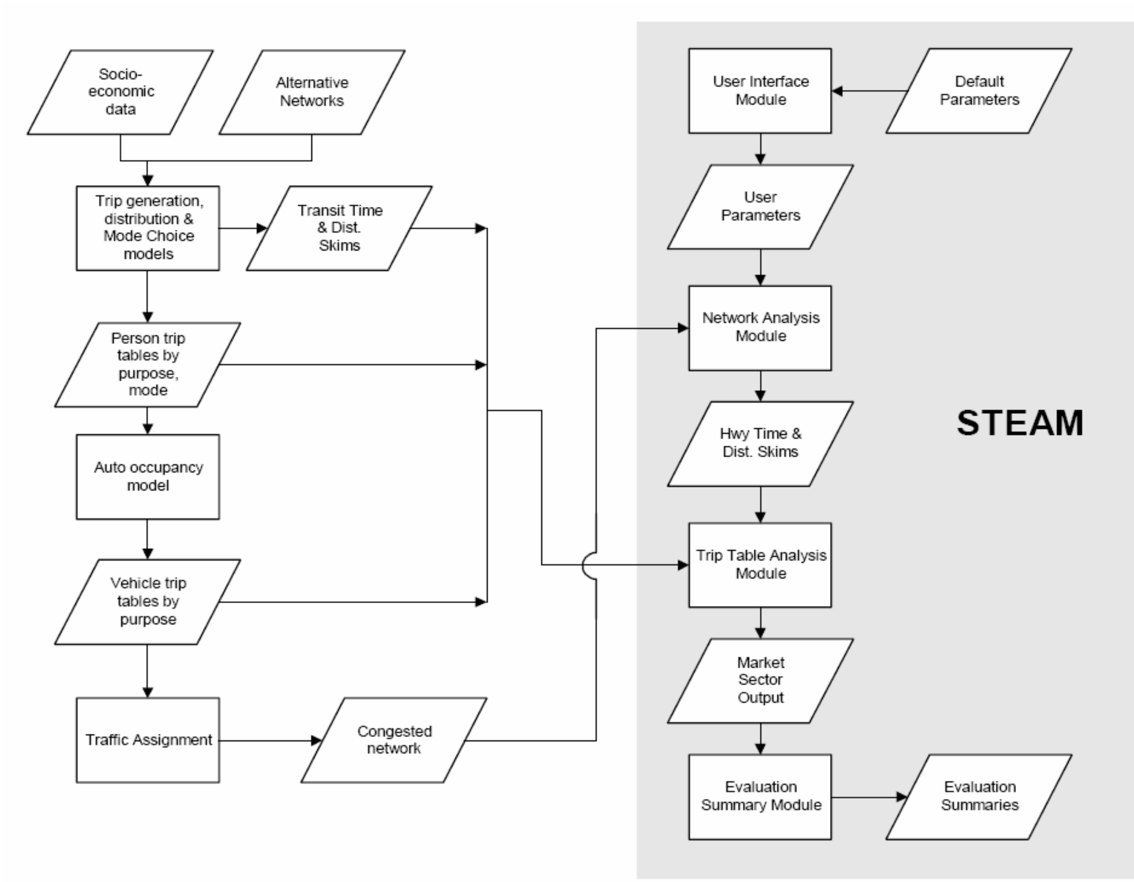


Figure 5-4 STEAM flowchart (DeCorla-Souza and Hunt 2005).

The program does have limited applications. The primary objectives of STEAM are to provide a framework for estimating impacts of multimodal transportation alternatives and assessing their overall merits; thus, the outputs are not directly related to the economic effects of capacity projects. The outputs may, however, be analyzed to obtain related information. In addition, STEAM only provides single year forecast analyses (DeCorla-Souza and Hunt 2005).

The FHWA no longer maintains STEAM. Instead, Cambridge Systematics maintains the model and provides support for technical questions.

5.5 Regional Input-Output Modeling Systems, RIMS II

As first outlined in Chapter 2, BEA developed RIMS II to estimate regional I-O multipliers, which are used in a standard I-O table (Bureau 2005). I-O tables use these multipliers, which are measures of inter-industry relationships, to predict how a change in one industry will affect another.

Accuracy of RIMS II has been questioned due to its simplicity and in response empirical tests indicate that multipliers used by RIMS II are similar in magnitude to those created using more expensive survey-based I-O models. These tests showed a difference between the multipliers generated by the two methods of less than 10 percent (Bureau 2005). This indicates that the results generated by RIMS II are not substantially different from other I-O models.

There are several advantages to RIMS II. First of all, main data sources are reasonably accessible (which reduces need of conducting expensive surveys). Second the structure of RIMS II helps to avoid aggregation errors (these often occur when industries are combined). Third, industry multipliers can easily be compared across areas due to standard estimation procedures. Finally, RIMS II multipliers are frequently updated to reflect most recent data (Bureau 2005).

Some limitations of RIMS II are similar to those of other I-O models. RIMS II accounting does not accommodate for changes in prices and wages as would be expected to occur over a long period of time. Because larger long-term projects often induce changes in price and wage RIMS II is generally limited to short term forecasting. Also, the multipliers are based on annual data so it is customary to assume that the impacts occur in one year. In addition, RIMS II impact studies are primarily suited for small changes to the regional economy. Finally, in order to compare multiple projects by economic impact, each calculation would need to be done individually.

Despite the potential limitation to the model, the application of RIMS II is broad. RIMS II has been used in many different impact studies including use by the U.S. Nuclear Regulatory Commission, the U.S. Department of Housing and Urban Development, and others. In addition, state DOTs have used RIMS II in estimating regional economic impacts of airport construction and expansion. However, no mention is made of using this model with transportation capacity improvement projects (Bureau 2005).

5.6 Minnesota IMPLAN Group, Inc.

IMPLAN is privately maintained by the Minnesota IMPLAN Group, Inc. (MIG, Inc.). IMPLAN is an I-O accounting system that describes commodity flows (Minnesota 2005). Similar to RIMS II, IMPLAN utilizes industry specific I-O multipliers to model the change of output of each and every regional industry caused by a one dollar change in any other given industry, and IMPLAN is not survey based. IMPLAN does, however, provide direct calculations of total employment, output, and income impacts (Minnesota 2005).

The IMPLAN system provides three functions: 1) data retrieval; 2) data reduction and model development; and 3) impact analysis. Using IMPLAN, the user develops a multiplier table to create an accounting matrix. This can be altered by the user if additional information concerning components such as production functions, trade flows, etc. is known. This multiplier table can be used to (Minnesota 2005):

- Examine the effects of a company moving into the region or the contributions of an existing company,
- Estimate industrial targeting opportunities,
- Examine resources regulated by the government,
- Analyze the benefits of commercial development and use the information to attract new companies,

- Analyze the effects of the tourism industry,
- Examine the region's strengths and market opportunities, and
- Analyze a wide variety of other economic/marketing issues.

Some of the results or outputs of IMPLAN include (Minnesota 2005):

- Industry output,
- Per-capita personal consumption,
- Labor income,
- Employee compensation,
- Proprietor income,
- Other property type income, and
- Employment.

5.7 User Benefit Analysis for Highways, AASHTO

AASHTO has developed a manual to aid transportation planners and policy makers in their responsibility of identifying and selecting projects that deserve implementation. The AASHTO Redbook (AASHTO 2003), as it was originally called, was initially developed in 1977 for the purpose of helping state and local agencies evaluate the user benefits of both highway and transit facilities. In August 2003 this manual was updated to the current *User Benefit Analysis for Highways* and includes only highway projects. The focus of the manual is on user benefits, or benefits that are enjoyed by travelers that are directly affected by a transportation improvement. The user benefits include the following (AASHTO 2003):

- Travel time costs,
- Operating costs, and
- Crash costs.

The total of these costs is essentially the price that travelers must pay to travel. It is important to reiterate that the focus of this tool is analysis of user benefits; this is because most of the economic benefits of transportation projects come from the reduction in user costs. It is known, however, that projects also impact people other than those who are direct users of the facility. These effects are generally referred to as indirect benefits or non-user benefits and include environmental impacts, effects on urban growth, economic influences, and the distribution of costs and benefits that belong to the project. The tool developed in the AASHTO guide does not include these indirect benefits.

The flowchart illustrated in Figure 5-5 outlines the relationship between the user benefit analyses emphasized by the AASHTO guide. Those items below the dashed line in the figure are outside of the scope of this analysis.

There are eleven basic steps in the user benefit analysis and include the following (AASHTO 2003):

1. Define the Project Alternative and the Base Case: Includes the network elements affected, engineering characteristics, project build-out schedule, project capital cost schedule, and project operating cost schedule.
2. Determine the level of detail required: This includes the vehicle classes to be studies, types of benefits and costs, hourly/daily/seasonal detail, the link vs. corridor perspective and the periods to model explicitly.
3. Develop basic user costs factors: These factors include value of time, vehicle occupancy rates, vehicle unit operating costs, and crash rate and cost parameters.
4. Select economic factors: The factors to select include the discount rate, analysis period, evaluation date, inflation rate, and the values of life, injury, etc.
5. Obtain traffic performance data for explicitly-modeled periods: This includes volumes, speeds/travel times, and occupancy before and after improvements. This step generally requires travel demand and traffic assignment models.

6. Measure user costs for affected links or corridors: This step includes collection of traffic volumes, travel time costs, operating costs, delay costs, and crash costs.
7. Calculate user benefits: The user benefits are derived from the data collected in step 5.
8. Extrapolate/interpolate benefits to all project years: This includes traffic growth rate factors, volume-delay function factors and peak-spreading assumptions.
9. Estimate terminal value: This includes assumptions about facility life and salvage opportunities.
10. Determine present value of benefits and costs: The data from Steps 1, 4, 7, and 8 are calculated to determine the present value of the benefits and costs to the system.
11. Make project selection decision: The final step is to make decisions based on budget constraints and the benefits associated with the project.

The reader is referred to the AASHTO *User Benefit Analysis for Highways* for detailed guidance for completion of each of the steps identified in the analysis.

The AASHTO *User Benefit Analysis for Highways* provides detailed guidelines and tools to analyze user benefits in transportation projects. The guidelines are easy to follow with ample resources provided to complete the required steps. The information for this analysis is generally readily available from UDOT and the MPO local to the project.

A limitation to this analysis is that the process does not account for indirect benefits including, but not limited to, job creation, GDP, and other detailed economic indicators.

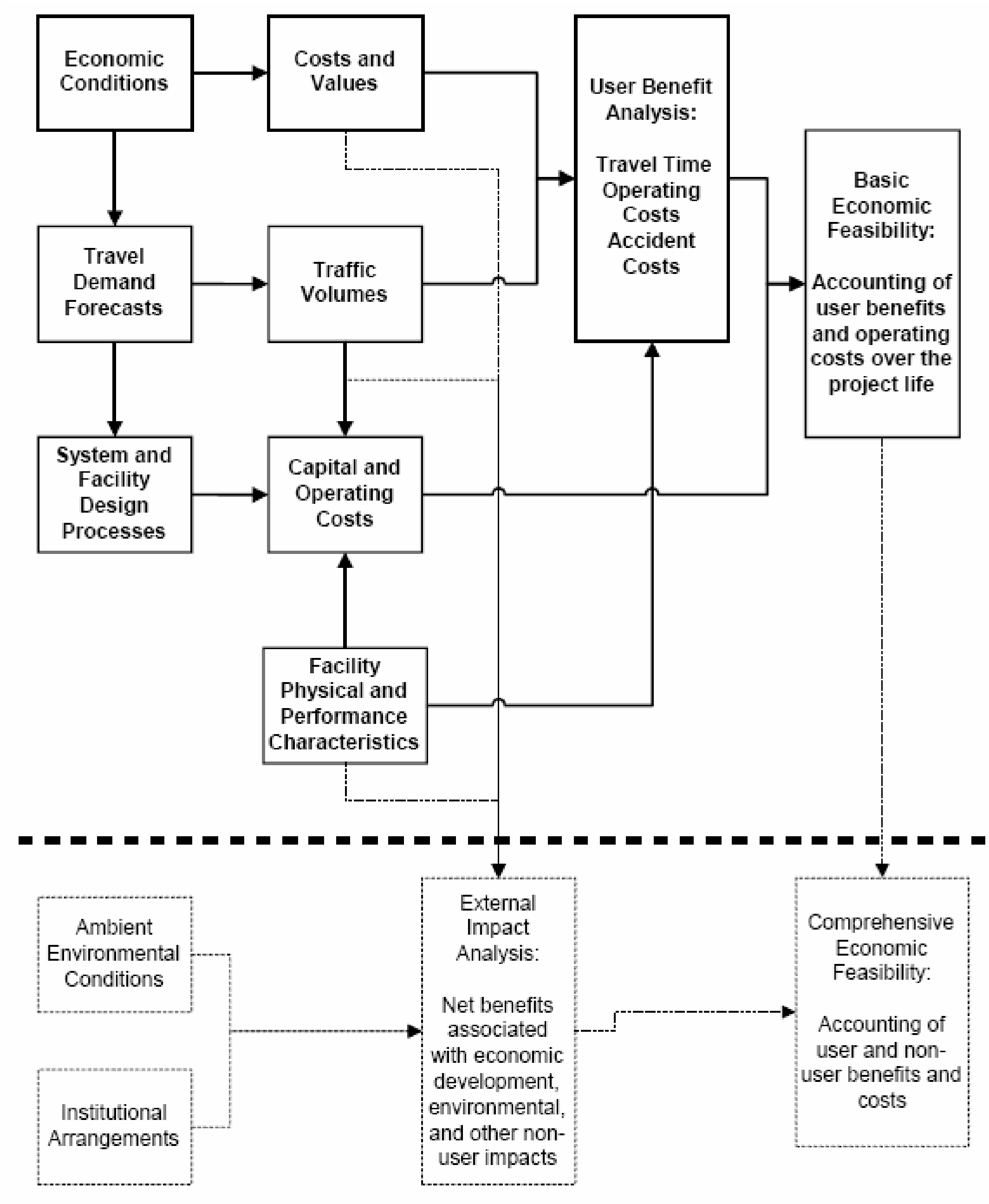


Figure 5-5 AASHTO user benefit analysis flowchart (AASHTO 2003).

5.8 I-80 Benefit-Cost Analysis, InterPlan

Recognizing that there is a limit to the ability of UDOT to fund large scale transportation improvement projects, and recognizing the need for improvements to Interstate 80 in the Salt Lake metropolitan area, UDOT retained InterPlan Co. to perform a BCA on the I-80 corridor. The results of this study are included in the *I-80 Benefit-Cost Analysis*, presented to UDOT Region 2 (Rifkin 2005). The primary benefits to this project were manifested in reduced travel time and delay to users of the facility, potential improvements to safety by eliminating the tight merge areas, and longevity improvements to pavements and structures. The direct benefits of the I-80 project are summarized as follows (Rifkin 2005):

- Improved safety for I-80 users,
- Reduced travel delay for I-80 users,
- Reduced pavement maintenance costs to UDOT, and
- Reduced structures maintenance costs to UDOT.

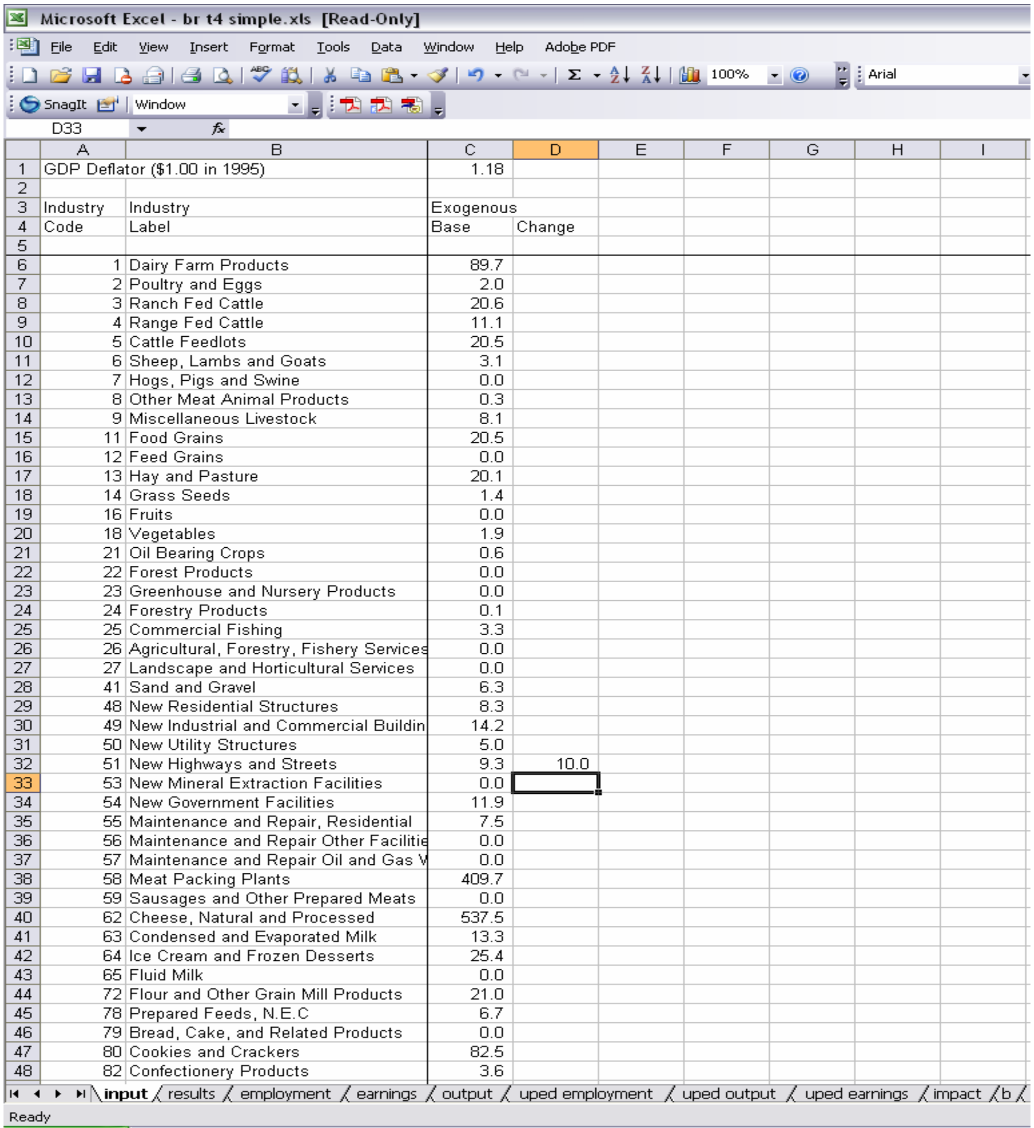
Other indirect benefits were omitted from this analysis consistent with the FHWA *Economic Analysis Primer*, and the AASHTO *User Benefit Analysis for Highways*. This analysis utilized data from UDOT to assign dollar amounts to the user benefits of the project, while identifying the costs of the project based on current cost estimates. This project provides a relatively simple procedure for a BCA that could be utilized for economic analysis of transportation projects.

5.9 Governor's Office of Planning and Budget, Input-Output Model

Peter Donner of the GOPB has developed a rather complex I-O model for the state of Utah (Donner 2005). The model includes data for 210 industries statewide. Mr. Donner has generated multipliers for each of these industries and has developed an exogenous base for the model. Changes can be made to the exogenous input to determine the economic benefits. The challenge with this type of model, however, is generating the industry change that would occur as a result of a transportation project. These changes are not related to new industry and the potential for job creation as a result of the improved efficiency of the transportation network. These types of "dynamic" job creation results require a dynamic model, such as REMI® for generation.

To demonstrate the procedure, an example problem is addressed. If the industry "*New Highways and Streets*" as shown in Figure 5-6 is modified; the input for the model in this analysis is a $10 million investment in new highways and streets, the results tab indicates the total job creation for the improvement. The resulting job creation is based on the construction industry only. As can is illustrated in Figure 5-7, the major change is in the construction sector of new highways and streets with 79 jobs created. Additional jobs are also created for a total of 160 jobs (not shown). Again these jobs are all related to the construction of the roadway.

The I-O model provides a relatively realistic estimate of job creation and earning potential for a market area. The primary limitation of the model, however, is that the input change is difficult to quantify without a more detailed analysis and in the case of investment in highways and streets, the change in employment is only for construction, which is generally not new jobs, rather a redistribution of jobs across the state from other construction projects.



	A	B	C	D
1	GDP Deflator ($1.00 in 1995)		1.18	
2				
3	Industry	Industry	Exogenous	
4	Code	Label	Base	Change
5				
6	1	Dairy Farm Products	89.7	
7	2	Poultry and Eggs	2.0	
8	3	Ranch Fed Cattle	20.6	
9	4	Range Fed Cattle	11.1	
10	5	Cattle Feedlots	20.5	
11	6	Sheep, Lambs and Goats	3.1	
12	7	Hogs, Pigs and Swine	0.0	
13	8	Other Meat Animal Products	0.3	
14	9	Miscellaneous Livestock	8.1	
15	11	Food Grains	20.5	
16	12	Feed Grains	0.0	
17	13	Hay and Pasture	20.1	
18	14	Grass Seeds	1.4	
19	16	Fruits	0.0	
20	18	Vegetables	1.9	
21	21	Oil Bearing Crops	0.6	
22	22	Forest Products	0.0	
23	23	Greenhouse and Nursery Products	0.0	
24	24	Forestry Products	0.1	
25	25	Commercial Fishing	3.3	
26	26	Agricultural, Forestry, Fishery Services	0.0	
27	27	Landscape and Horticultural Services	0.0	
28	41	Sand and Gravel	6.3	
29	48	New Residential Structures	8.3	
30	49	New Industrial and Commercial Buildin	14.2	
31	50	New Utility Structures	5.0	
32	51	New Highways and Streets	9.3	10.0
33	53	New Mineral Extraction Facilities	0.0	
34	54	New Government Facilities	11.9	
35	55	Maintenance and Repair, Residential	7.5	
36	56	Maintenance and Repair Other Facilitie	0.0	
37	57	Maintenance and Repair Oil and Gas V	0.0	
38	58	Meat Packing Plants	409.7	
39	59	Sausages and Other Prepared Meats	0.0	
40	62	Cheese, Natural and Processed	537.5	
41	63	Condensed and Evaporated Milk	13.3	
42	64	Ice Cream and Frozen Desserts	25.4	
43	65	Fluid Milk	0.0	
44	72	Flour and Other Grain Mill Products	21.0	
45	78	Prepared Feeds, N.E.C	6.7	
46	79	Bread, Cake, and Related Products	0.0	
47	80	Cookies and Crackers	82.5	
48	82	Confectionery Products	3.6	

Figure 5-6 Typical input for standard input-output model (Donner 2005).

	D	E	F	H	I	K	L
1		Employment		Output		Earnings	
2	Umrio Label	Level	Change	Level	Change	Level	Change
3							
4	Dairy Farm Products	526	0	102.3	0.0	20.6	0.0
5	Poultry and Eggs	21	0	4.4	0.0	0.5	0.0
6	Ranch Fed Cattle	325	0	26.7	0.0	3.6	0.0
7	Range Fed Cattle	142	0	13.5	0.0	1.8	0.0
8	Cattle Feedlots	160	0	29.4	0.0	5.2	0.0
9	Sheep, Lambs and Goats	161	0	3.5	0.0	0.5	0.0
10	Hogs, Pigs and Swine	58	0	6.1	0.0	0.5	0.0
11	Other Meat Animal Products	5	0	0.4	0.0	0.0	0.0
12	Miscellaneous Livestock	216	0	9.5	0.0	1.4	0.0
13	Food Grains	503	0	23.7	0.0	3.0	0.0
14	Feed Grains	158	0	11.6	0.0	1.4	0.0
15	Hay and Pasture	814	0	25.2	0.0	2.9	0.0
16	Grass Seeds	190	0	1.8	0.0	0.3	0.0
17	Fruits	18	0	2.3	0.0	0.5	0.0
18	Vegetables	43	0	6.8	0.0	1.9	0.0
19	Oil Bearing Crops	25	0	1.2	0.0	0.3	0.0
20	Forest Products	1	0	0.2	0.0	0.0	0.0
21	Greenhouse and Nursery Products	19	0	2.4	0.0	0.7	0.0
22	Forestry Products	2	0	1.2	0.0	0.1	0.0
23	Commercial Fishing	65	0	3.4	0.0	1.7	0.0
24	Agricultural, Forestry, Fishery Services	239	0	4.6	0.0	2.5	0.0
25	Landscape and Horticultural Services	467	3	4.5	0.0	3.2	0.0
26	Sand and Gravel	98	2	8.3	0.2	3.2	0.1
27	New Residential Structures	934	1	97.7	0.1	22.6	0.0
28	New Industrial and Commercial Building	707	0	86.4	0.0	25.2	0.0
29	New Utility Structures	214	0	22.1	0.0	7.8	0.0
30	New Highways and Streets	226	79	28.7	10.0	7.8	2.7
31	New Mineral Extraction Facilities	89	0	4.1	0.0	3.2	0.0
32	New Government Facilities	477	0	64.0	0.0	23.1	0.0
33	Maintenance and Repair, Residential	329	0	30.5	0.0	10.2	0.0
34	Maintenance and Repair Other Facilitie	999	1	66.6	0.0	35.2	0.0
35	Maintenance and Repair Oil and Gas W	1	0	0.1	0.0	0.0	0.0
36	Meat Packing Plants	1,086	0	434.3	0.0	35.4	0.0
37	Sausages and Other Prepared Meats	5	0	1.3	0.0	0.2	0.0
38	Cheese, Natural and Processed	994	0	548.3	0.0	40.5	0.0
39	Condensed and Evaporated Milk	41	0	17.4	0.0	1.3	0.0
40	Ice Cream and Frozen Desserts	105	0	28.5	0.0	2.3	0.0
41	Fluid Milk	5	0	2.1	0.0	0.2	0.0
42	Flour and Other Grain Mill Products	62	0	25.0	0.0	3.0	0.0
43	Prepared Feeds, N.E.C	33	0	16.5	0.0	1.2	0.0
44	Bread, Cake, and Related Products	20	0	3.3	0.0	0.8	0.0
45	Cookies and Crackers	436	0	88.2	0.0	15.3	0.0
46	Confectionery Products	56	0	8.8	0.0	0.5	0.0
47	Bottled and Canned Soft Drinks & Wat	8	0	3.1	0.0	0.3	0.0
48	Food Preparations, N.E.C	26	0	5.4	0.0	0.7	0.0

Figure 5-7 Typical output for standard input-output model (Donner 2005).

5.10 Chapter Summary

Table 5-1 provides a summary of economic impact analysis models that were evaluated in this study. These models can be categorized as static models and dynamic models. A static model is often considered “sketch planning” and is favorable for agencies that may not have the resources to make analyses using expensive long-range models. These simpler analyses use readily available socioeconomic, land use, traffic congestion, economic multipliers, and other data to serve as predictive models. The data can be compiled into a spreadsheet tool to calculate the desired data. The accuracy of these models is typically limited to a length of time less than one year (Bureau 2005).

This evaluation of tools for possible implementation by UDOT is not an exhaustive list of all possible tools. However, efforts have been made by the research team to select those that would be most effective. The featured tools include: software packages, REMI, HERS, HEAT, and STEAM; I-O calculators, RIMSII and IMPLAN, and external consulting groups, InterPlan, and the GOPB; and the eleven step AASHTO procedure.

This chapter's discussion of the tools and their respective advantages and limitations gave no final recommendation or discussion of how the tool might fit into a total analysis. Chapters 6, 7, and 8 present total analysis approach possibilities, recommended alternatives, and committee recommendations, respectively.

Table 5-1. Summary of Economic Development Models.

Software	REMI TranSight	HEAT	HERS-ST	STEAM	RIMS-II	IMPLAN
Produced by: (Organization)	Regional Economic Models, Inc. (REMI)	Cambridge Systematics (CS)	Federal Highway Administration (FHWA)	Federal Highway Administration (FHWA)	Bureau of Economic Analysis (BEA)	Minnesota IMPLAN Group (MIG, Inc.)
Type of model	Dynamic	Dynamic	Benefit/Cost	Benefit/Cost	Input/Output	Input/Output
Initial Cost	Varies (>$100,000)	Varies. >$500,000 for Montana DOT. If CS works as a systems integrator, given REMI products are available, cost may be >$100,000	Free	Free	Free	Varies for region files desired
Annual Cost	Varies (~$20,000)	Varies (~$20,000)	None	None	None	Varies
Department Costs[1]	1-3 FTE	1-3 FTE	1 FTE	0.5-1 FTE	0.5-1 FTE	0.5-1 FTE
Inputs	VMT, VHT, Emissions (VOC), Safety, Fuel demand, Time savings (from a transportation planning model)	Depends on set-up, but similar to REMI TranSight (for the Montana DOT, CS created a travel demand model)	Highway data in HPMS (Highway Performance Monitoring System) format. Can use GIS files for producing maps	From four-step travel demand models (e.g. TP+), person and vehicle trip table	Industry category, job cost (in 1997 dollars), location; a set of *multipliers* for the study region	Industry category, job cost, location; a set of *multipliers* for the study region
Outputs	Employment by industry, output by industry, wage rates and personal income, population by demographic group, gross regional product	Prioritization of projects (based on B/C), capital and operating costs of highway improvements, employment, industry impacts	REMI ready parameters, cost of highway deficiencies, capital expenditure justification	Network traffic effects of projects, compares projects of different modes, estimation of system-wide impacts	Wages/salaries, economic activity resulting from spending, jobs created	Impact data ("what if" data, e.g. what if industry x adds 200 jobs in Utah county)
Transportation terms	Yes	Yes	Yes	Yes	No	No
Economics analysis intensive	Yes	Yes	No	No	No	No
Transportation modeling	No, but inputs are from transportation model	Yes	No	No	No	No
Interface with Planning Model	Yes	Yes	Yes	Yes	No	No
Compatible with Governors Office of Planning and Budget (GOPB) model (REMI Policy Insight)	Yes	Yes	Yes	Yes	No	No
Support available	Yes	Yes	Yes	Yes, through Cambridge Systematics	Yes	Yes

[1] Department costs are estimates and are in units of Full Time Equivalent (FTE). Department costs could be supplemented with Consultant services

6 Process Development

This chapter provides information on the process development portion of the research. The purpose of this chapter is to develop a process whereby economic impacts can be incorporated in the evaluation of transportation capacity improvement projects if such analyses are required. This process development will incorporate the information gleaned from each of the previous chapters to formulate possible approaches, provide examples of how they might be implemented, and make preliminary recommendations. The primary evaluation methods to be summarized include BCA, selection process scoring, other economic program alternatives, and a combination of approaches.

6.1 Benefit Cost Analysis

As previously outlined, any potential tool for incorporating economics into the planning process is in some sense a BCA: weighing the benefits versus the costs of the project. The difference in the possible tool options is the extent in which benefits and costs are measured. For example, will the benefit or cost be simply a measure of direct impacts or will it include broader indirect economic impacts. Even among these two methods there are differing levels of investigation that can be conducted. The two types of BCA identified previously include UIA and EIA. Each of these will be discussed in more detail in the following sections including a discussion of UIA, short term EIA, and long term EIA.

6.1.1 User Impact Analyses

The foremost advantage of a UIA is its simplicity as a UIA can be done in-house without trained economists. Two examples of UIAs are the Interplan I-80 report (Rifkin 2005*)* and the AASHTO *User Benefit Analysis for Highways* (AASHTO 2003); both described in Chapter 5. Consulting costs for such a UIA would vary depending on the level of complexity and analysis. As indicated, UIAs provide only monetary savings and costs to users (not job creation or GDP predictions); however the users can be distinguished into market categories such as personal, freight, or other business user.

According to the research conducted, the AASHTO *User Benefit Analysis for Highways* guidelines provide what may be one of the best approaches to completing a UIA. The eleven basic steps in the user benefit analysis include the following (AASHTO 2003):

1. Define the project alternative and the base case.
2. Determine the level of detail required.
3. Develop basic user costs factors.
4. Select economic factors.
5. Obtain traffic performance data for explicitly-modeled periods.
6. Measure user costs for affected links or corridors.
7. Calculate user benefits.
8. Extrapolate/interpolate benefits to all project years.
9. Estimate terminal value.
10. Determine present value of benefits and costs.
11. Make project selection decision.

More detail about these steps individually is given in Section 5.7.

A major advantage of this process is that the AASHTO guidelines (AASHTO 2003) provide detailed guidance for completion of each of the steps identified in the analysis.

6.1.2 *Short Term Economic Impact Analysis*

EIA complexity depends primarily on the length of the time period to be analyzed. Static analyses, or measurements of impacts up to a year, can be completed relatively easily with I-O spreadsheets. Regional multipliers will translate business cost savings and construction spending to jobs and other outputs respective to the effected industry. These spreadsheets are readily accessible and relatively inexpensive and can be purchased from RIMS-II or IMPLAN, with IMPLAN available for under $2,000 (year 2005 dollars). Training can also be provided for IMPLAN for an additional cost of approximately $1,000 (year 2005 dollars) (Minnesota 2005). Additionally, locally created I-O matrices can be accessed through the Utah Governor's Office of Planning and Budget (GOPB) (GOPB 2005), while outside consulting could also be contracted for these types of analyses.

6.1.3 *Long Term Economic Impact Analysis*

Dynamic analyses or measurements of impacts over several years requires more powerful econometric modeling software. At the time of this study only one known program was on the market with these capabilities: REMI®'s economic development models and software programs, and only a handful of major consulting firms offer these services. The Utah GOPB currently uses REMI® Policy Insight™ for their economic analyses. Some experienced consulting firms that perform these services include Cambridge Systematics, EDR Group, and HLB Economics. As previously mentioned, Cambridge Systematics created the HEAT program for MDT (Wornum et al. 2005) and they have also completed an economic impact study for Envision Utah concerning the expansion of public transportation along the Wasatch Front (Cambridge 2005a). Based on discussion with the vendors and consultants, the estimated costs for a custom designed and built program from either REMI® or Cambridge Systematics is approximately $100,000 minimum for the setup of the model with yearly maintenance fees of approximately $20,000 per year (year 2005 dollars).

It is important to note that not all econometric analyses would have to be contracted out long term to consultants. After initial set-up, these analyses could be completed by a partnership of Utah organizations, namely UDOT, GOPB, and local MPOs.

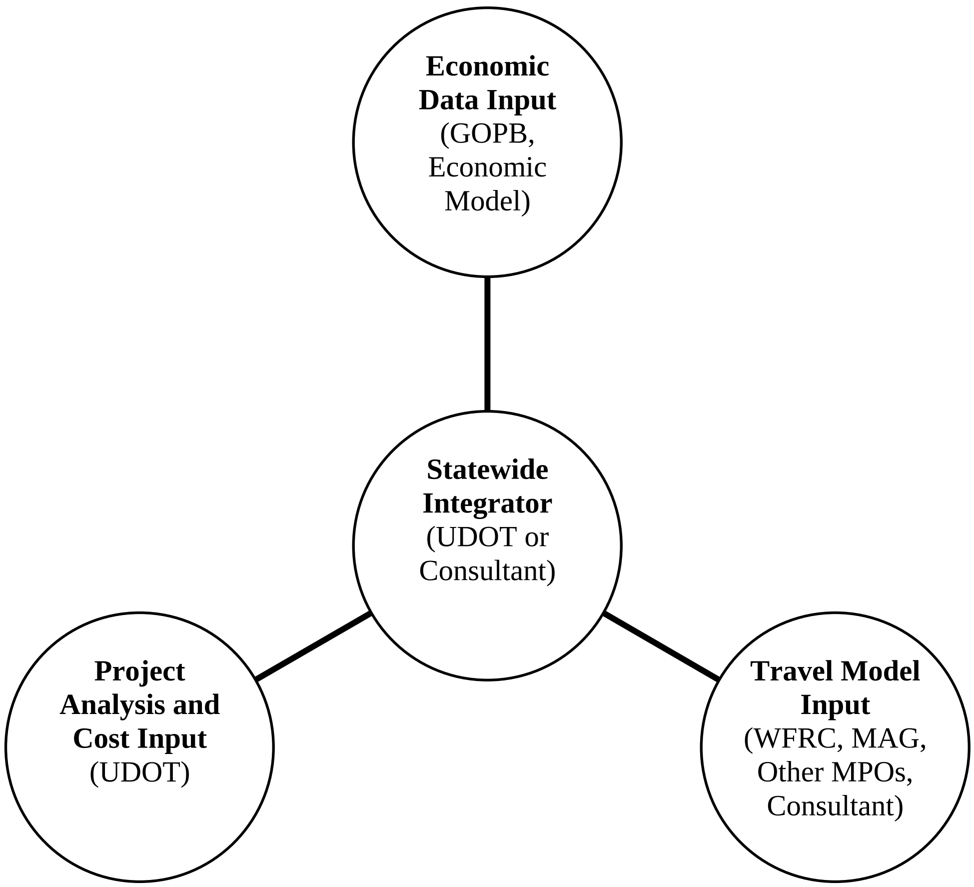


Figure 6-1 Conceptual agency coordination.

The research team recommends a partnership of this kind as a possible resolution for the completion of a long term EIA. In choosing this approach a consultant would have to be hired initially until one or more staff internal to one or more of the three partnering groups could be trained to carry out the procedure. The proposed conceptual organizational architecture developed by the research team for such a program is illustrated in Figure 6-1.

Some recommended requirements for success of such a model would include:

- Commitment and participation of all parties involved, including time, funding, and consistency in model input, use, and evaluation.
- Consistent and ongoing communication between all participants.
- Strong facilitator responsible for the integration within the proposed architecture (it is recommended that a consultant be retained for this role to provide stability and consistency to the process).

6.2 Including a BCA in the Selection Process through a Scoring System

The results of a BCA can be used to order or prioritize a list of project alternatives as to which provide the greatest benefits for the least cost. If this is the only project selection criteria then the first and best choice is the project that scores the highest in the BCA. However, this is typically not the only selection criterion that projects are subjected to and so the BCA carries only a portion of the total decision. This requires a categorical scoring process under which each project receives a score in each criterion and the individual scores are added for a total project score. The total project scores are the final prioritization results.

To determine the weight of the BCA in the total scoring process, the type of BCA used (UIA, static, or dynamic), its accuracy, and the extent of the analysis should be considered. The Wisconsin DOT weighs their economic criteria as 37.5 percent of the total (Wisconsin 1999). The equation for the total BCA score is (Wisconsin 1999): Benefit Cost Ratio Score = $[(B/C) / (B/C_{max})](100)(.375)$.

The Ohio DOT counts economic analysis criteria as 30 percent (Ohio 2003). The Missouri DOT changes the weighting of economic criteria according to the type of project, whether it is a safety oriented or capacity adding project. For capacity adding projects Missouri sets the weighting at 15 percent (Missouri 2004). From the results of the BYU/UDOT survey of Utah transportation professionals and decision makers, a representative weighting for economic criteria would be 10 to 15 percent.

Scoring of an EIA will require additional subcategories according to chosen metrics, such as, employment, income, GRP, etc. Some metrics may be of greater or lesser importance in the total decision. For example, if job creation is determined to be more important in the decision making process it should be assigned a greater weight in the selection process. To illustrate how the economic score can be allocated, the following examples are provided.

The Wisconsin DOT breaks their 40 percent economic score into the following (Wisconsin 1999):

15%	Reduction in travel cost versus construction costs
5%	Businesses that will benefit
5%	Economic growth potential
5%	Unique reasons why project will attract new businesses
10%	Part of Corridors 2020 (designated priority network)

The Ohio DOT breaks their 30 percent economic score into five parts (Ohio 2003):

10%	Non-retail jobs created
5%	Job retention
5%	Economic distress
5%	Cost effectiveness (ratio of cost divided by jobs created)
5%	Non-retail, private sector investment

The Missouri DOT breaks their 15 percent economic score into three parts (Missouri 2004):

6.0% Strategic economic corridor

4.5% Level of economic distress

4.5% Support of regional economic development plans

From the BYU/UDOT survey, respondents indicated that job creation, job retention, tax revenue, and location of the project are most important subcategories in the economic scoring. Any of the three above economic criteria require an EIA, meaning the AASHTO user benefit analysis method would be insufficient, unless supplemented with a Delphi or other discretionary analysis methodology.

6.3 Other Economic Program Alternatives

Choosing transportation improvements that best meet the needs of a developing economy might be best done with a separate program that allows for more freedom to create projects oriented towards economic development. These projects would likely be smaller in scale but would be contracted to meet specific economic development requirements, such as job creation. Such a program to design and build "economic development oriented projects" would be possibilities for partnership with other organizations that can share in funding and economic development experience. Several states have successful business or industry access program that could serve as a pattern for UDOT. Further freedom afforded by a this program would be seen in businesses generating and submitting candidate projects themselves leaving UDOT free to continue pursuing the development of the prioritized network and existing infrastructure. See section 2.6 for economic development oriented programs in various states. Please note that they are programs to fund projects with economic development implications, its selection criterion typically being the number of jobs created or retained by the projects.

6.4 Chapter Summary

This chapter presented a summary of the process development portion of the research. The purpose of this chapter was to develop a process whereby economic impacts can be incorporated in the evaluation of transportation capacity improvement projects if such analyses are required. This process development incorporates the information gleaned from each of the previous chapters to formulate possible approaches, provide examples of how they might be implemented, and make preliminary recommendations. The primary evaluation methods summarized include BCA, selection process scoring, other economic program alternatives, and a combination of approaches.

7 Recommended Alternatives

Discussion was made in the previous sections about the concepts of BCA, including: different levels of complexity; methods of including a BCA in the selection process; and other avenues to deal with inclusion of economic development issues in project selection and implementation. In this, the final section, recommended alternatives for UDOT to consider economic development as a factor for selecting future projects for funding are provided. Based on the findings of literature search, survey summaries, model evaluations, and outcomes of the steering committee meetings the following four approaches are recommended for consideration to meet the needs for project selection and the desire for considering economic development as a factor for project selection.

7.1 Approach 1: Benefit/Cost Analysis

Not all capacity improvement projects require consideration of economic development issues in their evaluations. Hence, the first level analysis would involve only UIA, the very basic method for evaluating the feasibility of a project. This level of project prioritization would follow the AASHTO guidelines (AASHTO 2003), in which direct user benefits are assessed. This analysis will weed out infeasible projects in the first step of the project prioritization process. The results of this analysis can be used independently to create a final prioritization list, or they can be used as input to further analysis. This level of analysis can be accomplished by UDOT engineers or their Consultants.

7.2 Approach 2: Economic Development Analysis

Once projects worthy for further considerations have been determined through a BCA analysis, UDOT can identify projects that require explicit economic development analysis through a formal EIA. As previously discussed, two levels of EIAs are available: short term and long term. For a short term, (e.g., one-year EIA), an I-O model analysis would be most suited. For a long term EIA, models that incorporate dynamic interactions of industry groups are required, such as REMI® TranSight™ (REMI 2005) or a HEAT type model (Wornum et al. 2005). This approach would follow the proposed architecture outlined previously in Figure 6-1. In this approach, UDOT would require a facilitator (either a consultant or UDOT), working with GOPB/REMI® (for economic analysis), UDOT (for cost estimation), and MPOs/consultant (for the modeling portion). Commitment of all organizations would be essential for this approach to be successful. Based on early cost estimates, this type of analysis would cost more than $100,000 initial start-up with yearly maintenance fees of approximately $20,000 (year 2005 dollars). This approach would require a minimum of one full-time UDOT staff member to run the model and coordinate the data. Additional staff may be required depending on the level of detail and involvement of the analysis as it progresses.

7.3 Approach 3: Project Scoring System

With approach 1, only results of BCA are used for project prioritization. Capacity enhancement projects are generally not solely selected based on the BCA value. Additional factors are often considered in finalizing project priorities. Project scoring has been used by many organizations; it is an effort to consider multiple objectives in project selection. This approach could follow a number of formats with the Ohio TRAC scoring (Ohio 2003) and the Wisconsin DOT scoring process (Wisconsin 1999) referenced as examples. Decision makers should come to consensus on the factors to be used, their weights, and the scoring structure that would be employed for Utah.

Scoring requires manpower. In Ohio's TRAC case for example, one full-time employee works with their TRAC, as well as two or three part-time employees who help with such tasks as estimating costs and scoring reductions. The employees do all of the briefing of the Committee (for Utah, the Transportation Commission), and prepare all of the documentation. Wisconsin has a similar process to which they have indicated that they have three full-time employees who administer the program (using REMI® Policy Insight®), and that the cost to the Department for the employees is approximately $200,000 per year (year 2005 dollars). As examples, Figure 7-1, Figure 7-2, and Figure 7-3 illustrate the overall scoring structures of the Wisconsin DOT, Ohio DOT, and Missouri DOT, respectively. While the previous discussion illustrated the economic criteria, these figures provide examples of the types of factors considered (including economic and other criteria) and their weights.

7.4 Approach 4: Combination of Approaches

This option combines Approach 1 (BCA), Approach 2 (EIA), and Approach 3 (Project Scoring System). The BCA could be worked into the scoring structure, or be independent of the score. For capacity improvement projects, the BCA is the first step to consider projects for prioritization. Once projects pass Approach 1, feasibility of the projects has been provided. In the second stage selection, a number of additional factors can be considered based on individual project service requirements, including economic development related factors, transportation efficiency factors, environmental factors, and others. Figure 7-4 provides a flowchart of the combination of approaches including optional inputs and overall output of the process.

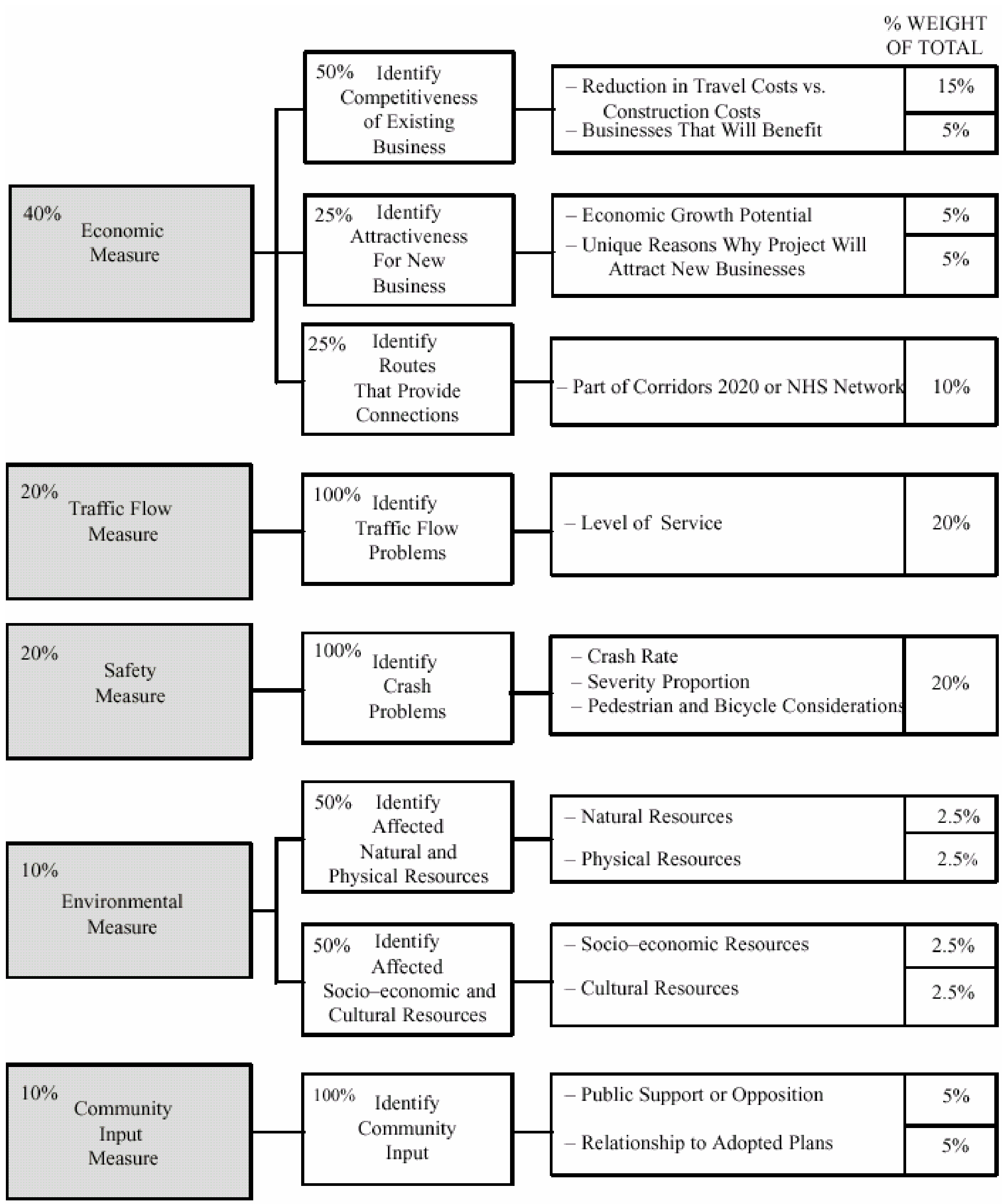


Figure 7-1. Wisconsin DOT prioritization process (Wisconsin 1999).

Goal	Factors	Maximum Score
Transportation Efficiency	Average Daily Traffic – Volume of traffic on a daily average	20
	Volume to Capacity Ratio – A measure of a highway's congestion	20
	Roadway Classification – A measure of a highway's importance	5
	Macro Corridor Completion – Does the project contribute to the completion of a Macro Corridor?	10
Safety	Accident Rate – Number of accident per 1 million mile of travel during 3 year period.	15
Transportation points account for at least 70 % of a projects base score		**70**
Economic Development	Job Creation – The level of non-retail jobs the project creates.	10
	Job Retention – Evidence that the job will retain existing jobs.	5
	Economic Distress – Points based upon the severity of the unemployment rate of the country.	5
	Cost Effectiveness of Investment – A ratio of the cost of the jobs created and investment attracted. Determined by dividing the cost to the Ohio for the transportation project by the number of jobs created.	5
	Level of Investment – The level of private sector, non-retail capital attracted to Ohio because of the project.	5
Economic development points account for up to 30% of a projects base score		**30**
Additional Points		
Funding	Public/Private/Local Participation – Dose this project leverage additional fund which allow state fund to be augmented?	15
Unique Multi-Modal Impacts	Does this project have some unique multi-modal impact?	5
Urban Revitalization	Does this project provide direct access to cap zone areas or Brownfield site?	10
Total possible points including transportation, economic development and additional categories		**130**

Figure 7-2. Ohio DOT TRAC prioritization process (adapted from Ohio 2003).

Prioritization Process

Major Projects:
System Expansion
11/04/2003

Major Projects: System Expansion

New major roadway, new bridge and roadway expansion projects

This process does not apply in TMA areas

Access to Opportunity
Weight: 5%

Vehicle Ownership	75 pts
Eliminate Bike/Ped Barriers	25 pts
Total	**100 pts**

Congestion Relief
Weight: 30%

Level of Service	40 pts
Daily Usage	30 pts
Functional Classification	30 pts
Total	**100 pts**

Economic Competitiveness
Weight: 15%

Strategic Economic Corridor	40 pts
Level of Economic Distress	30 pts
Supports Regional Economic Development Plans	30 pts
Total	**100 pts**

Efficient Movement of Freight
Weight: 5%

Truck Volume	60 pts
Freight Bottlenecks	20 pts
Intermodal Freight Connectivity	20 pts
Total	**100 pts**

Quality of Communities
Weight: 5%

Complies with Local/Regional Land-Use Plans	50 pts
Connectivity Between Cities/Regions	50 pts
Total	**100 pts**

Environmental Protection
Weight: 5%

Environmental Impact	100 pts
Total	**100 pts**

Safety
Weight: 30%

Safety Index	80 pts
Safety Concern	20 pts
Total	**100 pts**

Taking Care of the System
Weight: 5%

Bridge Condition (of bridge(s) to be replaced/rehabbed)	40 pts
Pavement Condition (of lanes to be replaced/rehabbed)	40 pts
Substandard Roadway Features	20 pts
Total	**100 pts**

- **The glossary explains how each factor is scored.**
- **Because this is a statewide process, there is no flexibilty in investment goal weight.**

Figure 7-3. Missouri DOT prioritization process (Missouri 2004).

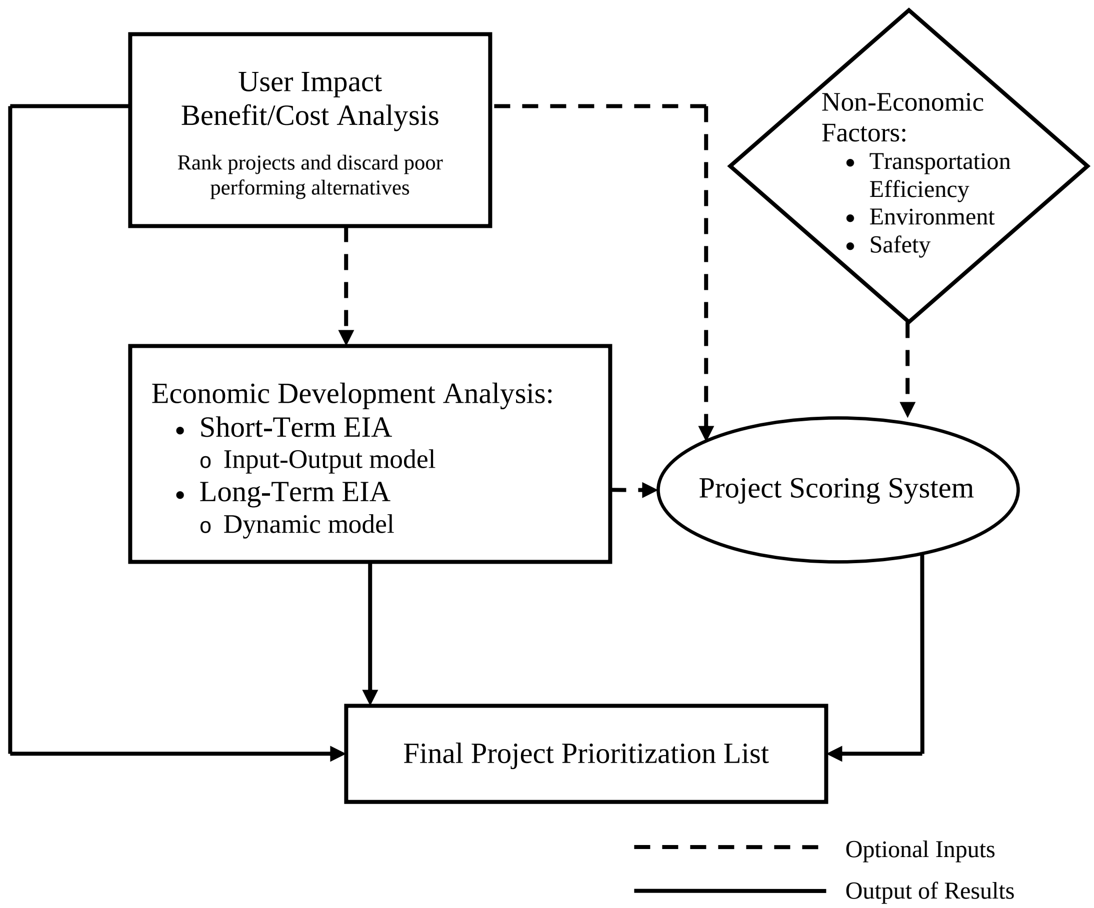


Figure 7-4. Economic analysis alternatives.

7.5 Summary of Alternatives

The preceding sections have identified a number of approaches available to assess the economic impacts of transportation improvement projects as a result of the research conducted. As can be seen from the analysis, a number of options are available for a wide range of costs to the Department. Each of the options and costs has been considered by the steering committee and the Transportation Commission, with a recommended action provided in the concluding section of this report.

8 Conclusions and Committee Recommended Actions

To provide an opportunity for increased efficiency in project selection the steering committee has recommended a process using economics as one of the available selection metrics. The tool formulated will provide direction and guidance to the Transportation Commission and the Utah Department of Transportation (UDOT) personnel on the prioritization of projects base on economic performance and analysis. The results are planned to be incorporated into the long range planning process. The following results or recommendations have been arrived upon through a procedure of: 1) determining the state of the practice for transportation economic analysis, 2) establishing the criteria that should be considered in the economic analysis process, 3) evaluating the tools available to meet these needs, and 4) making recommendations on how to proceed to meet these objectives. The project accomplished the purpose of evaluation of the tools available for incorporating economic evaluation metrics in the transportation planning process. The data gleaned from this process has led to current recommended action and will service as a reference in the future as the process is reconsidered in the case of improved technology or new economic and transportation system dynamics.

In response to the assessment of the economic development impacts of transportation improvement projects, the steering committee has recommended that a two tier project prioritization process be implemented. This means that all capacity increasing transportation projects submitted for funding approval will be subjected to a two tier evaluation system. The first tier submits all projects to an objective scoring system that includes transportation efficiency and safety factors. Those projects selected in the first tier for further analysis would be evaluated in the second tier, where economic development impacts are considered. This two tier type of analysis includes key components of both benefit/cost analysis (BCA) and project scoring processes, without assigning specific scores or weights to projects in the second tier evaluation process.

The first tier evaluation system is designed as the primary selection process. As the focus of this paper is economic criteria evaluation the first tier procedure, or safety and efficiency scoring, is outside of the scope of this project. The choices as to which weights and metrics to be included have been evaluated in a different setting and can be obtained through UDOT. In summary these metrics include: average daily traffic (ADT); truck ADT; type of roadway or function class; volume to capacity ratio (v/c), safety, and traffic growth. Weights assigned to the respective metrics would likely be between 5 and 25 percent.

Tier two of the procedure is a subjective evaluation intended to prioritize those projects selected in the first tier. Similar to the first tier, all criteria and sub-criteria to be included in the second tier have not been finalized, but it is the current recommendation of the steering committee that the economic development impact of the transportation project be considered as part of this tier. Other criteria considered in the tier two include: project cost, local participation, public/private partnering, and others as determined by UDOT, the legislature, and the Transportation Commission.

One of the primary reasons for this recommendation stems from the present high cost and complexity of the techniques and models used to quantify the economic development impacts of transportation improvement projects as outlined previously. The most accurate economic models would likely also require a full time staff dedicated to data gathering and entry and insuring local industry calibration. Furthermore, the accuracy of the resulting economic impact analysis (EIA) figures, regardless of the quality of the economic model, depends on the quality of the inputs. The inputs, provided by the estimations and outputs of the local travel demand model, would then stand in need to be evaluated and level of acceptable accuracy would be decided.

Rather than expending limited time and funds to a formal economic development modeling process a subjective economic development prioritization process will be implemented. In this process, the Transportation Commission will request information from the Governor's Office of Planning and Budget (GOPB) and/or the Governor's Office of Economic Development (GOED) on the economic potential of (e.g., job creation) of each project selected in the tire one process. Within the GOPB is a planning division of Demographic and Economic Analysis (DEA), who among other things: "assesses the economic, demographic, and fiscal impacts of projects and policies; projects and analyzes long-term economic and demographic trends; coordinates the U.S. Bureau of the Census State Business and Industry Data Center Program in Utah; compiles, organizes, and disseminates data and special studies on issues relevant to state planning and budgeting" (GOPB 2005). The GOPB currently holds two licenses of REMI®, which they use for economic impact forecasting. The GOED is a newly created office replacing the former Division of Business and Economic Development. Some major focuses of GOED are corporation recruiting, rural assistance, economic cluster initiative, and tourism (GOED 2005). It is anticipated that either or both the GOPB and the GOED would be able to provide important data estimations such as potential demographic and economic impacts on job creation, business relocation, tourism, personal income, business output, property values, tax revenue, and immigration. This information will then be used by the Transportation Commission in conjunction with other tier two evaluation criteria (e.g., project costs, local participation, private/public partnering, etc.) to make final project funding determinations.

This type of analysis includes key components of both BCA and project scoring processes without assigning specific scores or weights to project in the second tier evaluation process. The information, however, will be used by the Transportation Commission in making final funding decisions. A summary flowchart of the recommended process is provided in Figure 8-1.

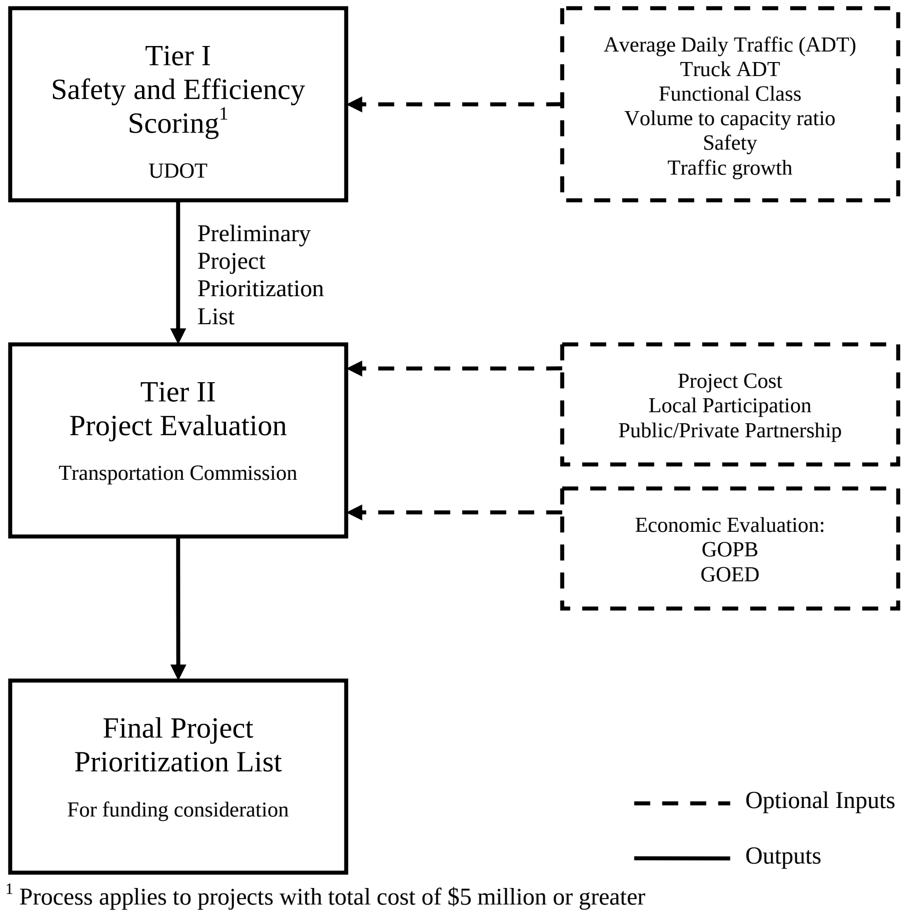


Figure 8-1. Proposed evaluation flowchart.

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Appendix A

Appendix A. State Specific Economic Development Programs

The following review of state specific economic development programs is taken from Study of the National Scope and Potential for Improvement of State Economic Development Highway Programs: Overview of State Economic Development Highway Programs (Tasks A-B Report), a study completed by the Economic Development Research Group, Inc., authored by Weisbrod and Gupta and revised January 2004.

A.1 Arizona Department of Transportation

Program Name: The Economic Strength Projects Program (ESP)

Objective: The program's objective is to fund projects that create and retain jobs, lead to capital investment, and contribute to the economy in the State of Arizona or within the local authority.

Program Requirements: The Arizona Department of Transportation works with the Arizona Department of Commerce in selection and funding of ESP projects. Projects are selected based on the following criteria: 1) cost of the project; 2) jobs created or retained, projected capital investment and contribution to the economy of the state; 3) cost/benefit ratio; 4) local match funding; 5) expenditure on local infrastructure relating to the project; 6) magnitude of the project and its relative value; and 7) and specific time schedule for project completion.

Funding: The funding for the ESP projects came from the Highway User Revenue Fund (HURF). From year 1991 to 2002, approximately $1 million was made available, $500,000 each on a semi-annual basis. In the year 2003, only $500,000 is allocated for ESP projects.

A.2 Florida Department of Transportation

Program Name: The Transportation Outreach Program (TOP)

Objective: The program's objective is to fund transportation projects that would preserve transportation infrastructure, enhance Florida's economic growth and competitiveness, and improve travel choices to ensure mobility.

Program Requirements: Most of the eligible economic growth and competitiveness projects include: 1) major highway improvements that provide linkage to major highways, bridges, trade and economic development corridors; access projects for freight and passengers; 2) major public transportation projects, such as seaport projects that improve cargo and passenger movements; aviation projects that increase passenger emplanements and cargo activity; rail projects that facilitate the movement of passengers and cargo.

Funding: The program is 100 percent state program funded at a minimum of $60 million each year beginning in FY 2001-2002. In the FY 2002-2003, $91.8 million in funds were approved for TOP projects. According to the Florida DOT's 2001/02 Program and Resource Plan summary for the next ten years, the Transportation Outreach Program will be funded up to $995 million by year 2010.

A.3 Georgia Department of Transportation

Program Name: The Governor's Road Improvement Program (GRIP)

Objective: The objective of GRIP is to fund a system of highways to bring access to the state's smaller communities and promote economic development. Once completed, the GRIP system will bring 75percent of Georgia's population within two miles of a four-lane road and 98percent of the State's population within 20 miles of a four-lane road. The program will also provide access for oversized trucks (requiring an oversize permit from the Georgia Department of Motor Vehicles) to all cities having a population above 2,000.

Program Requirements: GRIP targets nineteen corridors. These corridors are economic development highways consisting of existing primary routes and truck connecting routes. Under GRIP, the corridors will be widened to four lane roads. The total system length is 3,184 miles. Eleven of these corridors are currently active, meaning they have pre-construction activities underway. The estimated total cost to complete all of the GRIP corridors is approximately $3.6 billion. The cost to complete the active corridors is $2.4 billion.

Funding: The GRIP program has been funded by the state legislature with general fund money and bonds, and by the Georgia Department of Transportation utilizing state motor fuel and federal funds. In June 2001, Governor Roy Barnes announced the Governors Transportation Choices Initiative (GTCI) that proposes to accelerate completion of the active GRIP corridors in the next 7 years. The GTCI Program is proposed to be funded through many sources, but primarily by the use of Grant Anticipation Revenue Bonds, which would be reimbursed in future years with federal transportation funds. The funding sources and timeline for this accelerated program are subject to change. 55.4 percent of GRIP corridors are open or under construction, making up 1,371 miles;

19 projects were opened to traffic in FY 1998, representing 70.69 miles under construction at a cost of $122.9 million.

A.4 Kansas Department of Transportation

Program Name: The Local Partnership Program

Objective: The Local Partnership Program's economic development category focuses on highway and bridge construction projects that enhance economic development in Kansas.

Program Requirements: The Local Partnership Program funds economic development projects on a maximum of 75 percent state (maximum of $2.0 million) and 25 percent local match basis. The highway or bridge construction projects under economic development funds must have the potential to increase the area's income, jobs, and land values in the surrounding areas.

Funding: The Local Partnership Program's state funding for the economic development category during the FY 1998-2002 was set at $3.0 million annually. For the FY 2003-2009, the economic development fund is set at $7.0 million annually. However, since FY 1998, the funds for the Economic Development and Geometric

Link (ED/GL) categories have been pooled together, and the Highway Advisory Commission of the Kansas DOT selects projects from the total ED/GL applications. Thus, making the total funds for ED/GL for FY 2003-2009 $13.0 million per annum. Local Partnership Program Projects FY 2002 had total funds of $3,298,000.

A.5 Louisiana Department of Transportation

Program Name: The Transportation Infrastructure Model for Economic Development (TIMED)

Objective: The Transportation Infrastructure Model for Economic Development Program is developed to connect major cities of Louisiana with a four-lane highway; enhance economic development; promote connectivity of bridge crossing; and fund inter-modal enhancements.

Program Requirements: The program requires that 80 percent of the workforce consist of Louisiana residents.

Funding: The TIMED Program is funded by $.04/gallon taxes, yielding approximately $110 million in FY 2002 and a $260 million bond issued in 1990. Louisiana recently had a $275 million bond issued in 2002. The estimated cost to finish the TIMED Program is $2.5 billion. The highway construction needs are based on the actual progress of the program, and not on an amount determined by the legislature.

A.6 Mississippi Department of Transportation

Program Name: The Four Lane Highway Program or Advocating Highways for Economic Advancement and Development Program

Objective: The program's objective is to provide a four-lane highway within 30 miles or 30 minutes of every Mississippi resident.

Program Requirements: In 1987, the program originally planned to construct 1,088 miles of four-lane highway in three phases by the year 2001 with an estimated cost of $1.6 billion. As of June 30, 2001, about 680.4 miles of new four-lane highway constructions were completed and in use (Phase I). In 1994, Phase-IV was added to provide improvements to an additional 619 miles. The cost of the entire program, including Phase IV, is expected to cost approximately $5.5 billion.

In 2002, Vision 21, a needs-based highway program passed by the Mississippi Legislature now includes Phase IV of the AHEAD program and provides for construction of roads within the Gaming Roads program, as well as other needs.

Funding: Major sources of funding dedicated to fund the program includes a motor fuel tax, a $5 car tag fee, a highway contractor's tax, federal aid, and proceeds from the transportation bond retirement fund. Additionally, the Mississippi Department of Transportation was authorized to temporarily borrow $200 million, if additional funding resources were required.

A.7 Oklahoma Department of Transportation

Program Name: Industrial Access Road Program

Objective: The program's objective is to provide funds for the construction or improvement of direct access facilities to existing or committed industrial operations or areas.

Program Requirements: Local match funding is required. Project selection is based on some or all of the following: 1) industry being served indicating the number of new jobs which will be created; 2) estimated annual payroll; 3) number of heavy trucks per day which will serve the industry; and 4) estimated capital expenditures for construction or expansion of the plant facilities. If the funded facility is not adequately maintained, no future industrial projects will be approved for the county or the areas. All the criteria do not have to be met in order for the Oklahoma Department of Transportation (ODOT) to approve a project.

Funds: The program is 100 percent state funded. The state legislature requires ODOT to spend at least $2.5 million on Industrial Access Road Projects per state fiscal year. Frequently, the administration appropriates more funds than they require.

A.8 Oregon Department of Transportation

Program Name: The Immediate Opportunity Fund (IOF) Program

Objective: The purpose of the IOF is to support the location or retention of specific firms in Oregon through the improvement and construction of highways, streets, and roads.

Program Requirements: The fund is allocated to potential economic development projects requiring immediate response and commitment of funds. Projects must assist in locating or retaining specific businesses that provide jobs in a community and are divided into two categories: 1) specific economic development projects that confirm job retention and job creation opportunities primarily in manufacturing, production, warehousing, distribution or other industries; and 2) revitalization of business or industrial centers. The fund is not to be used for speculative investments.

Funding: The IOF Program is currently funded at $1 million per year. An increase in this amount is under discussion. In FY 2002, only one project of $500,000 for D street improvements in Baker City has been approved.

A.9 South Dakota Department of Transportation

Program Name: The Industrial Park Grant Program

Objective: The program's objective is to assist the local units of government or communities in the development of new or expanded access for new industries located within industrial parks.

Program Requirements: The industrial development must result in creating a minimum of 5 new jobs and the total employment in the industrial park or development project should be at least 50. Projects are prioritized for funds on primarily two conditions. Priority one projects include construction of roads within defined industrial parks. The program funds 60 percent of the cost for priority one projects. Priority two projects include construction of roads that are located parallel to an industrial park or connect a major route or street to an industrial park. The program funds 40 percent of the cost for priority two projects.

Funding: The program is funded at $1.0 million annually and there is no grant size limit. The Industrial Park Program Projects FY 2002 were awarded a total state amount of $857,550, which created 343 jobs. The private sector capital investment reached $10,577,000.

A.10 West Virginia Department of Transportation

Program Name: Industrial Access Road (IAR) Program

Objective: To provide construction and maintenance of industrial access roads to industrial sites within counties and municipalities.

Program Requirements: The program's basic requirements are: 1) IAR funds are only used for construction of industrial access roads within counties and municipalities to industrial sites on which manufacturing, distribution, processing or other economic development activities, including publicly owned airports, are already constructed or are under firm contract to be constructed; 2) IAR funds may not be expended until the governing body of the county or municipality certifies to the Division of Highways that the industrial site is constructed and operating or is under firm contract to be constructed or operated, or upon the presentation of an acceptable surety or device in an amount equal to the estimated cost of the access road or that portion provided by the Division of Highways.; 3) Up to $400,000 of unmatched moneys from the fund may be allocated for use in any one county in any fiscal year. The maximum amount of unmatched moneys, which may be allocated from the fund, is 10 percent of the fair market value of the designated industrial establishment. The amount of unmatched funds allocated may be supplemented with additional matched moneys from the fund, in which case the matched moneys allocated from the fund may not exceed $150,000, to be matched equally from sources other than the fund. The amount of matched moneys which may be allocated from the fund over and above the unmatched funds may not exceed 5 percent of the fair market value of the designated industrial site; 4) Funds may be allocated to those items of construction and engineering which are essential to providing an adequate facility to serve the anticipated traffic.

Funding: Industrial Access Road fund receives 0.75 percent of all state tax collections, which are otherwise specifically dedicated (by the provision of WV State Code) to the State Road Fund, or the percentage of those tax collections that will produce $3 million for each fiscal year. At the end of each fiscal year, all unused moneys in the fund revert to the state road fund. Generally, about $3.5 million is available each fiscal year for the IAR Program.

A.11 Wyoming Department of Transportation

Program Name: Industrial Road Program (IRP)

Objective: The program's objective is to provide state funding to supplement private industrial funding for construction of roadways serving an industrial facility. Thus, the program helps counties and communities with economic development efforts.

Program Requirements: The IRP is a legislatively created program to assist with industrial development projects and is funded at $4.0 million per biennium. This program requires a 50/50 match from private industrial firms, county road funds, or other sources, but not states road funds. Each county may receive IRP funding up to $1,000,000 per biennium. A county may sponsor one or more projects during a biennium as long as the total IRP funding does not exceed $1,000,000 for one or more projects.

The IRP funds are allocated on a first come, first served basis to those counties that have completed project request documentation. IRP funds may be used to construct a segment of a larger project using a combined programs funding approach but the IRP segment must meet overall IRP guidelines. The IRP project must be sponsored by the Board of County Commissioners within whose county the project is proposed.

Funding: The IRP is funded at $4.0 million per biennium. Each county is eligible for $1.0 million per biennium of the $4.0 million total biennial funded. Any funds not obligated during the biennium are returned to the highway fund.

Appendix B

Appendix B. Questionnaire to Transportation Professionals

Dear Transportation Decision Maker,

Transportation planning and decision making is an important aspect of the vitality of any state or metropolitan area. The diverse impacts caused by transportation projects necessitate a detailed analysis in any decision making process. The Utah Department of Transportation (UDOT) has recently undertaken a project to review and evaluate the tools available for incorporating economic evaluation metrics more fully into their transportation decision making process. One of the tasks undertaken in this project is an effort to collect best practices among transportation agencies across the nation for evaluating and assessing the economic development impacts of transportation improvement projects.

The National Cooperative Highway Research Program (NCHRP) Synthesis 290 indicates that there are a variety of methods to view and measure transportation development impacts including changes in:

- Business sales,
- Gross regional product (value added),
- Personal income generated, and
- Associate employment (jobs) within a given study area.

These are the general topics addressed in this study when referring to economic development impacts.

Two separate surveys have been developed for this study. One survey is targeted toward transportation decision makers, while the second survey targets transportation professionals and agency staff members (DOT, MPO, AOG, etc.). This specific survey is intended for transportation decision makers and is intended to glean information on the importance of economic development impacts in the overall decision making process to help guide UDOT as they plan the future of transportation development in the state.

Please be assured that regardless of whether your particular jurisdiction actively assesses the economic development impacts of transportation projects, the insights generated through your participation in this survey will be very much appreciated, and your answers will be relevant and important.

Our experience with this survey indicates that it will take approximately **20 minutes** to complete. **In appreciation for your efforts in completing the survey, I would be happy to send you a copy of the survey results once they have been tabulated.** Once you have completed the survey, please return the completed document and any supporting documentation by **<u>May 31, 2005</u>** to:

Dr. Grant G. Schultz
Brigham Young University
368 Clyde Building
Provo, Utah 84602

Fax: 801-422-0159
Phone: 801-422-6332
E-mail: gschultz@byu.edu

If you wish, you may fax your response or submit your answers by telephone. If you would prefer a telephone interview, please email me your telephone number indicating a good time to be contacted and I will arrange for a member of the research team to contact you. If you have any questions regarding this survey, please feel free to contact me via e-mail or telephone at the contact information listed above. Thank you in advance for your assistance with this survey.

Sincerely,

Grant G. Schultz, Ph.D., P.E., PTOE
Department of Civil & Environmental Engineering
Brigham Young University

Survey for: UTAH TRANSPORTATION DECISION MAKERS

Assessing the Economic Impacts of Transportation Improvement Projects

* Please feel free to attach additional sheets as necessary.

Agency/Organization:			
Name of Respondent:			
Title/Department:			
Population within Jurisdiction:		Phone:	
Date:		Email:	

Transportation Planning and Project Selection

1. What factors of transportation planning do you feel are important when choosing one transportation capacity project to fund over another in either the Long Range Plan (LRP) or the Statewide Transportation Improvement Program (STIP) within your jurisdiction? What weight (as a percent) would you place on each factor?

Factor	**Weight (%)**
Cost	
Travel Time Reduction	
Safety	
Mobility	
Accessibility	
System Connectivity	
Social Equity	
Economic Development	
Environment	
Public Input	
Others (please specify)	

Economic Development's Role in Project Selection

2. How important are the economic development impacts of a transportation project as criteria for project evaluation and selection among those listed in your answer to Question #1?

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3. Please list factors that are important to consider as part of the Economic Development score from Question #1 (e.g., job creation, job retention, business sales, etc.) and the weight (as a percent) that each factor should be expected to carry.

Factor	**Weight (%)**

Economic Development Impacts of Transportation to be Considered

4. What are the primary questions that need to be answered in an economic analysis of transportation projects?

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5. If forecasted, what factors (as listed in Question #3) of economic development impacts would be most beneficial to you as the decision maker?

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6. In rural/urban regions (please specify in your response) how can your agency be accountable to competitiveness, productivity, and efficiency in the selection of transportation projects?

7. What factors of the economic development impacts would the public be most interested in?

8. How can we measure quality of life and apply this measure in the analysis of economic development impacts of transportation projects?

9. Should the evaluation of economic development impacts include the influence of externalities such as pollution and other environmental impacts, or should we treat these as separate issues?

Additional Information

10. If there are studies or documents internal to your organization or done by others which you consider to be useful guides or best practice examples for assessing economic impacts please list them. If internal please attach a copy when returning this document or if external please provide, author, title, publisher and publication year so that they can be easily located by the research team.

11. If you have additional comments that you would like to express related to the assessment of economic development impacts of transportation projects, please provide these comments here or attach additional sheets.

Thank you for your response to the survey. The research team and the Utah Department of Transportation value your input. Please save and return the completed survey and any supporting documentation by <u>May 31, 2005</u> to:

Dr. Grant G. Schultz
Brigham Young University
368 Clyde Building
Provo, UT 84602
Fax: (801) 422-0159
Phone: (801) 422-6332
E-mail: gschultz@byu.edu

Appendix C

Appendix C. Questionnaire to Transportation Professionals

Dear Transportation Professional,

Transportation planning and decision making is an important aspect of the vitality of any state or metropolitan area. The diverse impacts caused by transportation projects necessitate a detailed analysis in any decision making process. The Utah Department of Transportation (UDOT) has recently undertaken a project to review and evaluate the tools available for incorporating economic evaluation metrics more fully into their transportation decision making process. One of the tasks undertaken in this project is an effort to collect best practices among transportation agencies across the nation for evaluating and assessing the economic development impacts of transportation improvement projects.

The National Cooperative Highway Research Program (NCHRP) Synthesis 290 indicates that there are a variety of methods to view and measure transportation development impacts including changes in:

- Business sales,
- Gross regional product (value added),
- Personal income generated, and
- Associate employment (jobs) within a given study area.

These are the general topics addressed in this study when referring to economic development impacts.

Two separate surveys have been developed for this study. One survey is targeted toward transportation decision makers, while the second survey targets transportation professional and agency staff members (DOT, MPO, AOG, etc.). This specific survey is intended for transportation professionals and agency staff and is intended to glean information on the importance of economic development impacts to help guide UDOT as they plan the future of transportation development in the state.

Please be assured that regardless of whether your particular jurisdiction actively assesses the economic development impacts of transportation projects, the insights generated through your participation in this survey will be very much appreciated, and your answers will be relevant and important.

Our experience with this survey indicates that it will take approximately **20 minutes** to complete. **In appreciation for your efforts in completing the survey, I would be happy to send you a copy of the survey results once they have been tabulated.** Once you have completed the survey, please return the completed document and any supporting documentation by **May 31, 2005** to:

Dr. Grant G. Schultz
Brigham Young University
368 Clyde Building
Provo, Utah 84602

Fax: 801-422-0159
Phone: 801-422-6332
E-mail: gschultz@byu.edu

If you wish, you may fax your response or submit your answers by telephone. If you would prefer a telephone interview, please email me your telephone number indicating a good time to be contacted and I will arrange for a member of the research team to contact you. If you have any questions regarding this survey, please feel free to contact me via e-mail or telephone at the contact information listed above. Thank you in advance for your assistance with this survey.

Sincerely,

Grant G. Schultz, Ph.D., P.E., PTOE
Department of Civil & Environmental Engineering
Brigham Young University

Survey for: UTAH TRANSPORTATION PROFESSIONAL

Assessing the Economic Impacts of Transportation Improvement Projects

* Please feel free to attach additional sheets as necessary.

Agency/Organization:			
Name of Respondent:			
Title/Department:			
Population within Jurisdiction:		Phone:	
Date:		Email:	

Transportation Planning and Project Selection

1. When choosing one transportation capacity project to fund over another, what factors does your agency currently consider and what weight (as a percent) does your agency typically place on each factor?

Factor	Weight (%)
Cost	
Travel Time Reduction	
Safety	
Mobility	
Accessibility	
System Connectivity	
Social Equity	
Economic Development	
Environment	
Public Input	
Others (please specify)	

2. Please list factors that are currently considered as part of the Economic Development score from Question #1 (e.g., job creation, job retention, business sales, etc.) and the weight (as a percent) that each factor carries.

Factor	Weight (%)

3. In the future, what weight (as a percent) would you *recommend* economic development impacts to carry in the selection process and how would this change other weighting factors?

4. What level of investment, if any, has been used as a cutoff value for including economic impacts as selection criteria in the transportation planning process? For example, UDOT is considering limiting their economic development impact analysis to capacity projects of $5 million or greater.

5. If economic development impacts are included in your decision making process, are other agencies utilized to aid in the economic analysis process (e.g., Office of Planning and Budget, Economic Development Office, etc.)?

6. How much consulting or in-house labor has been required to include economic development impacts in the decision making process? To make a correlation between expenditures on economic impact analysis and overall agency budget, please also include your total agency Capital Program budget.

Agency's Expenditures on Economic Analyses
Total Agency Capital Program Budget ($/year)
Economic Analysis Consulting ($/year)
Economic Analysis In-House Labor ($/year or FTEs)

7. What tools have been used by your agency in the past for analyzing economic development impacts (e.g., input-output models, simulation models, other economic models)? Which tools have been successful and how have they been successful? What tools have not been successful and why?

8. What criteria determine the use of one tool over another (e.g., cost, duration of construction, size of geographic influence, public interest, etc.)? Why?

9. If an economic analysis is included in the selection process, where does it fit in the hierarchy of the selection process (e.g., is it included in the initial analysis or is it applied later to a short list of projects already selected by some other means)?

10. Have you done any ex-post analyses to validate the predicted impacts? If so, how have the results compared and what lessons have been learned?

11. What has been done to build consensus in your economic analysis process and how have you educated stakeholders?

12. If there are studies or documents internal to your organization or done by others which you consider to be useful guides or best practice examples for assessing economic impacts please list them. If internal please attach a copy when returning this document or if external please provide author, title, and publication year so that they can be easily located by the research team.

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13. If you have additional comments that you would like to express related to the assessment of economic development impacts of transportation projects, please provide these comments here or attach additional sheets as needed.

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Thank you for your response to the survey. The research team and the Utah Department of Transportation value your input. Please save and return the completed survey and any supporting documentation by May 31, 2005 to:

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