2009-05-22

# Economic Development Criteria and Project Prioritization

Jason Scott McGee
*Brigham Young University - Provo*

# ECONOMIC DEVELOPMENT CRITERIA

# AND PROJECT PRIORITIZATION

by

Jason Scott McGee

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

August 2009

BRIGHAM YOUNG UNIVERSITY

GRADUATE COMMITTEE APPROVAL

of a thesis submitted by

Jason Scott McGee

This thesis has been read by each member of the following graduate committee and by majority vote has been found to be satisfactory.

| | |
|---|---|
| Date | Grant G. Schultz, Chair |
| Date | Mitsuru Saito |
| Date | W. Spencer Guthrie |

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| Date | Grant G. Schultz<br>Chair, Graduate Committee |

Accepted for the Department

E. James Nelson
Graduate Coordinator

Accepted for the College

Alan R. Parkinson
Dean, Ira A. Fulton College of Engineering and Technology

# ABSTRACT

## ECONOMIC DEVELOPMENT CRITERIA AND PROJECT PRIORITIZATION

Jason Scott McGee

Department of Civil and Environmental Engineering

Master of Science

To provide a more in-depth analysis of potential roadway projects, the Utah Department of Transportation (UDOT) desired a method of evaluating projects according to their economic potential without using potentially costly computer models or excessive data collection. Brigham Young University (BYU) was retained to research and recommend criteria for the economic development criteria in the project-prioritization process.

A literature review was first undertaken to better understand the transportation-economic development relationship. Using the literature review, combined with the information from the Economic Development Corporation of Utah, the Governor's Office of Planning and Budget, the Governor's Office of Economic Development, and a Technical Advisory Committee (TAC), criteria were established to evaluate the economic

potential of a roadway project. The criteria were finalized using a Policy Delphi method that included the Research Team and TAC. The four aggregate criteria and one bonus criterion recommended are: 1) population and education; 2) existing infrastructure; 3) economic attractiveness; 4) tourism; and 5) the bonus: economic choke-points, which allows UDOT regions to specify a prioritized list of projects that could help increase the economic development potential of an area if those projects are built.

An evaluation framework was also developed for the economic development criteria. Any project that passes the Tier I analysis is recommended to be subjected to the economic analysis of the Tier II process. The researchers recommend that once a list of passing Tier I projects is received, the list should be sent out to any participating in the expert feedback portion of the economic attractiveness scoring as well as to the UDOT regions and districts for choke-point prioritization analysis. All of the databases will be updated to provide the most up-to-date scoring possible. When all of the scores have been assigned, the projects will then be listed by highest to lowest scores. The list will then be compiled by UDOT who will present the information to the Transportation Commission in a manner that will best assist in the decision-making process.

The research created a scoring evaluation for each recommended criterion. Each criterion also received a weighting. The scoring and the framework are recommended to UDOT as the economic analysis of the Tier II evaluation. The criteria are recommended to be automated in a geographic information systems (GIS) database to aid in the scoring process.

ACKNOWLEDGMENTS

I first wish to thank my advisor and thesis committee chair, Dr. Grant G. Schultz, for his patience, guidance, and trust in me. His mentoring has been invaluable. I also thank all of those who worked on the Technical Advisory Committee with me at UDOT: Tim Boschert, Ahmad Jaber, John Thomas, Kevin Nichol, and David Stevens. The work presented herein is in large part because of your intellect and creativity. Thank you for your support and trust. I also thank Michael Flynn from the Economic Development Corporation of Utah who helped us gain a footing on the direction to take with the criteria. Also, thank you to everyone else who provided valuable input to this project, especially those at the Governor's Office of Planning and Budget, and the Governor's Office of Economic Development and those on my thesis review committee: Dr. Mitsuru Saito and Dr. W. Spencer Guthrie.

Last of all, I thank my family for their love, encouragement, and curiosity during this project. My educational accomplishments would have never happened without all of you behind me. You are all my rock on which I build. Thank you.

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# 1 Introduction

Every department of transportation (DOT) faces a similar question on projects: which projects can be completed with the current funding and which projects must wait? Because sufficient funding is typically never available to construct all possible transportation improvement projects, these questions must be answered in a manner that will provide the best benefit to the users. In considering the benefits of a project, the economic impact of that project is one factor that should be taken into account. Increasing the economy of an area will provide a benefit to the state and its funds. If the economic potential for a project can be estimated, then that information can be used by the decision-makers to choose the best projects for the state. The purpose of this research is to create criteria and a framework to estimate the economic development potential of roadway projects to assist in the decision-making process.

This chapter provides a deeper look into the purpose and the background of the research. The report organization is also provided.

## 1.1 Purpose and Background

Transportation planning continues to be an important aspect of the vitality of the state of Utah. The State of Utah Long-Range Transportation Plan (Transportation 2030) recognizes that the vehicle-miles of travel (VMT) will continue to grow as the population in the state increases. In response to this growth, the Utah Department of Transportation (UDOT) has committed themselves to providing "optimum levels of mobility on well-maintained, safe roads" (UDOT 2007a, p. 2). 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 2007a, p.2). The common thread that ties these four goals together is the need for 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 that capacity can be increased. Projects must continuously 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 must be selected. The selection of these projects occurs in the planning process as part of the long-range plan (LRP) process.

In allocating resources to address the 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 2007a). The transportation planning process is critical in determining which projects can be considered to address these priorities.

In the fall 2005 and winter 2006, UDOT worked with Brigham Young University (BYU) researchers to explore available planning alternatives that include economic development impacts in the decision-making process (Schultz et al. 2006). Separate from the BYU research, UDOT worked internally to develop a methodology for project-prioritization. As a result of these two efforts, the planning process has been greatly improved in the state. There was, however, work to be completed to further refine this process. For example, the results of the economic impact analysis recommends that UDOT 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 (e.g., job creation) for the group of projects selected in the “Tier I” analysis process, where the Tier I analysis is a primary analysis process that uses engineering factors to prioritize roadway projects. The information from the Tier I analysis is to be used in conjunction with other “Tier II” evaluation criteria in making final project funding decisions. The Tier II analysis is a secondary analysis evaluating: 1) congestion, 2) economics, 3) environmental impacts, and 4) safety. The full list of criteria for use in the Tier II analyses, as well as the specific overview process to follow in coordination with the GOPB and/or GOED, was not fully developed as part of the scope of work for either the BYU research or the UDOT work. There was a need, therefore, to document and formalize the Tier I evaluation procedure and to further refine and formalize the overview process to follow in the Tier II economic analysis, thus helping to identify priorities such as the need for economic evaluation as part of project selection.

The purpose of this project was to provide an overview of the Tier I evaluation procedure and to further refine and formalize the overview process to follow in the Tier II economic analyses. This was to be completed by: 1) performing a literature review, 2) providing an overview of the Tier I project evaluation process, 3) establishing and refining a set criteria through coordination with the Technical Advisory Committee (TAC) using the Policy Delphi method for the Tier II economic analysis, 4) establishing and finalizing an overview process through the Policy Delphi method, and 5) making recommendations on how to use the system most effectively. The results of this project can then be incorporated into the LRP process to evaluate mobility and systems analysis. This tool provides direction and guidance to UDOT personnel on recommending projects that will be available for immediate implementation in the LRP process, providing an opportunity for increased efficiency in project selection.

## 1.2 Report Organization

This report includes five main body chapters: 1) Introduction, 2) Literature Review, 3) Project Selection: Background of the Tiered Process, 4) Tier II: Economic Development Criteria and Framework, and 5) Recommendations and Conclusions.

Chapter 2 involves the completion of a comprehensive update to the literature review performed as part of previous research. The primary areas of focus for the literature review included, but were not limited to: 1) understanding the transportation-economic relationship, 2) defining important variables involved in economic development, 3) updating information on available economic analysis tools, and 4) reviewing current state practices that deal specifically with economic development analyses. The literature review is meant to provide the basis for all the research performed and provide a foundation for determining the economic development criteria. A literature review also aided in avoiding overlooking and/or unnecessarily duplicating information.

Chapter 3 describes the process of how the two-tiered evaluation system was created. A transportation administrative rule brought about the Tier I and Tier II evaluations. An overview of the Tier I evaluation is presented along with how it ties in with the Tier II evaluations.

Chapter 4 reports the process of how the economic development criteria were determined. The original possible criteria were extracted from the literature review, as well as the Economic Development Corporation of Utah (EDC Utah), the GOPB, the GOED, and the TAC. A Policy Delphi method was used to determine the most influential criteria in projecting the economic development potential of roadways. The TAC proposed goals for the state of Utah, and those goals directed the Policy Delphi method in determining the final criteria. The formalization of the economic analysis framework is also discussed.

Chapter 5 is the final chapter of the report and recommends a final approach for the TAC and UDOT.

Two appendices are included in the report to aid the readers: A) List of Abbreviations and B) Transportation Administrative Rule: R907-68.

# 2 Literature Review

As many states are pursuing programs and policies to include economics in prioritizing transportation projects at varying degrees, the literature review allowed researchers to glean any new knowledge that had been developed since the last literature review by the BYU research team (Schultz et al. 2006), identify any new research tools that may have contributed to this study, and avoid overlooking and/or unnecessarily duplicating information. The literature review provided the researchers with a greater understanding of the transportation-economic relationship, namely: 1) understanding the historic and present-day transportation-economic development relationship, 2) links between transportation and economic development, 3) an update on economic analysis tools, and 4) current state practices. The literature review is an integral part of the research done. It provided not only the background and basis for the study, but also guided the creation and finalization of the economic development criteria.

## 2.1 Understanding the Transportation-Economic Development Relationship

To better understand the transportation-economic development relationship, the historical significance must first be understood and then compared to the present-day relationship. As the transportation infrastructure has changed, so has the transportation-economic development relationship.

### *2.1.1 Historical Transportation-Economic Development Relationship*

The link between transportation and the economy is not a new concept, but is one that is being constantly explored. Even in the past, the link between transportation and economic development was obvious because economic growth relied upon the market access of the producer and customer through transportation routes. For example, the European nations that controlled the caravan and shipping routes (i.e., the Silk Road or the Spice route) had economic advantages because of the increase in market access. These routes would eventually become part of a network of trade that expanded markets and the ability of producers to reach new consumers, and thus increase the respective economies (Weisbrod 2006).

Transportation has always been an important factor of the United States (U.S.) economy as well. The U.S. invested in trade and freight routes almost two centuries ago by constructing new highways and waterways that would expand the market access for agricultural products to be shipped from inland farms to coastal cities, which increased the overall economy (Weisbrod 2007). In 1964, the U.S. government recognized how improving the transportation network of an area could help economically depressed areas. Congress funded the Appalachian Development Highway System as a means to generate economic development in previously isolated areas (ARC 1964). Funding of the Interstate Highway System continued this growth. Today, states across the U.S. are exploring possible ways to increase economic production of different regions through improving the transportation system (Gkritza et al. 2007, Kreis et al. 2006, Schultz et al. 2006).

In 2005, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was signed to authorize the federal surface transportation programs for highways, highway safety, and transit for a 5-year period (2005-2009). The act states that the planning processes for a metropolitan area will "support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency" (U.S. Congress 2005, p. 416). The act also touches on growth, indicating that the planning process should ". . . promote consistency between transportation improvements and State and local planned growth and economic development patterns" (U.S. Congress 2005, p. 416). The U.S. recognizes that transportation is needed to support economic growth, not induce it.

### *2.1.2 Present-Day Transportation-Economic Development Relationship*

Due to the complex interaction of several variables in the economy, no one variable itself is enough to induce development. A good transportation system is very much needed, but alone is not sufficient to stimulate economic development. Measuring the actual effects of highway investments on the economy is very difficult due to the problems of isolating those effects from the larger processes dealing with regional economic growth. Many studies show that there are several variables involved with economic development, so clear cause-and-effect relationships are hard to establish (Ewing 2008, Forkenbrock 1990, Gkritza et al. 2007, Rephann and Isserman 1994). For example, transportation and available land alone are not enough to induce economic benefits to an area. A tract of rural land may have an interstate freeway running through it, and it may even have an interchange, but the area may still not experience economic growth; it also needs the ability to attract the necessary factors of production, labor, capital, and materials.

To provide the best possible evaluation of transportation effects on the economy, understanding the present-day transportation-economic development relationship is important. As the effects of transportation impact the economy differently from the past, agencies need to understand: 1) economic benefits from transportation are important, but on the decline; 2) how transportation affects land development; and 3) a time lag exists between construction of a project and the full realization of the economic benefits.

#### 2.1.2.1 Economic Benefits from Transportation are Important, but on the Decline

Highway investments no longer generate enormous positive changes in the national or even state economy, as did the original construction of the Interstate Highway System. In fact, because of the interstate construction, most areas have a mature transportation system that is able to sustain a robust economy. Now that America is in a post-interstate era, improvements to that same network at any level produce "comparatively small improvements to interregional accessibility" (Ewing 2008, p. 6). Ongoing research provides more and more evidence that returns on highway investments are declining. In fact, once a certain level of accessibility is reached, future investments may have little or no additional value (Weisbrod 2000).

Giuliano argues that the economic benefits of transportation in a post-interstate era are all but over, saying “the transportation system in most U.S. metropolitan areas is highly developed, and therefore the relative impact of even major investments will be minor” (Giuliano 1995, p. 7). As for the economy, she said “...transport costs make up a relatively small proportion of household expenditures” (Giuliano 1995, p. 8).

Another argument for the decline of economic benefits from transportation investments stems from the fact that the bulk of infrastructure is in place and new transportation investments will only cause a redistribution of businesses and population; no net change will occur in the region. This can be called a “spillover effect” when transportation improvements cause industry, business, and population to only jump county or regional lines. A study by Chandra and Thompson (2000) showed that, approximately 10 years after construction, counties receiving highway investments had experienced statistically significant gains in total earnings. Surrounding counties did have a small increase in manufacturing earnings, but also showed a decline in retail and farming industries. Chandra and Thompson report, “highways raise the level of economic activity in the counties that they pass directly through, but draw activity away from adjacent counties, thereby leaving the net level of economic activity unchanged in non-metropolitan areas” (Chandra and Thompson 2000, p. 486-487).

Cevero and Landis (1995) counter that even though transportation improvements no longer have the effect they once had, “they still play an important role in channeling growth and determining the spatial extent of metropolitan regions...” (p. 3). Cambridge Systematics, Inc. (CSI) et al. (2008) agrees that transportation is still a “vital part of the nation’s economy” (p. 4).

CSI et al. (2005) also reports that, in order to sustain a growing economy, transportation must be invested in. The U.S. Chamber of Commerce, in 2005, found that an additional $50 billion a year must be invested in the highway and public transportation systems just to maintain the current performance of those facilities. Almost double that will be needed annually to improve the performance of those systems (CSI et al. 2005).

Earlier research by Lombard (1991) reports that consequences do exist for under-investing, as well as over-investing, in highway construction. Under-investment in a highway could inhibit economic development, and the perceived travel costs will be greater with decreasing competitiveness. Over-investment could result in a loss of overall efficiency in the system because the funds could have been used to improve another part of the system. Thus, due to limited funding, careful planning must occur to provide proper investment in the transportation system. Researchers agree that, while transportation improvements no longer have the effect they once had, they are still vital to economic growth and development of an area.

#### 2.1.2.2 Effects of Transportation on Land Development

Transportation has always been tied to land use and land development. It is a two-way relationship; as one changes, so does the other. When a transportation improvement is made, there is increased accessibility to an area, resulting in an increase in land value. This spurs development, which increases traffic demand to that area. The higher demand will add to traffic delays, discomfort, crashes, and a decrease in the quality of service, which could cause more transportation improvements to be required (Stover and Koepke 2002). Figure 2-1 illustrates this transportation-land use development cycle.

While comparatively little research has been done to show specific relationships between transportation improvements and new development or redevelopment, it is acceptable as an important effect of transportation improvements. In a European study, all transportation investment projects resulted in investments in urban development, redevelopment, and renewal of space. The amount of investment varied according to factors such as development potential, access to new land or a Brownfield, market pressures, etc. (Gospodini 2005). Several studies that are available were reviewed, and the following are the key topics currently understood concerning the transportation effects on development and redevelopment:

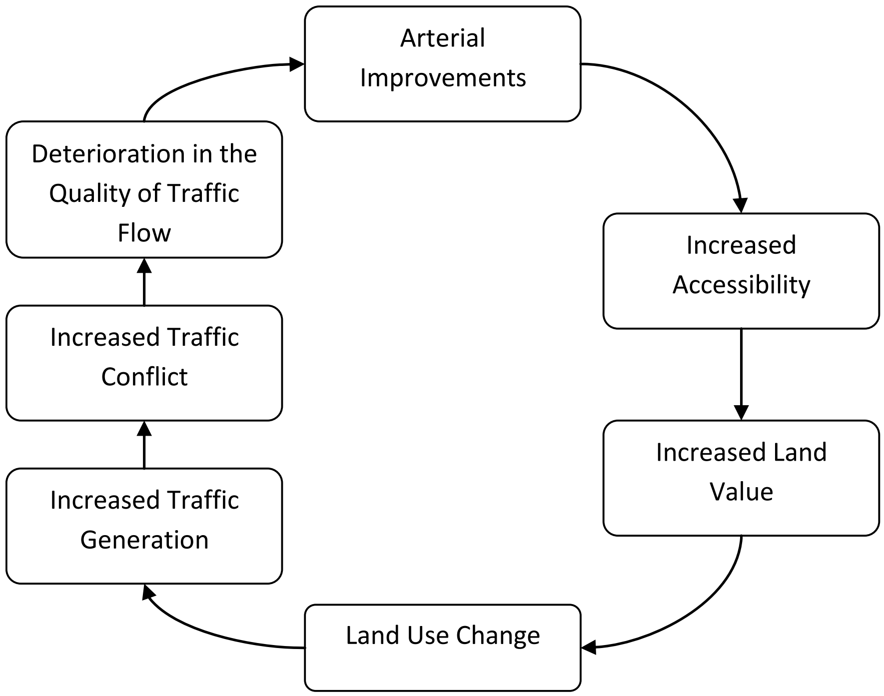


**Figure 2-1. The transportation-land use development cycle (adapted from Stover and Koepke 2002).**

- The area surrounding the transportation improvement will in large part determine what kind and how much economic development is induced. (Adams and VanDrasek 2007).
- If the project is specifically meant to help in redevelopment, the project must actually be within the redevelopment area (Adams and VanDrasek 2007).
- Overall, transportation improvements to a redevelopment area have a significant impact due to the increase in access. With sustained help in redevelopment by local government (as desired results may require decades), the end result will be a success (Adams and VanDrasek 2007, Amekudzi and Fomunung 2004).
- The site or footprint has three attributes that exert significant influence on the project: 1) available undeveloped land or land ready for redevelopment, 2) appropriate access for riders, and 3) directions of patron traffic to associated businesses (Adams and VanDrasek 2007).

- The characteristics of the area have three attributes that have a large influence: 1) the population and economic growth rates of the metropolitan area, 2) the current trends and conditions in local land prices and development densities, and 3) the centrality (link to other destinations to the transportation system) of the project (Adams and VanDrasek 2007).
- If the transportation LRP can promote redevelopment of such sites, several more benefits than just economic impacts will occur. A short list of the benefits of redeveloping these types of sites include: 1) environmental remediation, 2) job creation, 3) civil infrastructure renewal, 4) increased tax base, and 5) neighborhood revitalization (Amekudzi and Fomunung, 2004).
- Positive impacts of development through transportation include: 1) expand peripheral "new centers" or expand the city center, 2) transform existing urban and suburban cores into high quality residential areas, 3) promote development in peripheral urban areas, 4) promote urban reconstruction, and 5) work as a catalyst to accelerate and reinforce existing trends in the urban reconstruction and renewal (Gospodini 2005).
- With the positive effects come negative effects: 1) real estate prices and rent may rise considerably (which may exclude low-income families that used to live in the area) and 2) the development or redevelopment may lead to land speculation in some cases (Gospodini 2005).

Transportation infrastructure projects can work as a catalyst for urban development, redevelopment, and regeneration, but the effects vary. Some of the factors to consider are (Gospodini 2005):

- Type of transport infrastructure projects: big projects that serve large population areas will increase the accessibility of the area and tend to have greater potential in urban development, etc.
- Condition of the built environment in the greater corridor area: new transportation projects in declining urban areas (i.e., Brownfield) have a greater effect on redevelopment.

- Existing local market demand for new space and accommodation of new land uses.
- Local economic situation: if there is a dramatic shift in the general economic conditions, the effects of the transportation investment on urban development, redevelopment, and regeneration cannot be estimated accurately.
- Political climate.

Even beyond all of these variables that can affect development, another factor exists that is often overlooked: overall benefits of development are fully realized over time. Adams and VanDrasek (2007) argue that transportation projects should be evaluated with regard to a specific time period, maybe many years or decades.

#### 2.1.2.3 Time Lag of Economic Development Impacts

Economic impacts from transportation projects are typically divided into two periods: 1) construction (short-term) and 2) post-construction stages (medium- and long-term). The construction stage provides a large boost to the region due to construction expenditures, which are sustained until the completion of the project. In the post-construction period, the economic stimulus of construction is no longer present. The economic benefits of this period are the most difficult to estimate. While different views exist on how to evaluate the projects, knowing a time lag exists is important (Gkritza et al. 2007, Rephann and Isserman 1994).

A study done by Alam et al. (2005) shows that the lag of benefits from transportation projects is usually between 2 and 25 years. The study considered short-term benefits (increased employment and construction work) to occur within 5 years, with the benefits usually coming after 2 to 3 years. Medium-term benefits (increased retailing and movement of the workforce) occur up to 10 years later and usually within 6 to 8 years. Long-term benefits (new industry) occur within 25 years, and usually between 15 to 20 years.

With this understanding of how far-reaching a transportation investment may be, future development must be considered with transportation investments. Policy-makers may need to take this under consideration as transportation projects are being considered based on their potential economic impacts (Alam et al. 2005).

## 2.2 Links between Transportation and Economic Development

Despite declining returns, the future of the national economy and the economy of each state is still highly dependent on the transportation system that is in place. The transportation system must grow in order to sustain a growing economy. That does not mean that cities should rely solely on the car, but the system must be efficient and reliable as the surrounding economy burgeons and changes. Figure 2-2 shows that transportation is one of many key inputs in the link between economic growth and transportation investment (CSI et al. 2008).

The role of transportation in the economy is important, and the need to continue to evaluate projects according to their economic potential is also important. Gkritza et al. (2007) and CSI et al. (2008) show that transportation project factors relating to: 1) project type, 2) project location, and 3) reducing congestion (travel-time reduction), will result in lower cost trips and improved reliability, which all lead to better production and market access, which then leads to a more competitive economy.

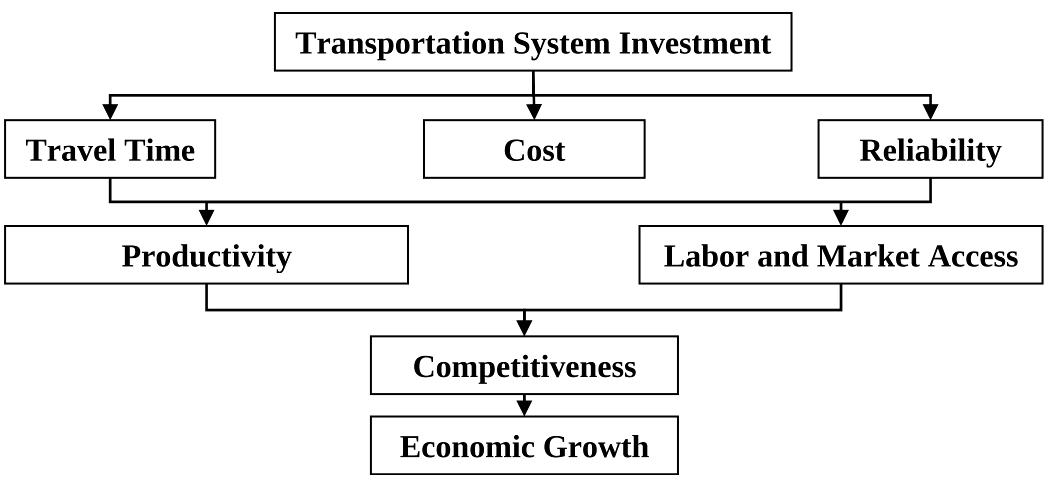


**Figure 2-2. Linkages between transportation investment and economic development (adapted from CSI et al. 2008).**

### *2.2.1 Project Type*

Researchers have shown that different projects affect the economy differently, so the type of project must be considered. A study of highway investments programmed for the state of Indiana investigated the effects of the project type on the economic development of an area using statistics. The authors concluded that the long-term economic developments are not equal across all projects. Projects need to be subdivided and compared within each group to better understand the dynamics of the projects (Gkritza et al. 2007).

Many different types of projects exist in transportation improvements, but the Gkritza et al. (2007) research team investigated the effects of the following types of projects on Indiana's economy:

- Added-capacity projects,
- Functional classification,
- New construction – roadways, interchanges, and medians, and
- Overall size of the project.

#### 2.2.1.1 Added-Capacity Projects

Added-capacity projects are usually programmed to meet current or future demand or to improve the existing level of service. Due to the nature of these projects, the scale of investment is large, which caused the Indiana research team to take great interest in the economic effects of this project type (Gkritza et al. 2007).

The researchers found that Indiana's economic development appeared to be enhanced by added-capacity projects. The evaluation showed that a 1 percent increase in highway spending on added-capacity projects resulted in 0.16 percent increase in real disposable income (1996 dollars) over a 20-year period after construction. The researchers felt the positive correlation of added-capacity projects and the economy could be due to the size of the project and the benefits of reduced travel time, which reduced costs to businesses and citizens (Gkritza et al. 2007).

#### 2.2.1.2 Functional Classification

The results of looking at added-capacity projects provided some insight on the type of roadways that would provide economic benefits as well. Overall, highway improvements had a stronger potential for economic development when compared to investments on roadways with lower functional classification. The researchers felt this could be due to the higher dependence of some industries (e.g., manufacturing) on the interstate for freight movement. Also, due to a higher freight dependence on U.S. highways, U.S. highways were also found to provide a significantly larger benefit than state highways (Gkritza et al. 2007).

#### 2.2.1.3 New Construction – Roadways, Interchanges, and Medians

New construction investment can be spurred by more than just the need to improve operating level of service or meet demand. New roadways and interchanges may be needed to provide more access to a region. Median projects may be needed in an attempt to improve safety. Along with their fulfillments of immediate needs, these new construction projects can positively influence the economy (Gkritza et al. 2007).

New roadway construction appears to have potential for long-term statewide economic development effects. The benefits are a function of both the project and location, which are discussed in section 2.2.2. Again, the size and functional class will dictate just how much of an influence the new roadway will have on the economy. The increase in accessibility with new roadways is a major factor in the increase in economic development (Gkritza et al. 2007).

The Indiana research team compared the construction of an interchange to that of a median and found that interchange construction would result in higher economic development effects in Indiana. This could be due to the increased access to a limited-access area; thus, the location of the interchange plays a large role in the magnitude of economic development potential. However, medians have been shown to reduce delays and crash rates when compared to facilities without medians to control traffic flow, but these benefits might not produce a measurable benefit in economic development (Gkritza et al. 2007).

#### 2.2.1.4 Overall Size of Project

Repeatedly, the Indiana research team found that the size of the project played a large role in the economic development potential of that project. A regression analysis by the Indiana research team suggested that "the larger the project, the greater the economic development benefits measured in terms of changes in output, income, and employment" (Gkritza et al. 2007, p. 99). The authors also found that the size of the project (length or cost) drove business attraction. Many of the larger projects also happened to be added-capacity projects.

### *2.2.2 Project Location*

The type of project is only one of several important factors; many of the other factors affecting the potential economic benefits of a highway can be found in the project location. The location of the project will dictate economic business attraction. Business owners will usually choose an area where they expect their resources to generate the highest income. Most of those who are willing to relocate have mobile resources or capital. Workers, similar to their employers, are seeking an area with the highest returns possible. Non-monetary quality-of-life considerations influence the attractiveness of an area for a business or worker (Forkenbrock 1990, Gkritza et al. 2007).

Businesses are looking to be competitive and efficient. In order to achieve that, several factors influence how attractive one area is compared to another. Some of these factors include (Gkritza et al. 2007, CSI et al. 2008):

- Access to the market, suppliers, and potential employees or labor;
- Current infrastructure; and
- Current economic trends.

#### 2.2.2.1 Access to the Market, Suppliers, and Potential Employees or Labor

Access is very much a key word to businesses needing to increase their competitiveness. A location that provides businesses with access to a large customer base, raw materials, and a future labor market is incredibly appealing; such an increase in access will result in a reduction in costs to the business overall (CSI et al. 2008).

Gkritza et al. (2007) found that added-capacity lanes in the urban area around Marion County, Indiana, caused larger increases in economic activity than similar added-capacity lanes elsewhere. The researchers attributed the increased benefit to increased access to education, labor (e.g., larger population), and infrastructure. However, the researchers also found that projects outside of Marion County, with a high degree of accessibility to employment, had better benefit-cost (B/C) ratios. Overall, the connectivity to a large population and education center plays a large role in the attractiveness of an area.

In a survey conducted by Gkritza et al. (2007), participants were asked to name features that make an area less attractive to businesses. The top three responses were: 1) a lack of skilled/trained workforce (i.e., no nearby institutions of higher learning), 2) lack of quality of life in the area, and 3) lack of support services (i.e., suppliers).

As for labor, the U.S. population is aging, and the competition for skilled and educated workers is increasing across industries. Economists expect more manufacturers to move to nearby cities to have greater access to highly skilled workers, as "good access to workers is correlated with improved labor and business productivity" (CSI et al. 2008, p. 16). The CSI et al. (2008) study also shows that a 10 percent increase in the size of the labor market results in a productivity output increase of 2.4 percent. Also, improving travel time by increasing travel speeds by 10 percent leads to a 15 to 18 percent increase in the labor market size.

#### 2.2.2.2 Current Infrastructure

The same survey by Gkritza et al. (2007) introduced in section 2.2.2.1 asked a question about important features to a business seeking a more attractive location. Respondents stated that the existing infrastructure of an area, including telecommunications capacity, would be an item that would attract businesses. In other words, the more existing infrastructure that is already in place will increase the attractiveness of an area.

#### 2.2.2.3 Current Economic Trends

As seen in the Gkritza et al. (2007) study, the urban center of Indianapolis in Marion County receives great benefits from infrastructure improvements. This can be attributed to the fact that several other factors are already present in the urban center and transportation may just be a missing link for an urban area.

However, smaller rural areas in Indiana actually received a greater benefit from transportation improvements. This could be due to the following: 1) rural areas are not in full employment compared to urban areas and/or 2) rural areas could be gaining improved access to urban markets, thus increasing the area's attractiveness to businesses (Gkritza et al. 2007). This research is in line with research stating that highway improvements in undeveloped locations with moderate to rapid development can have a large contribution of aggregate change leading to long-term impacts (FHWA 1992).

### *2.2.3 Reduce Economic Losses Associated with Congestion*

Congestion affects several aspects of the economy of an area. As congestion increases across all modes of transportation, the growth of tourism, competitiveness, and access to local and global markets will be reduced. A study by CSI et al. (2008) provides several examples of how industries are forced to change the logistics of business in order to meet demands. Examples of this include increasing the number of trucks being used to reach all customers because travel time is too great or paying extra money to make night and weekend deliveries because not all deliveries can be made during the week. "Congestion, deteriorating travel-time reliability, and escalating costs are offsetting the savings of a global supply network" (CSI et al. 2008, p. 37).

Some statistics for the future were provided in the report by CSI et al. (2008) to emphasize the need to reduce the effects of congestion on the economy. The U.S. population is projected to grow from 300 million to 380 million over the next 30 years. In the absence of any major global conflicts or recession, the U.S. economy will more than double in real terms over that same time period; even VMT will likely increase by 80 percent in the next 30 years. The demand for freight will also continue to go up, as an estimated 92 percent increase in ton-miles is projected to occur (6 trillion ton-miles in

2005 to 11 trillion ton-miles in 2035). In order to support the growth, transportation investments must be done intelligently and efficiently.

Another important aspect of the economy is the amount of time spent traveling. A report by Schrank and Lomax (2007) stated that underinvestment in transportation infrastructure will cost time and money. The report indicates that congestion caused drivers to purchase 2.9 billion extra gallons of fuel and spend 4.2 billion more hours in traffic. The estimated cost in 2005 dollars was 78 billion. If fuel costs rise, so will the cost of congestion.

#### *2.2.4 Better Productivity and Market Access Increase Competitiveness*

Better productivity and increased competitiveness come about as a result of the previously discussed factors of project type, project location, and reduced congestion. Transportation has a direct effect on the economic competitiveness of each region. For example, the Colorado DOT has begun research on how to include economic parameters into the decision-making process and has identified business attraction and expansion possibilities as some of the more important factors of transportation investment. As a state chooses to improve its transportation system, it can facilitate gains in economic competitiveness (i.e., business attraction) (Pickton et al. 2007).

Research by CSI et al. (2008) confirms that transportation can boost industry competitiveness and productivity. The better the transportation network, the greater the reduction in production and distribution costs. This is achieved by greater mobility, which creates better access to varied, specialized, and productive sources of labor. Mobility also provides a more diverse selection for inventory and raw materials, as well as a broader customer base.

### 2.3 Economic Analysis Tools – an Update on Dynamic Models

Several static and dynamic models are currently available to aid in economic analyses. Static models are generally used to predict short-term improvements. In general, a static model is used to take a snapshot in time of how an economic effect can ripple throughout the economy of a region. Static models do not have the ability for future (dynamic) forecasting of the economy of a region (Kreis et al. 2006). Dynamic models, on the other hand, can simulate the effects of several factors in the economy and predict how those factors will change the economy over time. Some of the factors often considered include wage rates, population, transportation costs, etc. Dynamic models attempt to forecast industry growth, change in technology, and the distribution of each industry in a region. While several DOTs have internally developed input-output (I-O) models (Burke et al. 2005), there is a trend in the market shifting from I-O models to dynamic regional economic models (Weiss and Figure 2003).

An in-depth review of static and dynamic models was presented in previous research for UDOT by Schultz et al. (2006). For the purposes of this research, only an update on the dynamic models is given, and only a select few require any updates. The following models are discussed: both Policy Insight® and TranSight™ from Regional Economic Models, Inc. (REMI®) and the Transportation Economic Development Impact System (TREDIS®). Due to the similar natures of TREDIS® and REMI® TranSight™, another section compares the two models and the cost to run them.

### *2.3.1 REMI® Policy Insight®*

REMI® is one of the most widely used economic simulation models and is available at a national, state, regional, or local county level. The REMI® Policy Insight® model was not designed specifically for transportation, but has a broader policy-based framework to estimate the regional economic changes due to taxes, investments (including transportation), and regulatory policies (Weisbrod 2007). The REMI® Policy Insight® model can forecast up to 41 years into the future, using econometrics, enabling forecasting of indirect effects on the regional economy. Other project-specific data can be included in the REMI® Policy Insight® model, including construction, operations, and other financial spending directly for infrastructure improvements (Schultz et al. 2006).

REMI® Policy Insight® tends to focus assumptions for economic development impacts on transportation investment centered on the changes in VMT and vehicle-hours traveled (VHT). Those travel cost savings dictate what REMI® Policy Insight® estimates the benefits will be. Some concerns have been raised about the estimation of business attraction based on improved highway access and connectivity. Several agencies, in answer to those concerns, have combined REMI® with a highway network model and other business attraction models (Weisbrod 2007).

### *2.3.2 REMI® TranSight™*

REMI® TranSight™ is a preprocessor for REMI® Policy Insight®. The REMI® TranSight™ model is used to forecast economic benefits across several modes of transportation, including: 1) roadway (bus or car), 2) rail, or 3) marine travel. The economic benefits are evaluated from both personal user cost savings and cost savings for businesses. Various sized projects can be evaluated in REMI® TranSight™; however, REMI® TranSight™ is not able to go as small in scope as the addition of turn lanes or exit ramps (Kreis et al. 2006). REMI® TranSight™ is compatible with several travel demand models, including TP+, which is used by the Wasatch Front Regional Council (WFRC) (Schultz et al. 2006).

REMI® TranSight™ uses the REMI® Policy Insight® economic forecasting simulation as its engine. This primary tool of analysis uses the following four functions to estimate economic benefits (Kreis et al. 2006):

- Forecasting,
- Economic competitiveness,
- Population migration analysis, and
- I-O.

REMI® TranSight™ does require specific inputs in order to make the internal calculations. The two most important factors are VMT and VHT. The more detailed each input can be (based on the model, transport mode, time of day, roadway type, and trip-parameter data), the more thorough the evaluation. The inputs produce the following outputs, which are reported by year (Kreis et al. 2006):

- Employment by industry,
- Output by industry,
- Wage rates and personal income,

- Population by demographic group, and
- Gross regional product.

The REMI® TranSight™ model is designed to be straightforward and simplistic. All outputs, except "population," are represented in monetary terms. The user is assumed to be a non-economist and needs only modest training to use the software. A total of 1 to 2 hours can be expected for data entry on each project (Kreis et al. 2006).

### *2.3.3 TREDIS®*

Since 2006, only one new tool has come onto the market that has received widespread recognition, the TREDIS® model. TREDIS® was developed by Economic Development Research Group, Inc. (EDR), which built upon an earlier product called Local Economic Assessment Package (LEAP). LEAP was a development of the Highway Economic Analysis Tool (HEAT), which built upon the Major Corridor Investment-Benefit Analysis System (MCIBAS) from Indiana. TREDIS® is a culmination of years of development. The model has been used in Appalachian highway studies in Tennessee, Mississippi, and New York (Kreis et al. 2006).

TREDIS® is a web-based system, intending to make the program more accessible to DOTs. The program is designed to work with "different transportation, access, and economic models" (Weisbrod 2007, p. 21). All modes of transport may be used in the economic model: air, marine, rail, or roadway. Another powerful element of TREDIS® is that the size of the project does not limit the ability of the program to assess potential economic benefits. The scope of possible projects for evaluation ranges from an addition of a single turning lane or intersection reconstruction to full-scale construction of a new highway (Kreis et al. 2006).

TREDIS® appears to be very flexible. There are large amounts of data fields to provide a deep level of modeling, but a large majority can be left blank, allowing a rough sketch for planning. The required inputs are (Kreis et al. 2006):

- VHT savings,
- VMT savings,

- Capacity or congested hours of operation, and
- Crash rate savings.

These inputs may be generated by any means available to the user. A frequently used tool to develop the inputs is the Highway Economic Requirement System (HERS) state model (HERS-ST). The 10 outputs of TREDIS® are (Kreis et al. 2006):

- Direct travel impact – base scenario;
- Direct travel impact – project scenario;
- Direct travel benefit from completing the project;
- Direct travel cost savings – by industry;
- Direct market access benefit – by industry;
- Summary of direct project impact – by industry;
- Summary of total economic impact – by year;
- Summary of short-term construction impact – by industry;
- Summary of long-term economic impact – by industry; and
- B/C analysis.

TREDIS® is a model similar to TranSight™ in evaluating economic impacts of transportation projects. TREDIS® calculates direct and secondary impacts. The "direct" impacts are associated with the travel-related cost changes in the project itself. Those outputs can then be used as inputs for a dynamic regional economic model in order to project any induced economic benefits. Three models may be used to do this: 1) Impact Analysis for Planning (IMPLAN), 2) Regional Dynamics Model (REDYN), or 3) REMI® Policy Insight® model. Each model has its benefits, but the REDYN model appears to be the primary component (Kreis et al. 2006).

A spokesman for TREDIS® stated that "the TREDIS® model requires no formal economic expertise or prerequisite staff qualification in order to run the model" (Kreis et al. 2006, p. 23). EDR tried to develop the model assuming the users would be planners or engineers and not full-time economists. A total of 1 to 2 hours can be expected for data entry on each project in TREDIS® (Kreis et al, 2006).

### *2.3.4 Comparing REMI® TranSight™ and TREDIS®*

Kreis et al. (2006) stated that both TREDIS® and REMI® TranSight™ are comparable in their forecasting abilities, required inputs from a traffic model, and the economic benefit outputs, including: 1) employment by industry, 2) output by business/industry, 3) wage rates, and 4) gross domestic/regional product. As both models attempt to provide the same type of analysis, a comparison will provide understanding of where the models differ and whether or not one has an advantage over the other.

TREDIS® is able to evaluate over a broader range of transportation modes and on a more refined geographic scale (down to the town level or an intersection reconstruction). Unlike REMI® TranSight™, TREDIS® is compatible with several regional economic models such as IMPLAN and REDYN instead of only REMI® Policy Insight®. As for the actual software, REMI® TranSight™ is installed on a single computer, whereas TREDIS® is a web-based system. The time requirements to input a project for analysis by either model does not differ significantly between the models (EDR 2006).

There is a difference in the computation styles between REMI® TranSight™ and TREDIS®. REMI® TranSight™ estimates how transportation improvements change the "effective distance" between regions, based on travel time or cost between county centers. TREDIS® uses geographic information systems (GIS) and travel times to measure this spatial component. In the end, the two models are not necessarily addressing the same things. REMI® TranSight™ has a focus on measuring economic growth impacts of ground transportation changes. TREDIS® has a focus on measuring benefits, costs, and other impacts across multi-modal projects (EDR 2006).

The Kreis et al. (2006) study also compared the products according to cost. The researchers made some assumption on the staffing, including how many hours per year would be applied to only entering data into either of the programs, number of projects per year, staffing requirements, staff salary, etc. After applying the assumptions, the cost of TREDIS® was initially estimated to range from $111,457 to $312,010 for the first year. Costs in subsequent years ranged from $101,457 to $302,010. REMI® TranSight™ was initially estimated to cost $120,657 to $315,210 for the first year. Costs in subsequent years were $88,657 to $272,010. These values corroborate the data provided from previous research by BYU (Schultz et al. 2006). The Kreis et al. (2006) research team concluded that REMI® TranSight™ would be more economical to acquire and operate over the long term than TREDIS®. Another benefit is the longer list of clients with REMI®.

Utah currently holds a license for REMI® Policy Insight® in the GOPB. The GOPB has a model for the state as a whole (including a multi-region model incorporating all 29 counties) and a single model for each county. With an efficient traffic model, REMI® Policy Insight® could be used to obtain a broad sense of the economic impacts transportation investments will have in the state of Utah (Schultz et al. 2006).

## 2.4 Current State Practices

As policies and project-selection processes are ever evolving, providing a snapshot of the current situation according to the literature is very important. Some states have scoring criteria, while others use a board of experts to estimate the economic impacts of a roadway project. Some states have deeply involved economic analysis procedures, while others have yet to develop them. Weisbrod and Gupta (2003) listed all of the economic development highway programs as of early 2003. Only 11 states had formal economic development highway policies. Another three states were then developing economic policies: 1) California, 2) Colorado, and 3) Utah.

An overview of the current state practices was provided by three surveys that occurred concurrently or after the original research performed by Schultz et al. (2006): 1) the Kentucky Transportation Center (KTC) performed a telephone survey to determine current policies and practices among state DOTs (Kreis et al. 2006); 2) a questionnaire was used in Indiana to help define what types of measurements should be used to estimate economic benefits of transportation projects, as well as the tools that could be used to estimate them (Gkritza et al. 2007); and 3) a Texas Transportation Institute (TTI) survey requested DOTs to summarize what types of models were being used, if at all, to project economic benefits (Burke et al. 2005).

In performing the literature review, researchers noted that several states are working on valid methods to forecast and include economic development into highway projects, while several states lack the method and process of using economics in the highway project-selection process (Horowitz et al. 2007). There are states that have programs designed to evaluate the economic effects of transportation improvements; a couple of interest are the Ohio DOT Transportation Review Advisory Council (TRAC) and the Indiana DOT MCIBAS. These two states evaluate the economic impact of transportation projects by various means including computer modeling and expert panel knowledge. TRAC appears to be more qualitative, while the MCIBAS is more quantitative. Because of the different methods, these two states were of particular interest to the researchers. Meanwhile, other states are waiting for tried and true practices to develop from those states investigating economic inclusion in project selection.

Several states have economic programs and policies that provide financial assistance to transportation projects that will help local industry, provide more access, etc. The literature provides an overview of these types of programs (Schultz et al. 2006, Weisbrod and Gupta 2004). The purpose of this section is not to review economic programs, but rather the project-selection processes that include some type of economic evaluation.

To provide the snapshot of current project-selection processes involving economic metrics, the following are discussed:

- Three surveys conducted to determine each state's economic practices,
- Ohio DOT TRAC, and
- Indiana DOT MCIBAS.

### *2.4.1 Surveys*

Two published surveys have been performed since the 2006 BYU study, as well as one that happened concurrently (Schultz et al. 2006). The KTC performed a telephone survey to a preselected group of DOTs in order to gauge what other agencies were using for economic assessment and prioritization (Kreis et al. 2006). Another survey, similar to the BYU national survey design, was sent to agencies and organizations in Indiana that had an interest in economic development (Gkritza et al. 2007). This section attempts to present the key findings from those surveys to supplement the survey that was performed for previous research. The last survey was performed by TTI to list states that had tried to model economic development and document which models were used (Burke et al. 2005).

#### 2.4.1.1 Kentucky Transportation Survey

A survey performed by the KTC shows a recent sketch of the state DOT methodologies surrounding economics. The states included in the survey were those considered to be similar to Kentucky, or have a strong record of considering economics, and include Arkansas, Indiana, Iowa, Missouri, Ohio, South Carolina, Tennessee, Virginia, and Wisconsin. A summary of results is as follows (Kreis et al. 2006):

- Arkansas, Iowa, and South Carolina DOTs: No formal economic factors have been developed. Arkansas and Iowa have commissions that make all the highway funding decisions, whereas South Carolina distributes the funds to the local Metropolitan Planning Organization (MPO) and other government agencies, which ultimately decide how the funds will be spent.
- Indiana DOT (INDOT): A weighted list of criteria for prioritizing potential transportation projects is used by the INDOT Planning Oversight Committee (IPOC). The main two factors in this consideration are jobs created/retained and economic distress in an area.
- Missouri DOT (MoDOT): MoDOT developed the *Missouri DOT 2004 Practitioner's Guide* for planning and decision-making and also has economic criteria infused in the processes. The two main points in this are economic competitiveness (which also has sub-topics) and efficient movement of freight. The three levels of economic competitiveness include: 1) level of economic distress (according to poverty and unemployment over an area), 2) strategic corridors (connect major urban/economic centers), and 3) district economic factors (expressed by each district in MoDOT).
- Ohio DOT (ODOT): The decision-making body for ODOT is a group of experts and appointees in TRAC. Following set procedures, several factors of economics are considered for major projects: 1) job creation, 2) job retention,

3) economic distress, 4) cost effectiveness of investment, and 5) level of investment.

- Tennessee DOT: The DOT follows seven guiding principles to evaluate the economic impact (economic development and goods/freight movement) of transportation jobs. Economic development considers five of the principles: 1) connectivity to a county seat, 2) service to high growth areas, 3) population center, 4) employment center, and 5) high unemployment. The goods/freight movement considers two more principles: 1) service of major freight movements and 2) the percentage of trucks in daily traffic.
- Virginia DOT: One of the goals for the Virginia DOT prioritization plan says "Improve Virginia's Economic Vitality and provide Access to Economic Opportunities for all Virginians" (Kreis et al. 2006, p. 7). The main idea behind this is freight movement in average daily truck volume and economic distress (high unemployment).
- Wisconsin DOT (WisDOT): The highway prioritization program "Corridors 2020" requires WisDOT Economic Development and Planning Section personnel to meet with the business community and economic development organizations to help identify economic needs and opportunities for the state.

#### 2.4.1.2 Indiana DOT Survey

A survey about economic parameters in project selection, similar to separate nationwide surveys sponsored by the National Cooperative Highway Research Program (NCHRP) and BYU (Schultz et al. 2006), was used in Indiana. The survey was intended to discover which measures for economic development impacts should be used, as well as which tools should be used. The full survey is contained in Gkritza et al. (2007). Located herein is a summary of the findings:

- Transportation agencies and consultants place a greater value on evaluation criteria such as safety and mobility than on economic criteria, which they assigned an average of 20 percent weight or less. Economic-development practitioners and planning agencies placed a weight that was greater than or equal to 20 percent.

- While transportation agencies and consultants thought that economic development impacts would not significantly affect a project's future, most participants thought it important to estimate economic development impacts of a project to aid in ranking those projects according to desirability (especially those projects specifically intended to promote economic development).
- As indicated in the BYU research team survey (Schultz et al. 2006) and with Weisbrod (2000), job creation and retention seem to be the most important factors to communicate to the public. Other factors that are important in this communication are B/C ratio, cost-effectiveness of investment, and impact on the local tax base. Freight mobility was also considered an important factor to develop an economic score.
- Most participants stated that the expansion of existing businesses has generated the most job growth in their jurisdiction in the last 10 years. The expansion of existing businesses as well as the creation of new businesses is expected to generate the most job growth in the next 10 years.

The survey revealed that not much had changed in the 2 years since BYU performed their national survey concerning economic parameters in the project-selection process.

#### 2.4.1.3 TTI Survey

A survey in 2004 showed that 16 states had reported some type of economic valuation. Of those 16 states, the researchers believe that most, if not all, of the studies were used to determine the feasibility of a project and not to receive more state funding (Burke et al. 2005). The following is a summary of 16 states and their models:

1. Arizona – Market-Oriented Cost-Benefit Analysis (MOCB): The tool calculates user highway benefits for commuters in order to determine roadway investments.
2. Florida – HERS and REMI® Policy Insight®: The HERS model is used to calculate user highway benefits as inputs for the REMI® Policy Insight® model. REMI® Policy Insight® is then used to estimate economic benefits for the Florida DOT Five Year Work Program.
3. Georgia – REMI® Policy Insight®: A forecast model is used to determine user highway benefits for interstates. The output is processed through REMI® Policy Insight® to determine economic benefits for the interstates.
4. Indiana – MCIBAS: The model includes three components: 1) travel demand module, 2) user benefit-cost analysis, and 3) an economic analysis system. The economic analysis system calculates user benefits and potential business attraction from the other two separate modules. Those outputs are used in REMI® Policy Insight® to project benefits for major highway corridor projects.
5. Iowa – I-O Model: An internal state model that estimates economic impacts from airports only.
6. Kansas – B/C Analysis, I-O Model: Two separate models are used in the transportation economic analysis. The B/C analysis is used to show return on investment for the highway plan users: HERS, surveys, cash flow models, etc. The I-O model is used to estimate the overall economic impacts from the Kansas transportation program. Neither model evaluates economic benefits on a project-by-project basis.
7. Louisiana – Internal Multiplier Model: Evaluates economic impacts derived from seaports only.
8. Maine – REMI® Policy Insight®: Used to determine the economic benefits derived from an east-west highway connector project to access Canadian markets.
9. Maryland – I-O Model: Estimates economic benefits for different modes of transportation including highways, airports, seaports, and transit. The I-O

model retrieves data from: U.S. Bureau of Labor Statistics, Consumer Expenditure Surveys, interview, census data, and local data as source inputs. Currently the model is used on a case-by-case basis and not on all potential transportation projects.

10. Michigan – REMI® Policy Insight®: Estimated benefits from the model are used for the Five-Year Transportation Plan of the Michigan DOT, which is not project-specific.
11. Missouri – REMI® Policy Insight®, RIMS, IMPLAN: The three models are used on a case-by-case project level to determine the potential economic benefits that could be derived from transportation improvements. The state DOT is considering using the REMI® Policy Insight® model in the future for planning and programming analyses.
12. Oklahoma – Homeland Security Model: A model is currently being formed to project negative economic impacts that could result from terrorist attacks on state bridges.
13. Oregon – Oregon Statewide Model: An I-O model based on IMPLAN, which tries to establish relationships between the state economy, land use patterns, and transportation flows.
14. South Dakota – REMI® Policy Insight®: The state DOT has used the model in the past for transportation projects but does not currently use it.
15. Vermont – IMPLAN, I-O model: Both models are used by the DOT to determine public-use airport’s effects on the state’s overall economy.
16. Wisconsin – REMI® Policy Insight®, IMPLAN, HERS-ST: The three models are used to assist the DOT assess transportation investments (highway bypass, bridge, aviation, rail, etc.) and their potential economic impacts.

According to the TTI survey, the following states were not using formal evaluations of economic impacts when assessing proposed transportation projects: Alabama, Alaska, Arkansas, California, Colorado, Connecticut, Delaware, Idaho, Illinois, Massachusetts, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Nevada, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Virginia, Washington, West Virginia, and Wyoming (Burke et al. 2005).

### *2.4.2 Ohio DOT –TRAC*

The Ohio TRAC is an expert panel that decides which projects will be funded and was created in 1997 to help Ohio improve their transportation network. The TRAC consists of the director of ODOT and eight appointees. TRAC, though still an expert panel, uses quantitative information to rank each project (ODOT 2006).

Ohio TRAC updated the ranking process and procedures in December of 2008. Changes in the major new project-selection criteria were made, including the weighting of the criteria, as well as the criteria themselves, in order to better align with the initiatives of ODOT in the project-selection process (ODOT 2008). The policies and procedures from 2006 more closely reflect the intent of UDOT and were thus of more interest in this research. The previous TRAC (ODOT 2006) procedures are discussed in this section.

TRAC is focused on major new capacity projects more than $5 million that do one 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 may include projects such as new interchanges for economic development or local access, addition of general purpose lanes, etc. TRAC may even choose to participate in non-traditional projects that cannot be scored according to traditional methods. These include projects such as Intelligent Transportation Systems (ITS), modal hubs, rail infrastructure, and other similar facilities that will help the transportation network (Schultz et al. 2006).

The TRAC scoring process generally begins in May each year with a final list of projects being produced around the end of June. Each project is then placed into three tiers. Tier I includes those projects recommended for construction that will be funded. Tier II projects receive funding for environmental impact analyses, right-of-way (ROW) acquisitions, and other studies needed before construction can begin on those projects (however, TRAC is not obligated to fund these projects for construction in the future). Tier III are projects not recommended for future development (ODOT 2006).

The scoring process has three different sections; however, all are considered concurrently. The scoring system is summarized in Table 2-1. As illustrated, points for economic development count for only 30 percent of the scoring; the other 70 percent goes towards engineering factors such as annual average daily traffic (AADT), congestion, and safety. TRAC does consider three additional parameters that act as “extra credit” in the scoring. The additional points include any public/private/local participation, if it is a unique multi-modal project, or if the project is trying to revitalize a Brownfield site.

Ohio TRAC has strict policies concerning how the economic parameters are scored. According to the policies and procedures, in order to “assign economic or job creation points for a project, the Ohio Department of Development (ODOD) and ODOT must be assured that the economic development is not speculative but is certain and documented” (ODOT 2006, p. 6).

Economic scoring is done by ODOD in conjunction with ODOT. The intent is to promote new economic development, which is new investment, employment, or retention that is directly tied to construction of the major new capacity project. These benefits must be realized within 3 years of the project completion. Projects that are to be considered are forwarded to ODOD, which then analyzes each project’s economic impacts.

Understanding how each economic parameter is scored is important. The scoring system can be seen in Table 2-2. The scoring is done according to five parameters: 1) job creation, 2) job retention, 3) economic distress, 4) cost effectiveness of investment, and 5) level of investment. Each is briefly discussed in the sections that follow.

#### 2.4.2.1 Job Creation

Job creation is defined as the total number of non-retail jobs created as a direct result of the transportation project construction. The scores can be applied to the “immediate” and/or “future” categories. TRAC also recognizes the contribution that tourism makes to the state’s economy and thus will pro-rate how many jobs are produced in tourism for how many months that job is available (e.g., a tourist facility that operates 6 months per year is discounted 50 percent) (ODOT 2006).

**Table 2-1. Ohio TRAC Scoring System (adapted from ODOT 2006)**

| 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 crashes per 1 million miles of travel during 3-year period | 15 |
| **Transportation points account for at least 70% of a project's 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 county | 5 |
| | Cost Effectiveness of Investment – A ratio of the cost of the jobs created and investment attracted. Determined by dividing the cost to 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 project's base score** | | **30** |
| **Additional Points** | | |
| Funding | Public/Private/Local Participation – Does this project leverage additional funds which allow state funds 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 sites? | 10 |
| **Total Possible Points Including Transportation, Economic Development, and Additional Categories** | | **130** |

**Table 2-2. Ohio TRAC Economic Scoring Table (adapted from ODOT 2006)**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Job Creation** | | | | | | |
| Number of Jobs (Immediate 0-3 years) | | 100-199 | 200-399 | 400-599 | 600-799 | 800 |
| Points: | | 2 | 4 | 6 | 8 | 10 |
| Future Number of Jobs (3+ years to 5 years) | | 100-799 | 800-1199 | >1200 | | |
| Points: | | 2 | 4 | 6 | | |
| **Job Retention** | | | | | | |
| Number of Jobs Retained | | 25-49 | 50-99 | 100-149 | 150-199 | 200 |
| Points: | | 1 | 2 | 3 | 4 | 5 |
| **Economic Distress** | | | | | | |
| County's 5-year Unemployment Rate in Relation to Statewide Rate | | 1-10% Greater than Statewide Rate | 10.1-20% Greater than Statewide Rate | 20.1-25% Greater than Statewide Rate | 25.1-30% Greater than Statewide Rate | 30.1% of Greater than Statewide Rate |
| Points: | | 1 | 2 | 3 | 4 | 5 |
| **Cost Effectiveness of Investment** | | | | | | |
| ODOT's Cost/# of Jobs Created | >$400,000 per job | $300,001-$399,999 per job | $150,001-$300,000 per job | $100,001-$150,000 per job | $50,001-$100,000 per job | $50,000 or less per job |
| Points: | 0 | 1 | 2 | 3 | 4 | 5 |
| **Level of Investment** | | | | | | |
| Amounts of Investment (Immediate 0-3 years) | | $50,000-4.99 Million | $5 – 9.99 Million | $10 – 14.99 Million | $15 – 19.99 Million | >$20 Million |
| Points: | | 1 | 2 | 3 | 4 | 5 |

### 2.4.2.2 Job Retention

Job retention recognizes the impacts that transportation investments have on retaining a viable economic base in a region. In order to be scored, the retention must be documented and the connection to the project explicit. The methods for documenting this are not defined by ODOT (ODOT 2006).

#### 2.4.2.3 Economic Distress

ODOT recognizes that not all counties have an equal ability to attract businesses and industries from out of state. Some counties lack the ability because of deficiencies in infrastructure. Points are awarded to “distressed” counties, or those that have a 5-year unemployment rate that is higher than the average statewide rate over that same period (ODOT 2006).

#### 2.4.2.4 Cost Effectiveness of Investment

Cost effectiveness of investment is a measure of the project benefits in terms of employment compared to the total completion cost (ODOT’s cost per number of jobs created). This parameter adds more weight to projects that create the largest number of jobs for the least cost. The ratio is calculated as total cost divided by number of jobs created. Scoring is based on the best-case assumption of a $5 million project creating 100 jobs as the top score (ODOT 2006).

#### 2.4.2.5 Level of Investment

Level of investment refers to the amount of investment coming from non-retail, private-sector capital to fund the project. Just as job creation, the funds must be realized in the project within 3 years of the completion of the project (ODOT 2006).

### *2.4.3 Indiana DOT – MCIBAS*

The system for Indiana has roots back to 1986 when the state identified economic development as a key strategy in the statewide transportation plan. In 1991, corridors were added to the plans and developed into MCIBAS, which is an integrated system of tools and models for assessing the relative costs, benefits, and economic impacts of proposed major highway corridor projects. Modules included in MCIBAS are Indiana Statewide Travel Model (ISTM), NET_BC, Economic Impact Analysis System (EIAS), and REMI® Policy Insight® (Gkritza et al. 2007).

The information generated by MCIBAS is used only for the decision-making process after accounting for in-state transfer of jobs among corridors. Impacts are measured and then monetized using business and tourism attraction models. MCIBAS also allows for projects within the state to be compared to each other (Gkritza et al. 2007).

There are some reported drawbacks that exist with MCIBAS. One study states that even though MCIBAS is a useful tool to analyze corridor alternatives, the models are difficult to use and costly for the prioritization of multiple projects or project packages in the statewide plan (CUBRC et al. 2001). MCIBAS also requires specialized expertise by users who must also have a sufficient understanding of the statewide economy and industries to properly interpret the results. Another study states that MCIBAS is too complex to be used in-house by INDOT; thus, projects evaluated by MCIBAS to assess project benefits have required the use of consultants and not staff (CSI et al. 2006).

## 2.5 Key Findings

The relationship between economics and transportation is an age-old question, and many papers have been written to verify how this relationship works and how it can be modeled. The tie between the two concepts is apparent but still being understood. From the literature review presented on the relationship between economics and transportation, the following are considered the key concepts learned:

1. Transportation itself is not enough to induce economic development. The transportation system is needed and should be considered an enabler of that development, but it alone is not sufficient to cause economic development. Several variables are involved in economic development, and not any one variable is the prime inducer (Ewing 2008, Forkenbrock 1990, Gkritza et al. 2007, Rephann and Isserman 1994).
2. The large economic benefits that followed major transportation improvements, such as the interstate system, are no longer being seen. Present-day improvements to a network produce a comparatively small improvement to accessibility, and thus do not have the same effect they once

had. However, transportation is still an important variable in the economic development equation (Ewing 2008, Gkritza et al. 2007, Weisbrod 2000).

3. A time lag exists for experiencing all of the possible benefits due to a transportation project. The short-term benefits are considered to happen within 5 years of construction. Medium-term benefits occur up to 10 years after construction and include benefits such as increased retail and movement of the workforce. Long-term benefits occur within 25 years and include new industry. Planners should understand the time lag to appropriately consider the economic potential of a project (Alam et al. 2005, Rephann and Isserman 1994).
4. Project type plays a large role in the possible economic potential provided to an area. Overall, investments on freeways or highway functional classes result in a stronger potential for economic development. The larger the project, the greater the economic development potential of the project (Gkritza et al. 2007).
5. Location is a major descriptor of the ability of a project to provide economic potential. Location determines access to raw materials, infrastructure, and potential employees (CSI et al. 2008, Gkritza et al. 2007).
6. Businesses located in or near large populations have greater access to labor markets. A large labor market also means a greater access to future employees (CSI et al. 2008, Gkritza et al. 2007).
7. Businesses located near institutions of higher learning have greater access to a skilled/trained workforce. In fact, businesses will go to areas where there are skilled workforces (CSI et al. 2008, Gkritza et al. 2007).
8. Existing infrastructure, including telecommunications, contributes to the attractiveness of an area. In other words, more existing infrastructure will make an area more attractive, and the lack of existing infrastructure will detract from the attractiveness of an area (Gkritza et al. 2007).
9. If transportation projects improve the productivity of a business, they are essentially providing a boost to the competitiveness of that business (CSI et al. 2008).

10. Congestion affects several aspects of the economy and will greatly affect the ability of companies to be competitive (CSI et al. 2008, Schrank and Lomax 2007).
11. TREDIS® and REMI® TranSight™ are very comparable software, as they both attempt to analyze economic benefits of transportation projects. TREDIS® provides a benefit in the ability to model on a much more refined scale. REMI® TranSight™ benefits from a much larger customer base, providing a broader range of stock data. Another benefit of REMI® TranSight™ is the lower cost to acquire and operate over the long term (Kreis et al. 2006).
12. In 2003 it was reported that three states were developing economic policies for transportation: 1) California, 2) Colorado, and 3) Utah (Weisbrod and Gupta 2003).
13. Surveys continually show that job creation and retention are the most important factors to communicate to the public (Gkritza et al. 2007, Schultz et al. 2006, Weisbrod 2000).
14. Ohio currently uses a system that provides a board of experts (TRAC) a group of projects ranked according to the economic potential of each project. TRAC then uses the extra material to support decisions on which projects should be programmed (ODOT 2006).

# 3 Project Selection: Background of the Tiered Process

Before a project receives funding for construction, a project-selection process must be followed. The first part of this process is the development of the LRP. UDOT works closely with the four Utah MPOs—Cache MPO, WFRC, Mountainland Association of Governments (MAG), and Dixie MPO—to develop a unified LRP that provides a consistent and accurate depiction of the statewide transportation needs. UDOT develops the LRP for the rural areas, whereas the MPOs develop the LRPs for the urban areas that they serve. The MPOs then facilitate the coordination of planning between any local agencies and UDOT in order to have a unified plan. This unified plan is based on common growth projections, financial assumptions, and project-selection processes on which the planning agencies have individually and collectively agreed. The project list is then divided into phases in order to address when the projects should most likely be considered over the approximately 25-year planning horizon (UDOT 2007a).

The next step in the planning process is the Statewide Transportation Improvement Program (STIP), a 6-year program of projects selected for implementation from the LRP. The first 4 years include projects with identified funding, whereas the last 2 years contain unfunded projects. The projects brought from the LRP to the STIP have the highest near-term feasibility and priority to the state and region and are consistent with the respective goals and the long-range plans of UDOT and the MPOs. The Federal Highway Administration (FHWA) requires that the STIP be updated every 4 years, but UDOT typically performs annual updates (UDOT 2007a).

Determining the priority of projects in the STIP is a large task and one that UDOT has continually addressed in order to program the best possible projects for Utah. Project prioritization is so important that Utah has an administrative rule (R907-68) for prioritization of new transportation capacity projects. A copy of the full text of the administrative rule R907-68 is provided in Appendix B. This rule gave rise to the current two-tiered project-selection process.

This chapter discusses the administrative rule R907-68 and how it produced the two-tiered evaluation process. An overview of how Tier I functions and is scored is provided next. Finally, the relationship between the Tier I and the Tier II processes is given.

## 3.1 Administrative Rule R907-68: Prioritization of New Capacity Projects

The strategic goals of administrative rule R907-68 that guide the prioritization process follow the four strategic goals of UDOT, namely: “1) take care of what we have, 2) make it work better, 3) improve safety, and 4) increase capacity” (UDOT 2007a, p. 2). The following are the strategic goals of R907-68:

1. UDOT will first seek to preserve current infrastructure and optimize the capacity of existing highway infrastructure before applying funds to increase capacity by adding new lanes.
2. UDOT will address means to improve the capacity of the existing system through technology such as ITS, access management, transportation demand management, and others.
3. UDOT will assess safety through projects addressed in goals (1) and (2). UDOT will also target specific highway locations for safety improvements.
4. Adding new capacity projects will be recommended after considered items in goals (1), (2), and (3).
5. All recommendations will be forwarded to the Transportation Commission for their review/action.

The administrative rule also sets forth procedures on how to prioritize the new capacity projects:

1. Major new capacity projects will be compiled from the LRP.
2. The list will be prioritized based upon transportation efficiency factors and safety factors. Each factor will have a specified weight.

3. Projects will be ranked from highest to lowest with priority being assigned to the projects with the highest overall rankings.
4. The Transportation Commission will further evaluate the projects with highest rankings, considering contributing components that include other factors such as economic development.

With the evaluation and ranking system, the Transportation Commission still has discretion as to where projects will be built or what criteria should be used to rank the projects. If the Commission decides to prioritize a project over another that has a higher ranking, the Commission must identify the change and the reasons for it and accept public comment on the change.

These procedures effectively created the current two-tiered system used by UDOT to evaluate potential roadway projects. In the first tier, Tier I, projects are evaluated according to transportation efficiency and safety factors. In the second tier, Tier II, further evaluation of the projects is performed. This further evaluation includes: 1) congestion, 2) economics, 3) environmental impacts, and 4) safety impacts. This two-tiered system produces the rankings that are then presented to the Transportation Commission, which makes the final decision on which projects are funded.

## 3.2 Tier I Overview

The UDOT Tier I process is the first step in the prioritization of transportation projects. In the primary selection process, any project that is estimated as $5 million or more is subjected to the Tier I objective scoring system. The projects scoring in the top third of Tier I are then evaluated in the Tier II process (Schultz et al. 2006, UDOT 2007b).

Originally an undocumented and anecdotal process was used to prioritize the projects for the STIP. However, UDOT and the state legislature recognized a need to provide a more consistent and automated system, which has given rise to the tiered process now in place. The current scoring system originated as a macro-based computer spreadsheet. However, in 2008, a consultant was retained to make the Tier I process more efficient and avoid double-counting parameters across a project. The system developed is called the "Decision Support System" and provides the same information as the original spreadsheets, but with greater ease of use. The same inputs are used in the new program, such as AADT and volume-capacity (v/c) ratios. The new program is designed to produce two summary sheets: 1) a summary that shows the scores of the project in all the different indices and 2) a summary that shows the funding that each of those projects is receiving in the order of highest to lowest scoring.

In order to explain what is happening in the Tier I process, first the standard indices used in scoring are presented. This is followed by a brief discussion on the types of project scoring classifications and their associated scoring indices.

### *3.2.1 Scoring Indices*

Each scoring index is evaluated on a project by project basis. These indices were formulated inside of UDOT and include:

- AADT,
- Truck AADT,
- v/c ratio,
- v/c ratio improvement,
- Safety index,
- Functional class,
- Transportation growth,
- Vehicle-hours-saved,
- B/C ratio,
- Adjacent interchange v/c ratio, and
- Average adjacent interchange distance.

#### 3.2.1.1 AADT

The AADT parameter is different depending on whether or not the facility is already in place or is still to be built. Three scenarios exist with this: 1) if the facility does not yet exist, projected AADTs must be developed for the facility; 2) the facility exists and must have the current AADT; and 3) the facility exists and needs a projected AADT.

Areas that have local MPOs have traffic models that estimate future AADT. Model data is supplied by the MPOs for this index. For rural facilities that already exist but need a projected AADT, a growth factor is provided by UDOT. For most projects these AADT values are those used as the volume component in the v/c ratios.

If the facility already exists but only needs a current AADT, the AADT information comes from traffic analysis by the Systems and Planning and Programming Division of UDOT. A web-based book called *Traffic on Utah Highways* is published yearly by UDOT. As of the writing of this report, the book was from 2007. *Traffic on Utah Highways* is specifically created with the intent that the statistics would be used by transportation management, business, and the public. The traffic information is intended to be used for planning, programming, highway design, maintenance, traffic control, and general administration of highway systems. The statistics are developed by the Traffic Analysis Section through the following counting stations (UDOT 2007c):

- 95 continuously operated, permanent, automatic, traffic-recording stations provided by UDOT.
- 3 continuously operated, permanent, automatic, recording stations provided by the United Stated Department of the Interior and National Park Service.
- 4 continuously operated, permanent, automatic, recording stations provided by the Colorado, Idaho, and Wyoming DOTs.
- 4,379 (approximately) short-time counts provided by UDOT.
- 19 seasonal counts that are provided by Cache and Salt Lake Counties.

In *Traffic on Utah Highways,* AADT represents traffic in both directions of travel and is the average for that particular section of the route. The routes are divided by the following: 1) major intersections, 2) sections where traffic volumes show a substantial increase or decrease, 3) beginning and ending of most incorporated limits and urban boundaries, and 4) county lines (UDOT 2007c).

#### 3.2.1.2 Truck AADT

For truck AADT, UDOT also publishes a web-based book yearly, similar to *Traffic on Utah Highways*, called *Truck Traffic on Utah Highways* (UDOT 2007d). The same methods used to obtain the data for AADT are used to obtain the Truck AADT percentages; UDOT then finds averages for rural and urban roadways based on the designations of the roadway as a freeway, major arterial, or minor arterial. The routes are defined just as in *Traffic on Utah Highways*, as discussed in section 3.3.1.1. Average truck percentages across functional classes, as used in the new facility construction type spreadsheet, are provided as a sample in Table 3-1. The only two inputs for this index are the AADT for that segment and the percentage of trucks. The AADT is multiplied by the percentage of trucks to find the number of trucks using the route.

**Table 3-1. Truck AADT Percentages According to Classifications**

| | Rural | | | Urban | | |
|---|---|---|---|---|---|---|
| Functional Class | Freeway | Arterial | Minor | Freeway | Arterial | Minor |
| Percentage (%) | 34.6 | 30.3 | 26.3 | 13.1 | 13.9 | 14.6 |

#### 3.2.1.3 v/c Ratio

The volumes used for the v/c ratio are the AADTs that are discussed in section 3.2.1.1. The v/c ratio provides information on the level of congestion to planners and decision-makers. Theoretically, the v/c ratio cannot go higher than 1.00, or traffic volumes equaling the capacity of the roadway. The capacities used in the v/c ratio are either already known from previous analyses or must be estimated.

Finding a capacity for a corridor is a function of several parameters. Roadways that have the same cross-sections may have different capacities because of different factors. Because of the amount of data required to accurately report the capacity of a roadway, UDOT retained a consultant to make a standardized process to estimate the capacity of any roadway in Utah.

Originally, the process was used for the environmental analysis by UDOT, but the planning division now also uses the capacity estimates. The UDOT consultant used the Highway Capacity Software (HCS) software, which is based on the *2000 Highway Capacity Manual (*HCM) (TRB 2000), to help create a table of capacities for surface streets. The tables allow for consistency in comparing alternatives. Using the tables allows for a large and relatively quick screening process of the capacities of existing and potential roadway projects (InterPlan, 2007).

The consultant made several assumptions in developing the tables using HCS and the standards used in the HCM (TRB 2000). Capacities were estimated to be based on the 30$^{th}$ highest daily hour volume (DHV). Using this assumption, the following factors for HCS were input as Utah state averages (defaults). More details on the default values used can be found in the literature (InterPlan 2007).

- K-factor,
- Directional split,
- Peak hour factor (PHF),
- Base saturation flow rate,
- Percent heavy vehicles,
- Percent turns from exclusive lanes,
- Arrival type (quality of progression between signalized intersections),
- Control type (how much is the signalized intersection actuated),
- Cycle length at a signalized intersection,
- Arterial class (based on speed and signal density),
- Posted speed,
- Median type, and
- Passing lanes.

The tables, using the default values, were stratified according to five categories (InterPlan 2007):

- Area Type: This refers to the area surrounding the project. The four types of areas are: 1) urbanized area within a Central Business District (CBD), 2) urbanized area outside a CBD, 3) small urban areas (less than 50,000 population), and 4) rural areas (areas with little or no development).
- Roadway Type: There are four roadway types to choose from: 1) high-speed arterials (speed threshold above 45 mph); 2) low-speed arterial (same as the high-speed arterials, but averaging below the speed threshold); 3) collector (intended to carry traffic from local streets to arterials); and 4) uninterrupted/interrupted (roadway segments with less than one signal per mile are considered "uninterrupted").
- Signals/Mile and Terrain: The segment length must be defined in order to analyze how many signals are in the segment. Once that segment length is defined, it may be divided into two categories according to terrain type: 1) flat and 2) rolling or mountainous.
- Basic Roadway Cross-Section: This is based primarily on the number of through lanes, and turn lanes when appropriate.
- Level of Service (LOS): The table capacities are defined according to the LOS.

The consultant states that the tables should only be used when planning a roadway project and there is a need to predict the capacity for project alternatives meeting generalized conditions. The tables are not expected to be accurate if the following variables are significantly different from the original assumptions: 1) directional split, 2) percent heavy vehicles, and 3) grade. The tables are very useful when a quick and generalized determination of capacity is sufficient and when statewide default values can be used. When no data exist for a project or roadway, the tables will broadly predict an outcome. However, the user must understand that accuracy and precision will vary according to the project. When evaluating several alternatives, the tables decrease the amount of time and data needed to estimate capacities (InterPlan 2007).

The consultants also note that the capacity tables should not be used for any operational analyses, which require more detailed inputs instead of defaults. If the roadways are not standard in any way (i.e., nonstandard lane widths, excessive amount of accesses, extreme directional split, etc.), the tables may either underestimate or overestimate the capacity. The tables are also meant for roadways that have the passenger car as the predominant vehicle. In addition, when detailed inputs are readily available, they should be used to obtain a more accurate capacity (InterPlan 2007).

The capacity tables provide a consistent, easily repeatable method for estimating the capacities of most roadways in Utah, making the process less time-consuming and less data-intensive to sort through a preliminary list of projects. These estimated capacities are then used in the v/c ratios. The volume data should be estimated from true traffic counts or projected traffic counts. Because the capacity tables are based on AADT, the volumes used in the v/c ratio should also be AADT values.

An example arterial roadway capacity table is provided in Table 3-2. The values shown are vehicles per day (vpd). In choosing the correct table from which to pull the estimated capacities, five steps must be followed: 1) determine the area type, 2) determine the roadway type (mainly by posted speed), 3) determine signal/mile and the terrain type, 4) determine the basic roadway cross-section (number of lanes), and 5) determine the desired LOS (this LOS is the LOS during the peak hour). The LOS is determined by choosing the acceptable LOS for that facility at the peak hour. The value given is the maximum daily traffic volume for each LOS (InterPlan 2007).

When calculating the capacity for freeways for Tier I, the HCM method is used for the estimate (TRB 2000). The capacity used from HCM is the maximum 15-minute passenger car equivalent flow rates for each freeway lane (passenger cars per hour per lane, pcphpl). The results from the HCM methodology are maximum capacities of 1830 pcphpl and 2170 pcphpl for rural and urban freeways, respectively. Standard factors such as PHF, direction split, and heavy vehicle factors for Utah were used for the HCM freeway calculation (InterPlan 2007).

**Table 3-2. Capacity (vpd) for a High-Speed Arterial in an Urbanized Area Outside of the CBD (adapted from InterPlan 2007)**

| **Urbanized Area – Outside CBD**<br>ARTERIAL, HIGH SPEED (>45 MPH) WITH: | | | | | |
|---|---|---|---|---|---|
| 0-2 Signals/Mile: | | | | | |
| | Design Hour Level of Service | | | | |
| Total # Lanes | A | B | C | D | E |
| 2 no Turn Lanes | 2,100 | 6,000 | 10,400 | 12,600 | 13,400 |
| 2w/ Turn Lanes | 3,400 | 9,600 | 16,200 | 19,300 | 20,500 |
| 4 | 7,600 | 21,700 | 34,700 | 38,900 | 41,200 |
| 6 | 10,900 | 30,900 | 48,600 | 53,500 | 56,700 |
| 8 | 14,900 | 38,000 | 65,700 | 71,500 | 75,700 |
| More than 2 Signals/Mile: | | | | | |
| | Design Hour Level of Service | | | | |
| Total # Lanes | A | B | C | D | E |
| 2 no Turn Lanes | 2,000 | 4,500 | 6,400 | 12,200 | 12,800 |
| 2w/ Turn Lanes | 3,200 | 6,900 | 10,300 | 18,600 | 19,600 |
| 4 | 7,400 | 18,100 | 23,300 | 37,700 | 39,400 |
| 6 | 10,400 | 26,400 | 33,300 | 52,000 | 54,300 |
| 8 | 12,800 | 36,200 | 45,600 | 69,500 | 72,400 |

### 3.2.1.4 v/c Ratio Improvement

The roadways surrounding a potential project must be analyzed according to their v/c ratio (as discussed in section 3.2.1.3) for both a “no-build” and “build” scenario. The no-build v/c ratio is then compared to the v/c ratio of the system with the roadway improvement in place. A percentage improvement is then calculated and scored as the v/c ratio improvement. Overall, this index measures how the roadway improvement will alleviate congestion in an area.

### 3.2.1.5 Safety Index

The safety index (SI) was internally developed at UDOT. It is meant to measure the degree of risk for the driver regarding both the crash rate (crashes per million vehicle-miles traveled or crashes/MVMT) and crash severity. UDOT has defined severity as a scale of 1 to 5: 1) possible property damage only, 2) possible injury, 3) bruises and abrasions, 4) broken bones and bleeding wounds, and 5) fatality. The scale was created to consider both the severity and the crash rate, according to the functional class. UDOT has found the index to be viable and has used the index for several years in the Planning Division. Equation 3.1 is used to determine the SI for a roadway segment. The equation needs two primary inputs: 1) crash rate score and 2) crash severity score.

$$SI = (Crash\_Rate\_Score) + [3 \times (Severity\_Score)] - 2 \qquad (3.1)$$

The crash rate score is determined for a corridor using a graph with crash rate (crashes/MVMT) versus mile segment. A graph will be made for each roadway segment being analyzed for safety. An example of the graph used for determining the crash rate score is provided in Figure 3-1. The graph is for an urban principal arterial; the large, bold numbers represent the crash rate score with bold lines separating the point ranges. The mile segments (on the *x*-axis) are ordered from lowest to highest crash rate, creating a distribution of crash rates on the corridor. The graph is divided into thirds by taking the highest crash rate in the corridor and dividing the value by three to create a range for scores; the bottom third is considered good and assigned 1 point, the middle is considered fair and assigned 2 points, and the top third is considered poor and assigned 3 points. Thus, the crash rate score ranges between 1 and 3 points.

The same procedure for scoring the crash rates is followed for assigning points to the crash severity. The graph, shown in Figure 3-2, represents the number of crashes versus mile segments. The mile segments (on the *x*-axis) are plotted according to the frequency of severe crashes (4 and 5 on the crash severity scale by UDOT) over a year, creating a distribution of crash-severity frequency on the corridor. Figure 3-2 is split into thirds for scoring. The highest frequency is divided by three to create ranges for the crash-severity scores, the highest third receiving 3 points and the lowest receiving 1 point. The range for severity score is 1 to 3, with 3 being the most severe.


**Figure 3-1. Urban principal arterial crash rate score.**

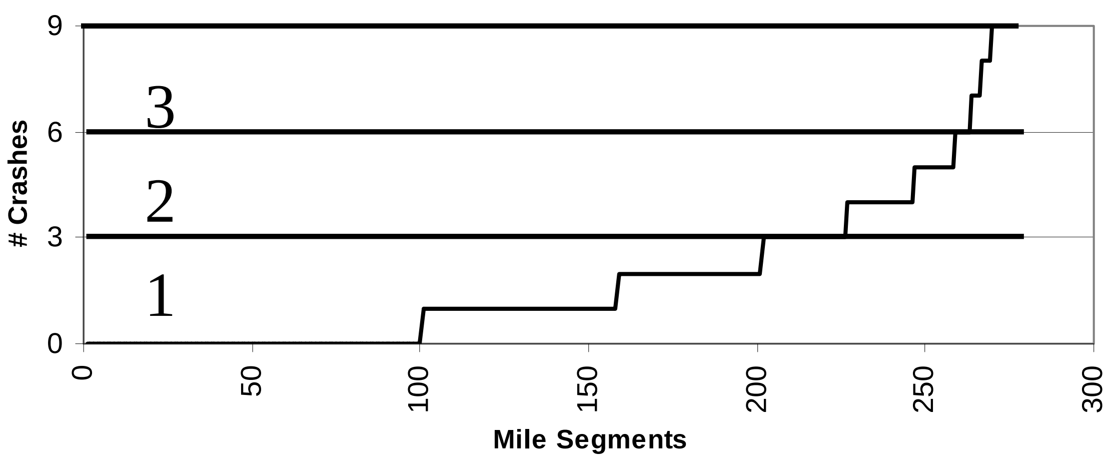


**Figure 3-2. Urban principal arterial crash severity score.**

Once the crash rate score and the crash severity scores are determined, the values are applied to the SI in Equation 3.1. This will result in a score between and 2 and 10. When no crashes have occurred on a segment, the equation is not used, but the segment SI would be 1, creating a final index range of 1 to 10. Currently for project selection, the SI value used is the average SI for that segment over the last 3 years for which data are available. This way a decrease in traffic volume the last year will not have as great of an effect on the safety of the highway. A sample of the SI results is shown in Table 3-3.

**Table 3-3. Possible Scoring Results for the Safety Index**

| Rate Score | Severity Score | SI Score |
|---|---|---|
| (no crashes) | (no crashes) | 1 |
| 1 (w/crashes) | 1 | 2 |
| 2 | 1 | 3 |
| 3 | 1 | 4 |
| 1 | 2 | 5 |
| 2 | 2 | 6 |
| 3 | 2 | 7 |
| 1 | 3 | 8 |
| 2 | 3 | 9 |
| 3 | 3 | 10 |

#### 3.2.1.6 Functional Class

UDOT bases the functional classifications on the specifications in *A Policy on Geometric Design of Highways and Streets 2004* by the American Association of State Highway and Transportation Officials (AASHTO) (AASHTO 2004). Every 2 years UDOT develops maps classifying each roadway by functional class. The most recent maps are used to determine the functional classification to be used in the project-selection process.

#### 3.2.1.7 Transportation Growth

Transportation growth is dependent upon whether or not the roadway is considered an urban or rural roadway. For this criteria, an urban roadway is within MPO boundaries, while rural is outside of the MPO boundaries. The local MPOs are charged with creating LRPs in metropolitan areas; UDOT has the same charge for rural roadways. MPOs have working models for the urban roadways and have generated the transportation growth in those roadways. Rural roadways receive a straight-line forecast based on UDOT LRP results.

### 3.2.1.8 Vehicle-Hours-Saved

The vehicle-hours-saved index is specifically designed for determining the time savings for any roadway project that is an interchange or an intersection. Time savings are very important when considering roadway transportation projects. If increasing accessibility to the network can decrease travel times, it is a great benefit. UDOT developed Equation 3.2 to specifically measure the daily vehicle-hours-saved by adding/upgrading an interchange or intersection. Daily hours saved is the difference of the travel-times of the no-build and build alternatives for a new interchange/intersection. The total traffic for the equation is the AADT that would use the ramp or the intersection.

$$Daily\_Vehicle\_Hours\_Saved = \frac{[Total\_Traffic \times 30]}{3600} \qquad (3.2)$$

### 3.2.1.9 B/C Ratio

The B/C ratio builds off of Equation 3.2, which is then used to find user cost savings (Equation 3.3) that can then be used to find the B/C ratio (Equation 3.4). The projects are only considered on a case-by-case basis. The user B/C ratio assumes a benefit of $12 for each vehicle hour saved over 50 years. The estimated net interchange costs are based on the location to the metropolitan area as follows: 1) central urban area interchange is $40 million, 2) fringe urban area interchange is $25 million, and 3) rural area interchange is $15 million.

$$User\_Cost\_Savings = [Daily\_Vehicle\_Hours\_Saved] \times 50 \times 365 \times 12 \qquad (3.3)$$

$$B/C\_Ratio = \frac{[User\_Cost\_Savings]}{[Net\_Interchange\_Cost]} \qquad (3.4)$$

#### 3.2.1.10 Average Adjacent Interchange Distance

The average adjacent interchange distance score results from the distance to the adjacent interchanges, which is based on an average of the two nearest interchanges. The larger the average distance to the interchanges or the farther away adjacent interchanges are, the higher the score or need for the new interchange.

#### 3.2.1.11 Adjacent Interchange v/c Ratio

The adjacent interchange v/c ratio is based on the v/c ratio of the projected year. The v/c ratio estimates are from peak period traffic volumes from the MPO travel demand models. For interchanges outside of the MPO boundaries, the diversion of traffic from adjacent interchanges was estimated based on service area, local knowledge, and engineering judgment. The no-build v/c ratio is then compared to the build alternative v/c ratio, and the difference is taken between the two. Scores are then awarded accordingly. However, scores will only be calculated if the no-build alternative has the adjacent interchange operating at a v/c ratio above 0.75 (LOS D).

### *3.2.2 Types of Project Scoring Classifications*

Each project is classified by the type of roadway construction project: 1) widening existing facilities, 2) constructing new facilities, 3) constructing new interchanges on existing freeways, and 4) upgrading existing at-grade intersections (signalized). The four types of project scoring classifications each use a different set of scoring indices in ranking a project as summarized in Table 3-4.

### *3.2.3 Moving Forward after Tier I*

Projects that score in the top third of total scores in Tier I will move forward to the Tier II process. The Tier II process is a more in-depth evaluation of congestion, economics, environmental impacts, and safety. Tier II is meant to provide decision-makers with a wider view of the overall benefits and costs associated with a project. More details of the basic Tier II design and need are addressed in the following section.

**Table 3-4. Scoring Indices by Project Type**

| Scoring Index | Project Type: Widening Existing Facilities | Constructing New Facilities | Constructing New Interchange on Existing Freeway | Upgrading Existing at-Grade Intersections (Signalized) |
|---|---|---|---|---|
| AADT | ✓ | ✓ | ✓ | ✓ |
| Truck AADT | ✓ | ✓ | | |
| v/c | ✓ | ✓ | | |
| v/c Improvement | | ✓ | | ✓ |
| Safety | ✓ | | | |
| Functional Class | ✓ | | | |
| Transportation Growth | ✓ | | | |
| Vehicle-Hours-Saved | | | ✓ | ✓ |
| B/C | | | ✓ | ✓ |
| Adjacent Interchange v/c | | | ✓ | |
| Avg. Adjacent Interchange Distance | | | ✓ | |

## 3.3 Tier II Creation

The Tier II process is mandated by the transportation administrative rule R907-68. The rule requires that further analyses, specifically an economic analysis, need to occur after the Tier I analysis. The projects that advance to the Tier II evaluation are the top third from Tier I. Tier II is meant to be a supplement to the Tier I process and provide more information to the Utah Transportation Commission as they consider which projects should be included in the STIP.

Tier II consists of four performance measures: 1) congestion, 2) economics, 3) environmental impacts, and 4) safety. Any project passing through the Tier I process will be scored according to all four performance measures in Tier II. Because of the different metrics used in the other three parts of the Tier II analysis, some criteria that directly affect economics (e.g., congestion) were not directly considered in this research in order to avoid double-counting.

The economic analysis of Tier II provides an evaluation of the economic development potential of a group of projects based on several factors. The information is provided to the Transportation Commission as part of the "Decision Support System" to increase the amount of information available and assisting in more informed decisions. The economic component of Tier II is the focus of this research, and a system is suggested to evaluate and score the projects for economic development potential.

## 3.4 Chapter Summary

The two-tiered analysis of potential projects is a result of UDOT and the state legislature agreeing that a documented process was needed for the project-programming process. The result was the transportation administrative rule R907-68, which effectively created the two-tiered analysis. This chapter provided an overview of how the Tier I process works, discussing the evaluation criteria for each project type evaluated. The Tier II economic development criteria and framework are introduced and thoroughly discussed in Chapter 4.

# 4 Tier II: Economic Development Criteria and Framework

The Tier II process consists of four different evaluations: 1) congestion, 2) economics, 3) environmental impacts, and 4) safety. The research performed for this report was done to develop an economic development analysis, including criteria and a framework of the procedures. As no universal method exists for an economic analysis, a Policy Delphi method was used in the TAC to develop the economic development criteria and the framework.

One specific goal of the economic development analysis was to keep it a relatively inexpensive and effective method that could be quickly implemented, but is not overly complex. As the literature review showed, and as previously suggested by Schultz et al. (2006), the current computer economic models of REMI® TranSight™ and TREDIS® are not currently recommended for use in economic analyses for Utah. The cost, as well as the data collection effort needed, exceeds the current needs of Utah and UDOT. Without a dynamic model to predict job growth, criteria needed to be developed that would describe the economic growth occurring because of the transportation projects.

The most important item describing economic growth that needs to be disclosed to the public is job creation, as per the literature review. Without a dynamic computer model to provide a value for jobs created, the TAC determined to describe the potential for job creation as a result of transportation projects. In other words, instead of predicting the number of jobs created by a roadway project, the underlying variables of job creation would be evaluated to provide a potential or likelihood of economic growth due to a project.

This chapter discusses: 1) the TAC, 2) the Policy Delphi method and how it was used, 3) the economic development criteria development and finalization, and 4) the establishment and refinement of a set analysis framework.

## 4.1 TAC

To support this UDOT-funded research project, a TAC was formed to guide the development and finalization of the economic development criteria, as well as the analysis framework. The TAC included experienced professionals from UDOT and the BYU research team. The members include:

- Tim Boschert – UDOT Planning Division;
- Ahmad Jaber – UDOT Systems Planning Division;
- John Thomas – UDOT Planning Division;
- Kevin Nichol – UDOT Planning Division;
- David Stevens – UDOT Research Division;
- Peter Donner – GOPB;
- Grant Schultz – BYU; and
- Jason McGee – BYU.

## 4.2 Policy Delphi Method

As discovered in the literature review, there is no standard process of determining the criteria for economic analysis. No states share a general consensus on the possible economic development criteria. In fact, there is no method for exactly measuring economic development caused by a transportation improvement project. The lack of methods in creating such a process presented an exciting challenge to the research team. A system had to be created that would provide Utah with a well-defined method that would also be viable and simple to apply.

Members of the TAC used a Policy Delphi method to introduce, eliminate, and justify criteria that could be used to describe the economic potential a roadway could provide the state of Utah. “Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem" (Linstone and Turoff 1975, p. 3). The Policy Delphi method was used because the problem at hand would not be solved through analytical techniques alone, but also from subjective judgment on a collective basis.

The Policy Delphi method provided "an organized method for correlating views and information pertaining to a specific policy area and for allowing the respondents [which are experts in the field of study] representing such views and information to react and assess differing viewpoints" (Linstone and Turoff 1975, p. 87). Members of the TAC were such decision-makers and experts in the field of transportation and the project-selection process. Thus, this committee worked in an iterative process using information from the literature review, as well as economic experts to determine the economic development criteria and needed analysis framework.

Four steps in the Policy Delphi method were followed: 1) exploration of the subject, 2) finding how the group views the issues, 3) exploring the disagreements, and 4) final evaluation (Linstone and Turoff 1975).

### *4.2.1 Exploration of the Subject*

The exploration and gathering of needed data was performed by the BYU research team, who were also members of the TAC. Data was garnered through the literature review as described in Chapter 2, as well as through supporting field experts (i.e., EDC Utah, GOED, and GOPB). The information was then compiled by the team, and recommendations were created based on that data. These recommendations and their subsequent details were presented to the TAC for discussion.

### *4.2.2 Finding How the Group Views Issues*

Before the TAC meetings, each member would be presented a memorandum summarizing the recommendations from the BYU research team, along with any supporting information. These recommendations were formally presented to the TAC at the review meetings. Members of the TAC asked questions, voiced concerns, or offered opinions about the proposed recommendations. Many times the TAC brought up new ideas and issues concerning the recommendations. These ideas and issues were researched and then addressed in further evaluations in the Policy Delphi method with the collaborative help of the TAC members.

### *4.2.3 Exploring the Disagreements*

All of the input from the TAC was valuable information and was used to consider the issues relating to the problem at hand; all opinions or ideas expressed by the group were considered and debated. During the meeting the group would come to a conclusion on each problem resulting in abandoning an idea, continuing to research an idea, adding a new idea, or finalizing an idea. The BYU research team would take the results of each meeting and prepare for the following meeting either by continuing research on an idea, researching the new ideas, or formalizing the accepted ideas. This iterative process was used at each TAC meeting to finalize the criteria and economic analysis framework presented herein.

### *4.2.4 Finalization*

Through the Policy Delphi method the TAC narrowed down the criteria and the analysis framework to an exhaustive list. Once the TAC agreed on a certain set of criteria and a basic outline of the analysis framework, the BYU research team began to formalize and document the economic development analysis process. Once the criteria were formalized with weighting, scoring, and procedures, the formalized process was once again presented to the TAC for final consideration. The final results are presented herein. Overall, six rounds of meetings using the Policy Delphi method were used to identify those criteria the TAC felt would meet the goals of UDOT and the Transportation Commission.

## 4.3 Developing the Economic Development Criteria

The TAC understood the goals and visions for the economic development tool and intended to create criteria and policies that would support action to achieve those goals and visions. In order to create viable criteria or measures of effectiveness (MOEs), the MOEs must adhere to the following characteristics (Fricker and Whitford 2004):

1. Comprehensive: Includes all the important aspects of the problem.
2. Relevant: Is useful in differentiating between alternatives.
3. Well-defined: Is easily understood by all.
4. Non-redundant: Avoids double-counting of the attributes of the alternatives.

With no universal method of economic analysis for roadway projects and with the absence of dynamic computer modeling, the MOEs needed to provide insight into the economic growth potential had to be developed using the Policy Delphi method. Two main sources were tapped to provide a basis from which to start the analysis of possible criteria: 1) the literature review and 2) input from EDC Utah, GOPB, GOED, and TAC members.

### *4.3.1 Literature Review*

While the actual number of all the variables involved in the transportation-economic development relationship are not identified or even well known, there are some key factors that show the economic growth potential of the project. The following were discussed by the TAC using the Policy Delphi method to determine their use in the economic evaluation:

- Transportation alone does not induce economic development: Other variables are involved, but none are a prime inducer.
- Time lag: Understanding how benefits will come to fruition will play a role in determining the type of criteria.
- Functional classification: A highway will have a greater effect on economic development than a local street.

- Overall size (cost) of the project: The more money that is spent on a project, the greater the immediate economic benefit to an area.
- Access to the market and labor: Businesses are not only looking for customers, but a skilled work force.
- Existing infrastructure: Developers would prefer to move into an area that has most of the amenities they are already looking for; otherwise, they will have to pay to receive those amenities.
- Current economic trends: The local economy will play a role in business location. Either a locale is missing a piece of the puzzle to attract a business, or the locale is experiencing so much success that businesses want to move there.
- Congestion: Time is money, and the less time spent in traffic will result in economic benefits.
- Job creation and retention: These are the most important factors to communicate.

Through the Policy Delphi method and the desire to have effective MOEs, the only one that was ruled out quickly was congestion. This is not because it is not an economic factor; quite to the contrary, it is one of the biggest factors in economic development. However, double-counting does not provide a good analysis tool. The operational analysis, as well as parts of the other Tier II analyses (congestion, environmental impacts, and safety), that will occur before or concurrently with the economic development analysis already consider travel times and v/c ratios that describe congestion. Because of this, neither congestion nor travel time was included in the economic development criteria discussion in this research.

### *4.3.2 EDC Utah, GOPB, GOED, and TAC Members*

The literature review provided the researchers with ideas on MOEs that were important for job creation, but collaboration with EDC Utah, economic experts (e.g., GOPB and GOED), and the TAC members, provided a foundation of the type of metrics that could be used in the evaluation. EDC Utah provided a list of several criteria used to rank possible locations for developers, so that developers would understand what a particular site or area has to offer.

Through the Policy Delphi method, the TAC confirmed that several of the MOEs from EDC Utah and others matched quite well with those from the literature review. This helped to justify the use of the criteria for the economic development criteria. Upon further evaluation and analysis through the Policy Delphi method, five MOEs were further developed and included in the economic development criteria. Those MOEs that were consistent across both sources include:

- Population: Matched with the access to labor.
- Education infrastructure: Matched with the access to skilled work force.
- Existing infrastructure: Matched with the current infrastructure in an area.
- Recent economic success: Matched with the current economic trends.
- Expert feedback: Matched with the ODOT TRAC system.

### *4.3.3 Finalized Criteria*

The main focus of the Policy Delphi method was in converging upon a finalized list of criteria. Dozens of criteria were considered by the TAC before the criteria were finalized. The Policy Delphi method was also used to determine the weighting for the finalized criteria; however, the point spreads for the weighting converged very quickly based on the literature review and TAC input. The weightings were only slightly modified from the original recommendations.

Through the Policy Delphi method, the research team determined that more MOEs would be needed to provide a meaningful analysis. Through discussion with the TAC in the Policy Delphi method, as well as using information from the literature review, four more MOEs were identified and submitted for finalization:

- Size of project (cost): Cost of the project has been used by ODOT.
- Tourism: This is a large part of the economy of Utah.

- Economic hot spots: GOED, GOPB, and EDC Utah have job ready sites, just as ODOT.
- Economic choke-points: This allows specific portions of the state to identify which projects would help their area the most economically.

After much discussion and research, the TAC made a final decision on the economic development criteria. These MOEs were chosen because they provide a broad view of the factors affecting economic development and avoid double-counting metrics used in other performance measures of the project-selection process. The broad range of MOEs also provided a good balance of considering the time lag of economic benefits. These criteria are expected to provide the potential for job creation caused by the roadway project. The finalized nine MOEs include:

1. Population
2. Higher education infrastructure
3. Existing infrastructure
4. Recent economic success
5. Economic hot spots
6. Size of project
7. Expert feedback
8. Tourism
9. Economic choke-points

## 4.4 Finalized Economic Development Criteria and Weighting

Because nine MOEs were identified by the TAC through the Policy Delphi method for finalization, simplifying the presentation of the results was important to avoid complexity. The MOEs were suggested to be aggregated to make the results easier to understand. The research team consolidated the nine MOEs into four aggregate criteria and one bonus criteria: 1) population and education, 2) existing infrastructure, 3) economic attraction, 4) tourism and 5) bonus: economic choke-points. These aggregate criteria provide all of the areas of the state the same opportunity or access to points.  In other words, if an area is lacking in a score, there is potential for that area to increase its attractiveness over a certain amount of time to become more competitive.

Along with aggregating the MOEs into four main criteria and one bonus criterion, the aggregate criteria were also recommended to be weighted according to their importance to the economic potential of an area.  This assessment was based primarily on the literature review and the results of discussions with EDC Utah, GOPB, GOED, and the TAC.  To make the scoring process easier, the total points possible for the economic development criteria is 100, with the potential of 10 bonus points from economic choke-points, as summarized in Table 4-1.

Before discussing the criteria, it is important to define an urbanized area and a non-urbanized area.  An urbanized area is defined as an area with a population of 50,000 people or more, whereas a non-urbanized area consists of a population less than 50,000. Non-urbanized areas for this research include small rural areas (5,000 – 50,000 population) and rural areas (less than 5,000 population) based on the AASHTO *A Policy on Geometric Design of Highways and Streets* (AASHTO 2004).

Because of the different nature of the economic choke-points criterion, the choke-point criterion was recommended to be considered for bonus points.  The researchers recommended that for the economic choke-points each UDOT region provide a prioritized list of projects (in the case of Region 4, the districts will provide these lists) that the regions/districts feel would best build the economic potential of that region/district.  The intent of this criterion is to provide the non-urbanized parts of the state more equal influence in the project-selection process.

Each aggregate score is discussed in the following sections along with their sub-criteria.  The discussion includes why the criteria is considered important, where to look for the database information, and any other special recommendation needed to understand the scoring criteria.  Along with the discussion of the sub-criteria, a table is included to help explain the distribution of points.  The criteria selected are considered good indicators of the economic potential a roadway project will have.

**Table 4-1. Scoring Criteria**

| Criteria | Points Possible |
|---|---|
| 1) Population and Education | |
| Two sub-criteria are analyzed: 1) population within a 20-mile radius of the project and 2) education within a 40-mile radius of the project | 10 points each |
| *Total Points Possible* | *20* |
| 2) Existing Infrastructure | |
| Evaluated by proximity to the roadway project. Six different types are evaluated: 1) electrical power (transmission lines), 2) culinary water, 3) railway mainline/spur, 4) freeway interchange, 5) industrial level sewer, and 6) advanced communications | 5 points each |
| *Total Points Possible* | *30* |
| 3) Economic Attractiveness | |
| Four sub-criteria are analyzed: 1) recent economic success of area, 2) economic hot spots, 3) size (cost) of the project, and 4) expert feedback | 10 points each |
| *Total Points Possible* | *40* |
| 4) Tourism | |
| Evaluated by proximity to a tourist attraction (Non-urbanized[1] area radius is 50 miles and urbanized[2] area radius is 10 miles) as well as achievement of state goals and the roadway project classification | |
| *Total Points Possible* | *10* |
| **Total Points Available** | **100** |
| Bonus: Economic Choke Points | |
| Evaluated based on the priority given by the UDOT region or district | |
| *Total Points Possible* | *10* |
| **Total + Bonus** | **110** |

[1]Non-urbanized: Areas with a population of less than 50,000

[2]Urbanized: Areas with a population of more than 50,000

### *4.4.1 Population and Education*

Population and education are the backbone for economic development. These two factors provide an employer with the answers to two questions: 1) will there be an employee base, and 2) will the employee base be skilled? Without an employee base now and in the future, an area may not be attractive. However, an employee base may be as large as any, but, if that base is not skilled, a potential employer may not be interested in that area. The population and education criterion focuses on two sub-criteria: 1) population within a 20-mile radius and 2) education infrastructure within a 40-mile radius.

#### 4.4.1.1 Population within a 20-mile Radius

All employers are looking for access to an employment base. No matter the company, without access to employees, that company will likely fail. The supply must be large enough to not only sustain the company, but support desired growth as well; thus, the greater the accessibility to employees, the more attractive an area becomes.

The 20-mile radius was selected as it represents an approximate Utah commuter distance, based on commuter travel times from the U.S. Census Bureau (2005) and average travel speeds from the TTI 2007 Urban Mobility Report (Schrank and Lomax 2007). The average travel time for Utah was reported to be approximately 20 minutes. The average travels speeds were 52.4 mph and 28.0 mph for freeways and arterial streets, respectively. The distances were then calculated according to the proportion of time spent on either a freeway or arterial. That number, in order to be conservative, was rounded up to the nearest 5 miles of travel. The radius should evolve, as needed, to accurately represent the commuting population of Utah. If, over time, UDOT and/or the Transportation Commission decide there is a need, the radius could be reevaluated to better represent conditions at that time.

After the radius has been applied for a project, the population can be determined from the GOPB. The data for the population from the GOPB should be stored in a database that can be updated annually for the scoring. Table 4-2 provides the recommended scoring for population within a 20-mile radius.

**Table 4-2. Population Scoring**

| Population within a 20- mile radius | Points |
|---|---|
| 0-10,000 | 0 |
| 10,000-50,000 | 2 |
| 50,000-100,000 | 4 |
| 100,000-250,000 | 6 |
| 250,000-500,000 | 8 |
| 500,000 + | 10 |

#### 4.4.1.2 Higher Education Infrastructure within a 40-mile Radius

In addition to a population base, employers are also looking for a skilled workforce. Higher education infrastructure provides this potential for employers. The higher education infrastructure includes applied technical colleges (ATC) or vocational colleges (VC), 2-year-degree colleges, 4-year-degree institutions, and institutions with advanced degrees. The 40-mile radius was determined in part from the average commute time and discussion in the Policy Delphi method.

Data on this topic can be easily compiled into a database by UDOT. The state of Utah has a listing of the public institutions in the state, and obtaining a listing of the private institutions is also easily performed. Once this database is created, maintaining it only needs to happen if a new institution is built or if an existing institution is restructured or modified. Table 4-3 provides the recommended scoring for education infrastructure within 40 miles.

### *4.4.2 Existing Infrastructure*

Transportation is only one piece of the infrastructure puzzle that developers consider; transportation alone cannot induce economic development. The literature review results identified other infrastructure as an important variable in the attractiveness of an area for economic development. With EDC Utah, GOPB, GOED, and the TAC, six types of infrastructure were identified as having the largest attraction potential: 1) electrical power (transmission lines), 2) culinary water, 3) a railway mainline or spur,

4) a freeway interchange, 5) industrial level sewer service, and 6) advanced telecommunications. Each of these infrastructure components and their overall proximity to a transportation project is expected to play a key role in determining economic growth potential. The radius of influence (distance to roadway project) was determined through the Policy Delphi method.

Because existing infrastructure is owned primarily by private companies, the data may be more difficult to obtain; however, with the cooperation of EDC Utah, UDOT could be granted access to data from private corporations that provide these utilities. Table 4-4 provides the recommended scoring for existing infrastructure.

**Table 4-3. Education Scoring**

| Education Infrastructure within a 40-mile radius | Points |
|---|---|
| No higher education institutions | 0 |
| ATC/VC | 2 |
| ATC/VC and 2-year degree | 5 |
| ATC/VC, 2-year degree and 4-year degree programs | 8 |
| ATC/VC, 2-year degree, 4-year degree and advanced degree programs | 10 |

### *4.4.3 Economic Attractiveness*

One item that was gleaned from cooperation with the experts from EDC Utah, GOPB, GOED, and the TAC was the fact that businesses like to move where success is already occurring; following the idea that success breeds success. Consistent with this idea, the success, or the economic attractiveness of an area, must be considered. Through the Policy Delphi method, four indicators were determined to provide a broad look at the economic attractiveness of an area as well as how a project may affect that attractiveness: 1) recent economic success, 2) economic hot spots, 3) size (cost) of the project, and 4) expert feedback.

**Table 4-4. Existing Infrastructure Scoring**

| Scoring for Each Type of Infrastructure | |
|---|---|
| Distance to Roadway Project | Points |
| 1.50 + miles | 0 |
| 1.00-1.50 miles | 1 |
| 0.75-1.00 miles | 2 |
| 0.50-0.75 miles | 3 |
| 0.25-0.50 miles | 4 |
| 0.00-0.25 miles | 5 |
| Types of Infrastructure | Max Points |
| Electrical Power (Transmission Lines) | 5 |
| Culinary Water | 5 |
| Railway Mainline/Spur | 5 |
| Freeway Interchange | 5 |
| Industrial Level Sewer Service | 5 |
| Advanced Telecommunications | 5 |
| Total Points Possible for Criteria | 30 |

#### 4.4.3.1 Recent Economic Success

A developer does not generally want to be the first into an area or go to an area that is struggling. If a county is experiencing overall economic growth, the attractiveness of that area is increased for a developer. The recent economic success should be calculated through the job growth of an entire county, as demonstrated in Table 4-5.

Data for such job growth should be from the most current year available. If data are not available within the last year, this item may be suspect in providing a reliable reflection of the economic attractiveness of the area. As EDC Utah, GOPB, and GOED already provide potential developers with recent job growth numbers, UDOT could obtain the data from those agencies. Overall, these data should be easy to obtain and maintain on a yearly basis.

**Table 4-5. Recent Economic Development Success Scoring**

| County Job Growth | Points |
|---|---|
| Negative Growth | 0 |
| 0-0.5% | 1 |
| 0.5-1.0% | 2 |
| 1.0-1.5% | 3 |
| 1.5-2.0% | 4 |
| 2.0-2.5% | 5 |
| 2.5-3.0% | 6 |
| 3.0% + | 8 |

#### 4.4.3.2 Economic Hot Spots

Identifying areas that are already primed for economic development but lack some level of accessibility would benefit the state greatly. EDC Utah, GOPB, and GOED have defined areas or economic clusters called "economic hot spots" that are areas of the state primed for business development and are being actively promoted as such. ODOT currently has similar criteria in their analysis that they have called Ohio Job Ready Sites (ODOT 2008). UDOT would only need to compile a list of the top 20 sites each year before the Tier II analysis begins. The scoring would be based on the proximity of a project to such hot spots, as illustrated in Table 4-6.

Through the Policy Delphi method, it was recommended that UDOT participate with EDC Utah, GOPB, and GOED to identify a listing of the top sites in the state that are considered economic hot spots. This would serve two primary purposes: 1) UDOT would be informed of areas around the state that have the potential for large developments and thus large changes in traffic and 2) this would allow the UDOT Planning Division to be more proactive in their planning. The additional knowledge of hot spot locations may affect the overall design of the roadway project.

**Table 4-6. Economic Hot Spot Scoring**

| Project Distance from Hot Spot | Points |
|---|---|
| Within 4+ miles | 0 |
| Within 3 miles | 2 |
| Within 2 miles | 5 |
| Within 1 miles | 8 |
| Borders on or runs through hot spot | 10 |

#### 4.4.3.3 Size (Cost) of Project

As outlined in the literature review, there has been a reasonable amount of research done on the relationship between economic development and the size (cost) of the project being built. In general, researchers have noted that the more money that is spent on infrastructure, the higher the immediate economic benefit for the area. One example to help with this criterion comes from ODOT. ODOT uses specific ranges for the project cost, as discussed in section 2.4.2, for scoring amounts of investments over an immediate period of 0-3 years, on a project-by-project basis (not a group of projects) (ODOT 2006).

Through the Policy Delphi method, the TAC determined that considering this criterion would provide insight into the short-term lag benefits of a project. As the goals of Utah are to help immediately, as well as in the long-term, considering criteria that view the full breadth of the project potential is important. The money from construction will provide a short-term benefit to an area.

The project cost data will have already been estimated before they are brought to the Tier II analysis. Thus, ranges were created through the TAC to accurately capture average projects in the middle of the scoring range, as illustrated in Table 4-7. As changes occur in Utah and the economy, the ranges will have to be adjusted to accurately reflect the type of projects UDOT is constructing.

**Table 4-7. Size (Cost) of Project Scoring**

| Estimated Cost | Points |
|---|---|
| $5-49.99 million | 2 |
| $50-99.99 million | 4 |
| $100-149.99 million | 6 |
| $150-199.99 million | 8 |
| $200+ million | 10 |

#### 4.4.3.4 Expert Feedback

As certain topics will not be included in the initial criteria, or certain topics may be difficult to score, experts will discuss the economic viability of an area and estimate whether a roadway project has the potential to increase the economic vitality of that area. This MOE was inspired by ODOT, which uses an expert panel to evaluate the results of their economic development criteria. The feedback will also show if experts in the field are in agreement with the other scores from the economic development criteria. Due to the difficulty of identifying all possible variables in the transportation-economic development relationship, experts can provide a bridge for areas that may have not been considered, or may be difficult to quantify. The TAC discussed the option of expert feedback and determined that having such a committee would provide great insights. Another benefit of the panel will be an increased level of interagency communication and awareness, which will in turn aid the state of Utah. A non-exhaustive list of suggested topics should be provided to those participating in the expert feedback to spur discussion. A sample of possible discussion topics include:

- The cost of land surrounding the project. If the land is too expensive, it will be seen as unattractive to developers.
- Possibilities of development and redevelopment surrounding the project.
- Does the project help the state achieve its goals (e.g., tourism, economics)?
- Local government participation.
- Accessibility of the surrounding land with and without the roadway.

- How much will the roadway increase an area's economic development potential?
- Travel time.
- Will transportation provide a final link in the chain to provide development, or are there other missing pieces?
- Does the project help UDOT meet their four strategic goals?

Potential experts to include in the expert feedback are Chambers of Commerce, the Division of Workforce Services (DWS), EDC Utah, GOED, GOPB, the State of Utah School and Institutional Trust Lands Administration (SITLA), the Utah Department of Commerce, the Utah Division of Real Estate, the Utah Office of Tourism, and the Utah State Office of Education.

Due to the subjectivity of this portion of the analysis and the need to provide a balanced outlook on the entire state, two groups will participate: 1) voting members and 2) non-voting members who can provide information.

Voting members include primary state agencies. The rights of these members allows them to submit a score (0-10 points) for each project based on their knowledge of the site, project, municipality, etc. A suggested scoring outline is given in Table 4-8. The scores from all of the voting members will be averaged to provide the expert feedback score in the economic analysis. The following is a list of recommended voting members:

- DWS,
- GOED,
- GOPB,
- Utah Department of Commerce,
- Utah Division of Real Estate,
- Utah Office of Tourism,
- Utah State Office of Education, and
- Others as determined by UDOT.

**Table 4-8. Expert Feedback Scoring**

| Project potential to increase the economic vitality of an area | Points |
|---|---|
| None | 0 |
| Little | 2 |
| Modest | 4 |
| Average | 6 |
| Above Average | 8 |
| Excellent | 10 |

Non-voting members are allowed to provide input to help the voting members make informed decisions. These members may also provide a written statement about those projects they wish to address. The recommended non-voting members include:

- Chambers of Commerce,
- EDC Utah,
- SITLA, and
- Others as determined by UDOT.

All members of the expert feedback panel should receive a list of potential projects to be considered, as well as their locations, cost, and functional class (i.e., freeway or arterial). The lists should be distributed at least one month in advance of actual scoring to allow both the voting and non-voting members to consider the implications of the projects. This will also allow any non-voting member to prepare oral or written recommendations before the meeting.

Before the meeting to provide final scoring for each project, each voting member should provide their opinions on the subject as well as a preliminary score. During the discussion, all of the opinions, comments, and concerns will be addressed. Once those have been addressed, the expert feedback panel will work to converge on a finalized score for the project, using the preliminary scoring average as a starting point. This method should follow the Policy Delphi method described in section 4.2.

#### 4.4.4 *Tourism*

Tourism plays a large role in the economy of Utah. As such, Utah consistently sets goals to improve the tourism in the state, which in turn provides great amounts of benefit to the economy. The state is very unique in the attractions provided such as national parks, ski areas, Lake Powell, and areas similar to Moab. These are large seasonal attractions and must be considered in the economic analysis. A “tourist attraction” must be clearly defined for this criterion to function properly. The recommendation by the researchers is to include all national recreation areas, national monuments, national parks, ski areas, and state parks in the tourism criteria.

Tourist attractions should be evaluated based upon location: either urbanized or non-urbanized areas. Non-urbanized area tourist attractions will have a larger radius of benefit. Many of the national parks and national recreation areas are located outside of urbanized areas. If a tourist attraction falls in the proximity of a project (based on the area: urbanized or non-urbanized), the points will be assigned under the tourism criterion. If in proximity, points can also be assigned according to how much the expert feedback panel feels the project will meet state goals. The functional class will also provide points for the project.

Data for the tourism analysis could be collected from the Utah Office of Tourism and other state agencies, depending on the information needed. The data required would include the physical locations of all sites that qualify as a tourist attraction. When the list of projects is submitted to the expert feedback panel, the proximity to a tourist attraction must also be included, and whether the tourist attraction is considered urbanized or non-urbanized. Table 4-9 provides the recommended scoring for the tourism criterion.

**Table 4-9. Tourism Scoring**

| Proximity to Tourist Attraction | | Points |
|---|---|---|
| In a Non-urbanized[1] Area | In an Urbanized[2] Area | |
| 50+ miles | 10+ miles | 0 |
| 40-50 miles | 8-10 miles | 1 |
| 30-40 miles | 6-8 miles | 2 |
| 20-30 miles | 4-6 miles | 3 |
| 10-20 miles | 2-4 miles | 4 |
| 0-10 miles | 0-2 miles | 5 |
| IF in Proximity: Does it achieve Goals? Determined by Expert Feedback | | |
| None | | 0 |
| Little | | 1 |
| Average | | 2 |
| Excellent | | 3 |
| IF in Proximity: Roadway Project Classification | | |
| Minor Arterial or Lower | | 1 |
| Major Arterial or Higher | | 2 |
| | | |
| Total Points Possible | | 10 |

[1]Non-urbanized: Areas with a population of less than 50,000
[2]Urbanized: Areas with a population of more than 50,000

### *4.4.5 Bonus: Economic Choke Points*

Because over 75 percent of Utah's population lives in the urbanized areas of the Wasatch Front (Logan to Spanish Fork) (EDC Utah 2009), the non-urbanized areas are anticipated to be lagging in points from the economic development criteria. This criterion will allow non-urbanized areas to have more equal input as to which project should be done and provide feedback to Utah on projects that are considered critical. Through the Policy Delphi method, the TAC determined that each UDOT region/district should provide a prioritized list of projects in their respective region/district that they feel would alleviate any bottlenecks (or choke-points) to desired economic development. Each region/district will provide a list of up to five projects ranked from highest priority to lowest, and then bonus points will be assigned accordingly. The priority list from each region would be compiled yearly, with Priority I being the highest priority and Priority V being the lowest. Identification of economic choke-points would occur separately from the expert feedback. The point scale is shown in Table 4-10.

**Table 4-10. Economic Choke-Point Scoring**

| Priority | Points |
|---|---|
| None | 0 |
| Priority V | 2 |
| Priority IV | 4 |
| Priority III | 6 |
| Priority II | 8 |
| Priority I | 10 |

## 4.5 Tier II Framework

Before any scoring on a project begins, projects must pass through the Tier I analysis, which consists of several engineering and safety parameters. Once the top third of that list has been selected, the four parts of the Tier II process begin: 1) congestion, 2) economics, 3) environmental impacts, and 4) safety.

This section discusses the analysis framework for the economic development criteria. Four things must happen for the economic development analysis to take place: 1) databases must be updated, 2) a list of possible projects must be sent out to the UDOT regions/districts and the expert feedback panel, 3) the database scoring and expert feedback scoring must occur concurrently without the experts knowing results from the database scoring, and 4) the results must be presented to the Transportation Commission.

### *4.5.1 Update Databases*

Each database must be updated before the Tier II analysis begins so that the most up-to-date information is being used, which in turn will provide a much more accurate analysis. Several of the databases may not be maintained by a government agency, such as a database for electrical power and transmission lines. These databases will only need to be updated once a year. The criteria that will use a database include:

- Population and education: New population numbers or any new higher education institutions should be added.
- Existing infrastructure: As infrastructure is built every year, analyzing the most up-to-date information is paramount for an accurate score.
- Economic attractiveness:
    - Recent economic success: Only the most recent data will provide accurate results.
    - Size (cost) of project: The cost of each project will already be estimated in Tier I.
    - Economic hot spots: The locations of the top 20 will need to be input every year.
- Tourism: The database of tourist attractions is not expected to fluctuate greatly, nor is the location of an attraction (urbanized or non-urbanized) expected to change frequently.

The databases are intended to create a pool of data from which to score the criteria. To automate the process, a GIS database is proposed. With all of the criteria within database, there should also be a database of projects. Using a GIS database will allow UDOT to input the locations and functional classifications for each project. This database may then be overlaid across the criteria databases to estimate the scores. Along with updating the criteria, the project database must be kept up-to-date, as project lengths and types are sometimes in flux.

### *4.5.2 List of Projects*

The list of potential projects that will be subjected to the Tier II analysis should be provided to participating agencies in advance of the scoring. The project list should be sent out a month ahead of the expert panel meeting to allow all voting and non-voting members to become familiar with the projects being considered. UDOT regions will need the list in order to provide a priority list of the projects that will help them the most, economically. In the case of UDOT Region 4, the districts will be given the list of potential projects. Each district will then provide its prioritization.

The list of projects should be accompanied by supporting information, such as:

- Location,
- Cost,
- Functional class,
- Size of the project (length, added lanes, etc.),
- Proximity to tourist attractions, and
- Location (urbanized or non-urbanized) within the state.

### *4.5.3 Scoring*

Once the potential project list is compiled and has been disseminated, the scoring process can begin. Scoring from the databases should be completed as soon as all databases have been updated. Once the databases are compiled and updated, the scoring can be completed relatively quickly. Concurrently with the database scoring, the expert feedback scoring should be conducted. No member of the expert panel should be told the results of the database scoring until after the panel agrees to a score for each roadway project. This way, an unbiased outlook will be provided from the expert feedback portion of the analysis. Each project will be scored on its own, according to the criteria. This means the discussion should follow a project-by-project basis. The projects will then be ranked according to the scores from the criteria and presented to UDOT. The scores will aid in the "Decision Support System" developed by UDOT. If there is a need to compare a group of projects to another group, an average of the economic scores should be compared.

### *4.5.4 Presenting to the Transportation Commission*

After the database scores have been compiled and the expert feedback panel has scored all of the projects in Tier II, the list of projects will be ranked according to the highest score; the higher the ranking, the higher the economic development potential of that roadway project. This ranking is meant to be a tool for the Transportation Commission that will provide valuable insight in the decision-making process. The ranking is not meant to dictate which projects are to be built.

When all of the Tier II evaluations (congestion, economic, environmental impacts, and safety) have been completed, all the results will be combined. UDOT will then present that information to the Transportation Commission. The method of compilation and communicating the results from the Tier II process should be done in a manner consistent with the goals of Utah and also in a way that easily presents the results. Such presentation will be left to the discretion of UDOT.

An example of how the economic development criteria scoring may be used is as follows: if two projects score equally high in the Tier I process and there is a discussion that only one can be built, more information will be needed to determine which project should be built. As both provide the same results operationally, the Tier II analyses will provide more insight. The Transportation Commission may turn to the economic development criteria to determine which project has a higher economic development potential. This information may provide the information necessary to break a “tie” in the programming process.

## 4.6 Chapter Summary

Chapter 4 presents the methods and results of economic development criteria and the analysis framework for the economic analysis of the Tier II process. This chapter showed the method used to create the economic development criteria, namely the Policy Delphi method. The Policy Delphi method was used to synthesize the information from the literature review and the supporting agencies (EDC Utah, GOPB, GOED, and the TAC) in order to develop viable criteria. After all the discussions with the TAC, nine total MOEs were aggregated into four criteria with a bonus criterion: 1) population and education, 2) existing infrastructure, 3) economic attractiveness, 4) tourism, and 5) bonus: economic choke-points.

After the criteria are evaluated and scored through the databases, expert feedback, and the UDOT region/district choke-point prioritization analysis, the projects are ranked and listed from highest to lowest economic development potential scores.  This list will later be compiled with the other three sections of Tier II (congestion, environmental impacts, and safety) and then presented to the Transportation Commission.

# 5 Recommendations and Conclusions

Before a project receives funding for construction, a project-selection process must be followed. The first part of this process is the development of the LRP. The project list is then divided into phases in order to address when the projects should most likely be considered over the approximately 30-year planning horizon. The next step in the planning process is the STIP. The projects brought from the LRP to the STIP have the highest near-term feasibility and priority to the state and region and are consistent with the respective goals and the long-range plans of UDOT and the MPOs.

Determining the priority of projects in the STIP is a large task and one that UDOT has continually addressed in order to program the best possible projects for Utah. Project prioritization is so important that Utah has an administrative rule (R907-68) for prioritization of new transportation capacity projects. This rule gave rise to the current two-tiered project-selection process.

The goal of UDOT is to develop an economic analysis tool that provides useful information to the members of the Transportation Commission who will decide which projects to program. The tool provides direction and guidance to the Transportation Commission and UDOT on the prioritization of projects based on economic development potential. The results and recommendations were a product of: 1) performing a literature review, 2) providing an overview of the Tier I project evaluation process, 3) establishing and refining a set criteria through coordination with the TAC using the Policy Delphi method for the Tier II economic analysis, 4) establishing and finalizing an overview process through the Policy Delphi method, and 5) making recommendations on how to use the system most effectively.

## 5.1 Literature Review

A literature review was first undertaken to better understand the methods currently being used for economic analysis, investigate the transportation-economic development relationship, and update any possible analysis tools. The results of the literature review indicated that transportation itself is not enough to induce economic development. The following are other important variables in the transportation-economic development relationship:

1. The larger the project, the greater the economic potential.
2. Location or proximity to population and higher education is important in attracting businesses.
3. Existing infrastructure in an area increases that area's attractiveness to developers.
4. Job creation is the most important factor to illustrate to the public.
5. There is a time lag to experience all economic benefits (short- and long-term), which is between 2 and 25 years.

## 5.2 Overview of the Tier I Process

Providing the overview of the creation of the two-tiered process established a basis for the Tier II economic development analysis. Understanding the Tier I process also shows why the Tier II process exists, to provide more information to supplement the operation side. The two-tiered system was a result of the transportation administrative rule R907-68 created by UDOT in accordance with the Utah state legislature.

The UDOT Tier I process is the first step in the prioritization of transportation projects. In the primary selection process, any project that is estimated at $5 million or more is subjected to the Tier I objective scoring system. The projects scoring in the top third of Tier I are then evaluated in the Tier II process. The economic analysis takes place once a list of projects is produced from the Tier I analysis.

## 5.3 Economic Development Criteria

Based on the results of the literature review combined with information from EDC Utah, GOED, GOPB, and the TAC, criteria were established to evaluate the economic potential of a roadway project. The TAC finalized criteria using a Policy Delphi method through six meetings. Nine MOEs were recommended to evaluate the economic growth potential of roadway projects. These nine MOEs were collapsed to four aggregate criteria along with a bonus criterion that would aid in providing input from all areas of the state. The full criteria include: 1) population and education, 2) existing infrastructure, 3) economic attractiveness, 4) tourism, and 5) bonus: economic choke-points. The scoring and weighting for each aggregate are summarized in Table 5-1.

### *5.3.1 Population and Education*

All employers are looking for two things: 1) access to the labor market and 2) a skilled employment base. No matter the company, without access to skilled employees now and in the future, that company will likely fail. The supply must be large enough to not only sustain the company, but support desired growth as well; thus, the greater the accessibility to employees, the more attractive an area becomes. The employment base must also be supplemented by institutions of higher learning in order to continue replenishing those skilled workers.

### *5.3.2 Existing Infrastructure*

Transportation is only one piece of the infrastructure puzzle that developers consider; transportation alone cannot induce economic development. Through the literature review and EDC Utah, GOPB, GOED, and the TAC, six types of infrastructure were identified as having the largest attraction potential: 1) electrical power (transmission lines), 2) culinary water, 3) a railway mainline or spur, 4) a freeway interchange, 5) industrial level sewer service, and 6) advanced telecommunications.

**Table 5-1. Aggregate Criteria and Weighting**

| Criteria | Points Possible |
|---|---|
| 1) Population and Education | |
| Two sub-criteria are analyzed: 1) population within a 20-mile radius of the project and 2) education within a 40-mile radius of the project | 10 points each |
| *Total Points Possible* | *20* |
| 2) Existing Infrastructure | |
| Evaluated by proximity to the roadway project. Six different types are evaluated: 1) electrical power (transmission lines), 2) culinary water, 3) railway mainline/spur, 4) freeway interchange, 5) industrial level sewer, and 6) advanced communications | 5 points each |
| *Total Points Possible* | *30* |
| 3) Economic Attractiveness | |
| Four sub-criteria are analyzed: 1) recent economic success of area, 2) economic hot spots, 3) size (cost) of the project, and 4) expert feedback | 10 points each |
| *Total Points Possible* | *40* |
| 4) Tourism | |
| Evaluated by proximity to a tourist attraction (Non-urbanized[1] area radius is 50 miles and urbanized[2] area radius is 10 miles) as well as achievement of state goals and the roadway project classification | |
| *Total Points Possible* | *10* |
| **Total Points Available** | **100** |
| Bonus: Economic Choke Points | |
| Evaluated based on the priority given by the UDOT region or district | |
| *Total Points Possible* | *10* |
| **Total + Bonus** | **110** |

[1]Non-urbanized: Areas with a population of less than 50,000

[2]Urbanized: Areas with a population of more than 50,000

### *5.3.3 Economic Attractiveness*

Success breeds success. Consistent with this idea, the success, or the economic attractiveness of an area, must be considered. Through the Policy Delphi method, four indicators were determined to provide a broad look at the economic attractiveness of an area as well as how a project may affect that attractiveness:

1. Recent economic success: A county experiencing economic growth is very attractive to potential developers who want to build on current success. Job growth should be measured according to the county.
2. Economic hot spots: EDC Utah, GOED, and GOPB have economic clusters or hot spots already defined. These hot spots are sites primed for development and may be lacking some level of accessibility. UDOT needs to work with these agencies to create a list of these hot spots.
3. Size (cost) of the project: This will help decision-makers to consider the short-term benefits of a project. The more money spent in an area provides immediate impacts to the economy.
4. Expert feedback: Not only will this increase the level of interagency awareness and communication, it will allow a broader understanding of the economic development potential of roadway projects. As certain topics will not be included in the initial criteria, or certain topics may be difficult to score, experts will discuss the economic viability of an area and estimate whether a roadway project has the potential to increase the economic vitality of that area. Because of the difficulty of identifying all possible variables in the transportation-economic development relationship, experts can provide a bridge for areas that may have not been considered or may be difficult to quantify. Due to the subjectivity of the criteria and a need to provide a balanced outlook, both voting and non-voting panel members are recommended. The scoring process will follow the Policy Delphi method. Before the meeting to finalize the score for each project, each voting participant should submit their opinions as well as a preliminary score. At the meeting the opinions, comments, and concerns submitted previously will all be addressed. After further discussion, the actual scoring will take place, using the average of the preliminary scoring as a starting point.
    a. Recommended voting members include: DWS, GOED, GOPB, Utah Department of Commerce, Utah Division of Real Estate,

Utah Office of Tourism, Utah State Office of Education, and others as determined by UDOT.

b. Recommended non-voting members include: Chambers of Commerce, EDC Utah, SITLA, and others as determined by UDOT. These members may provide oral or written information on any project for consideration by the voting members.

### *5.3.4 Tourism*

Tourism plays a large role in the economy of Utah. The state is very unique in the attractions provided, such as national parks, ski areas, Lake Powell, and areas similar to Moab. These are large seasonal attractions and must be considered in the economic analysis. The recommendation by the researchers is to include all national recreation areas, national monuments, national parks, ski areas, and state parks as “tourist attractions” in the tourism criteria.

Tourist attractions should be evaluated based upon location: either urbanized or non-urbanized. Non-urbanized tourist attraction will have a larger radius of benefit. Many of the national parks and national recreation areas are located outside of urbanized areas. If a tourist attraction falls in the proximity of a project (based on urbanized or non-urbanized), points will be assigned under tourism. If in proximity, points can also be assigned according to how much the expert feedback panel feels the project will meet state goals.

### *5.3.5 Bonus: Economic Choke Points*

Because over 75 percent of Utah’s population lives in the urbanized areas of the Wasatch Front (Logan to Spanish Fork) (EDC Utah 2009), the non-urbanized areas are anticipated to be lagging in points from the economic development criteria. This criterion will allow non-urbanized areas to have more equal input as to which project should be done and provide feedback to UDOT on projects that are considered critical. Each UDOT region/district should provide a prioritized list of projects in their respective region/district that they feel would alleviate any bottlenecks (or choke-points) to economic development, if so desired. Each region/district will provide a list of up to five projects ranked from highest to lowest priority (Priority I being the highest and Priority V being the lowest). This would be separate from expert feedback.

### 5.4 Tier II Analysis Framework

After the Tier I analysis produces a list of projects, those projects will then be subjected to the Tier II analysis, which will evaluate them according to four categories: 1) congestion, 2) economics, 3) environmental impacts, and 4) safety. The research for this project was concerned with creating criteria and an analysis framework for the economic development portion of Tier II. Once the list of projects for the Tier II economic development analysis is received, it should first be sent out to participants in the expert feedback group and also the UDOT regions/districts who will provide a list of five prioritized projects. The project list should be sent out a month before the expert panel is to meet, allowing the panel enough time to become familiar with the projects being considered.

Concurrently with the expert feedback, the databases used to score the other criteria will be updated. Once the updated information is gathered, the scoring can begin. If the database scoring occurs before or during the expert feedback and economic choke-point phases, the results shall not be disclosed, in order to maintain unbiased results from the experts and UDOT regions/districts.

After the database scores have been compiled and the expert feedback panel has scored all of the projects in Tier II, the list of projects will be ranked according to the highest score; the higher the ranking, the higher the economic development potential of that roadway project. This ranking is meant to be a tool for the Transportation Commission that will provide valuable insight in the decision-making process. The ranking is not meant to dictate which projects are to be built.

When all of the Tier II evaluations (congestion, economic, environmental impacts, and safety) have been completed, all the results will be combined. UDOT will then present that information to the Transportation Commission. The method of compilation and communicating the results from the Tier II process should be done in a manner consistent with the goals of Utah and also in a way that easily presents the results. Such presentation will be left to the discretion of UDOT.

A flow chart showing the recommended Tier II analysis process is shown in Figure 5-1. The economic development analysis is specifically emphasized, as it is the focus of this research.

An example of how the economic development criteria scoring may be used is as follows. If two projects score equally high in the Tier I process and there is a discussion that only one can be built, more information will be needed to determine which it will be. As both provide the same results operationally, the Tier II analyses will provide more insight. The Transportation Commission may turn to the economic development criteria to determine which project has a higher economic development potential. This information may provide the information necessary to break a "tie" in the programming process.

These criteria will provide information on the potential economic development of a project concerning job growth. The economic development analysis tool does not try to predict any exact amount of job creation; because of this, no expensive computer model or method will need to be used to provide Utah with an inexpensive and simple economic evaluation of each roadway project.

## 5.5 Recommendations

The TAC and the researchers understand that the process may not be perfect in the first attempt. Because of that understanding, the following recommendations are provided:

- No recommendation will be made as to how to present the results to the Transportation Commission. UDOT must decide how to provide the information in such a way as to facilitate effective decision-making. No specifics will be set forth also because the needs of the Transportation Commission may change over time.

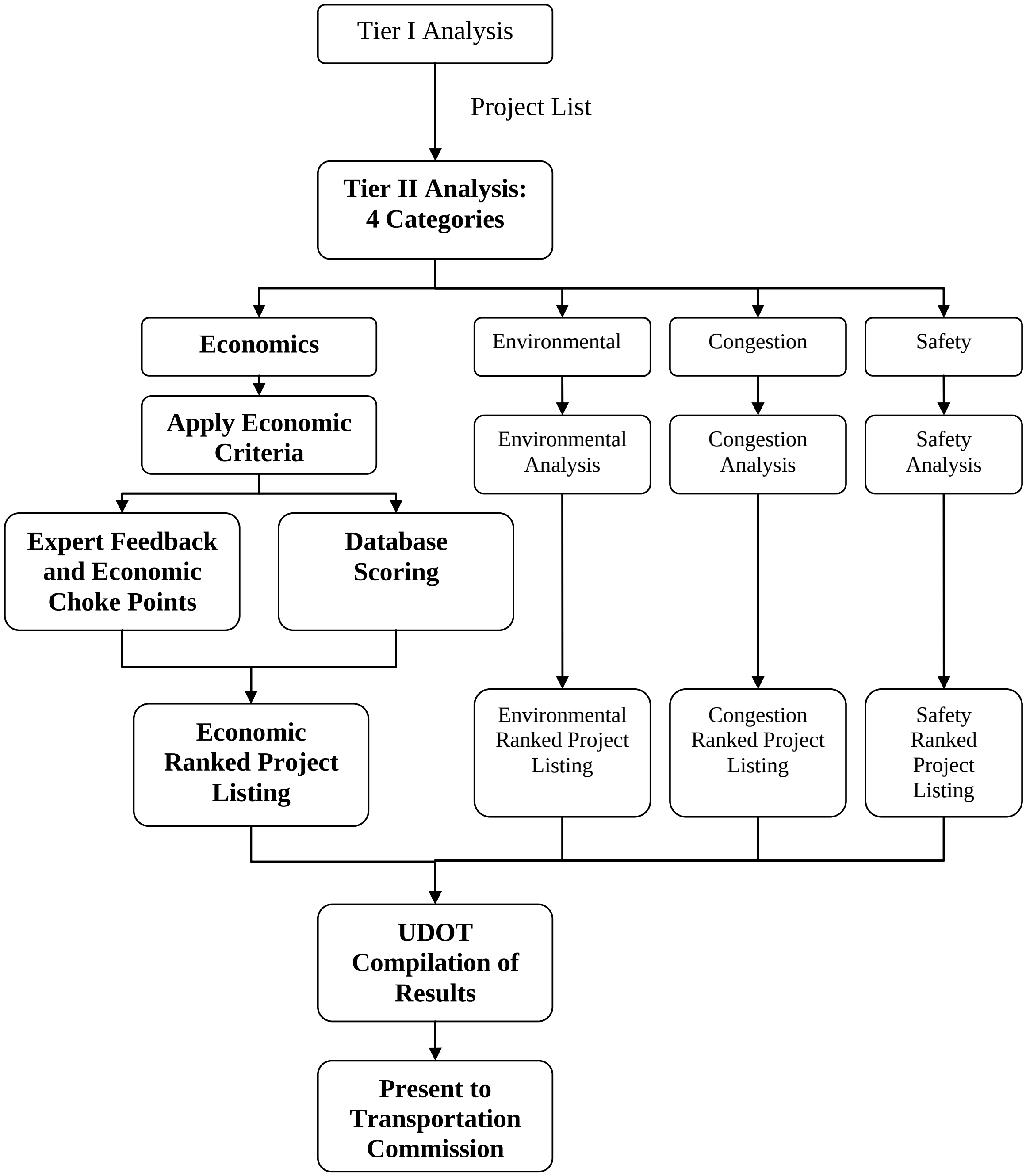


**Figure 5-1. Recommended economic analysis flowchart.**

- The researchers recommend that an automated model, using the criteria outlined, should be created. The most appropriate model would be a GIS-based model. This is due to the large amount of available GIS data corresponding with available projects and also the ease of geographically representing a project. With such a GIS database in place, projects for each analysis would only need to be placed into the model to be scored.

- UDOT should run a sensitivity analysis on the criteria, after the criteria have been used at least once, to refine the point scale. This should allow UDOT to understand what a "high score" is and what a "low score" is. This evaluation will also verify that the criteria are meeting the goals of Utah.
- Once the complete Tier II analysis (congestion, environment, safety, and economics) is functional, a B/C ratio or return-on-investment (ROI) analysis is suggested to provide more information to the decision-making process. Performing a B/C or ROI analysis on only one segment of Tier II would fail to take into account all of the available benefits of the roadway and potentially provide inaccurate results.

## 5.6 Future Research

The criteria presented herein are to be seen as a foundation and starting point for such an analysis for Utah. As this has never been done before in the state of Utah, the criteria and economic analysis should be allowed to evolve as necessary to capture the goals of Utah and provide useful information to the Transportation Commission. Some ideas for future research include:

- More in-depth research needs to be done to determine which variables are the best descriptors of economic development. As of right now, no in-depth analysis has been done to show the link between transportation and other variables in influencing the economy.
- UDOT should analyze the roadway projects selected from the economic development criteria and determine the actual effects of the project in the short-, medium-, and long-term lagging phases. This will provide UDOT with a better understanding if the criteria are producing accurate results.

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# Appendix A. List of Abbreviations

| | |
|---|---|
| AADT | Average Annual Daily Traffic |
| AASHTO | American Association of State Highway and Transportation Officials |
| ATC | Applied Technical College |
| B/C | Benefit-Cost |
| BYU | Brigham Young University |
| CBD | Central Business District |
| CSI | Cambridge Systematics, Inc. |
| DHV | Daily Hour Volume |
| DOT | Department of Transportation |
| DWS | Division of Workforce Services |
| EDC Utah | Economic Development Corporation of Utah |
| EDR | Economic Development Research Group, Inc |
| EIAS | Economic Impact Analysis System |
| FHWA | Federal Highway Administration |
| GIS | Geographic Information System |
| GOED | Governor's Office of Economic Development |
| GOPB | Governor's Office of Planning and Budget |
| HCM | Highway Capacity Manual |
| HCS | Highway Capacity Software |
| HEAT | Highway Economic Analysis Tool |
| HERS | Highway Economic Requirement System |
| HERS-ST | Highway Economic Requirement System-State Model |
| IMPLAN | Impact Analysis for Planning |
| INDOT | Indiana Department of Transportation |
| I-O | Input-Output |
| IPOC | INDOT Planning Oversight Committee |
| ISTM | Indiana Statewide Travel Model |
| ITS | Intelligent Transportation System |
| KTC | Kentucky Transportation Center |
| LEAP | Local Economic Assessment Package |
| LRP | Long-Range Plan |
| LOS | Level of Service |
| MAG | Mountainland Association of Governments |

| | |
|---|---|
| MCIBAS | Major Corridor Investment-Benefit Analysis System |
| MOCB | Market-Oriented Cost-Benefit Analysis |
| MoDOT | Missouri Department of Transportation |
| MOE | Measure of Effectiveness |
| MPO | Metropolitan Planning Organization |
| MVMT | Million Vehicle Miles Traveled |
| NCHRP | National Cooperative Highway Research Program |
| ODOD | Ohio Department of Development |
| ODOT | Ohio Department of Transportation |
| PCPHPL | Passenger Cars Per Hour Per Lane |
| PHF | Peak Hour Factor |
| REDYN | Regional Dynamics Model |
| REMI® | Regional Economic Models, Inc. |
| ROI | Return-On-Investment |
| ROW | Right-of-Way |
| SAFETEA-LU | Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users |
| SI | Safety Index |
| SITLA | The State of Utah School and Institutional Trust Lands Administration |
| STIP | Statewide Transportation Improvement Program |
| TAC | Technical Advisory Committee |
| TRAC | Transportation Review Advisory Council |
| TREDIS® | Transportation Economic Development Impact System |
| TTI | Texas Transportation Institute |
| UDOT | Utah Department of Transportation |
| U.S. | United States |
| v/c | Volume/Capacity |
| VC | Vocational College |
| VPD | Vehicles Per Day |
| VHT | Vehicle-hours Traveled |
| VMT | Vehicle Miles of Travel or Vehicle-Miles Traveled |
| WFRC | Wasatch Front Regional Council |
| WisDOT | Wisconsin Department of Transportation |

# Appendix B. Transportation Administrative Rule: R907-68

**R907. Transportation, Administration.**
**R907-68. Prioritization of New Transportation Capacity Projects.**
**R907-68-1. Definitions.**

(1) "ADT" means Average Daily Traffic, which is the volume of traffic on a road, annualized to a daily average.

(2) "Capacity" means the maximum hourly rate at which vehicles reasonably can be expected to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.

(3) "Commission" means the Transportation Commission, which is created in Utah Code Ann. Section 72-1-301.

(4) "Economic Development" may include such things as employment growth, employment retention, retail sales, tourism growth, freight movements, tax base increase, and traveler or user cost savings in relation to construction costs.

(5) "Functional Classification" means the description of the road as one of the following:

(a) Rural Interstate;
(b) Rural Other Principal Arterial;
(c) Rural Minor Arterial;
(d) Rural Major Collector;
(e) Urban Interstate;
(f) Urban Other Freeway and Expressway;
(g) Urban Other Principal Arterial;
(h) Urban Minor Arterial;
(i) Urban Collector;

(6) "Major New Capacity Project" means a transportation project that costs more than $5,000,000 and accomplishes any of the following:

(a) Add new roads and interchanges;
(b) Add new lanes;
(c) Modify existing interchange(s) for capacity or economic development purpose.

(7) "MPO" as used in this section means metropolitan planning organization as defined in Utah Code Ann. Section 72-1-208.5.

(8) "Safety" means an analysis of the current safety conditions of a transportation facility. It includes an analysis of crash rates and crash severity.

(9) "Strategic Goals" means the Utah Department of Transportation Strategic Goals.

(10) "Strategic Initiatives" means the implementation strategies the Department will use to achieve the "Strategic Goals".

(11) "Transportation Efficiency" is the roadway attributes such as ADT, Truck ADT, Volume to Capacity Ratio, roadway Functional Classification, and Transportation Growth.

(12) "Transportation Growth" means the projected percentage of average annual increase in ADT.

(13) "Truck ADT" means the ADT of truck traffic on a road, annualized to a daily average.

(14) "Volume to Capacity Ratio" means the ratio of hourly volume of traffic to capacity for a transportation facility (measure of congestion).

**R907-68-2. Authority and Purpose.**

Utah Code Ann. Section 72-1-304, as enacted by Senate Bill 25, 2005 General Session, directs the Commission, in consultation with the Department and the Metropolitan Planning Organizations in the State, to issue rules that establish a prioritization process for new transportation projects that meet the Department's strategic goals. This rule fulfills that directive.

**R907-68-3. Application of Strategic Initiatives to Projects.**

The Department will use the Strategic Goals to guide the process:

(1) The Department will first seek to preserve current infrastructure and to optimize the capacity of the existing highway infrastructure before applying funds to increase capacity by adding new lanes.

(2) The Department will address means to improve the capacity of the existing system through technology like intelligent transportation systems, access management, transportation demand management, and others.

(3) The Department will assess safety through projects addressed in paragraph (1) and (2) above. The Department will also target specific highway locations for safety improvements.

(4) Adding new capacity projects will be recommended after considering items in paragraph (1), (2) and (3).

(5) All recommendations will be forwarded to the Transportation Commission for its review/action.

**R907-68-4. Prioritization of Major New Capacity Projects List.**

(1) Major New Capacity Projects will be compiled from the State of Utah Long Range Transportation Plan.

(2) The list will be first prioritized based upon Transportation Efficiency Factors, and Safety Factors. Each criterion of these factors will be given a specific weight.

(3) The Major New Capacity Projects will be ranked from highest to lowest with priority being assigned to the projects with highest overall rankings.

(4) The Commission will further evaluate the projects with highest rankings considering contributing components that include other factors such as Economic Development.

(5) For each Major New Capacity Project, the Department will provide a description of how completing that project will fulfill the Department's strategic goals.

(6) In the final selection process, the Commission may consider other factors not listed above. Its decision will be made in a public meeting forum.

**R907-68-5. Commission Discretion.**

The Commission, in consultation with the department and with MPOs, may establish additional criteria or use other considerations in prioritizing Major New Capacity Projects. If the Commission prioritizes a project over another project that has a higher rank under the criteria set forth in R907-68-4, the Commission shall identify the change and the reasons for it, and accept public comment at one of the public hearings held pursuant to R907-68-7.

**R907-68-6. Need for Local Government Participation for Interchanges.**

New interchanges for Economic Development purposes on existing roads will not be included on the Major New Capacity Project list unless the local government with geographical jurisdiction over the interchange location contributes at least 50% of the cost of the interchange from private, local, or other non-UDOT, funds.

**R907-68-7. Public Hearings.**

Before deciding the final prioritization list and funding levels, the Commission shall hold public hearings at locations around the state to accept public comments on the prioritization process and on the merits of the projects.

**KEY: transportation commission, transportation, roads, capacity**
**Date of Enactment or Last Substantive Amendment: June 1, 2006**
**Authorizing, and Implemented or Interpreted Law: 72-1-201**