

ECONOMIC PERFORMANCE MEASUREMENT PROJECT

Assess Best Practices for Economic Transportation Performance Metrics/Modeling

Task 1A Report

Prepared for
North Carolina Department of Transportation

Prepared by
Institute for Transportation Research and Education
North Carolina State University
with
Economic Development Research Group

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Introduction

Project Context

NCDOT desires to identify best practices regarding transportation related economic performance measures and tools to improve decision-making such that North Carolina's transportation investments provide greater support for the state's economic development and competitiveness. *The key question is -- are we investing in the most economically productive infrastructure -- not from a short-term perspective, but from that of improving the economic prosperity of all North Carolinians for the decades ahead?* While NCDOT is currently using economic performance criteria as part of the project prioritization process, there is a growing desire to improve the prioritization process and extend the use of economic performance to other phases of the transportation decision-making and system management processes. Consequently, NCDOT asked the Institute for Transportation Research and Education (ITRE) at North Carolina State University to conduct a scan of literature and best practices to provide NCDOT with critical information to evaluate how to move forward with ensuring that economic performance becomes integrated into policy, planning, programming and project level decision-making. This work is being conducted in phases with the first devoted to a review of readily available resources. It is expected that input from this report will further clarify the unique interests and needs of NCDOT and; subsequently, inform a more detailed evaluation of current practice. The work presented in this report was done in association with nationally and internationally recognized economic analysis experts from the Economic Development Research Group (EDRG).

The North Carolina and US economies continue to recover -- albeit haltingly -- from the effects of years of recession. State governments have less revenue to work with, and the demands on transportation and other essential infrastructure in North Carolina and the US exceeds the ability of government transportation agencies to adequately maintain it, much less expand it. "Doing more with less", with or without changes to funding mechanisms will continue for the foreseeable future. The competition for additional funding among all sectors of government has become the norm while being unpopular with the general public. Transportation executives must "make the case" for additional funding in support of growing the economy to benefit the industries and businesses that provide jobs to North Carolinians.

Focusing investment on projects that generate the greatest economic returns not only maximizes benefits to taxpayers and society, but can also demonstrate value to legislators and the public. Economic returns go far beyond traditional economic related transportation measures such as travel time savings, vehicle operating costs, and safety benefits to users. Non-users and society as a whole can benefit from wise, prudent, and tested project proposals that can create long term jobs, attract businesses, and increase economic productivity. Increased economic productivity makes local businesses more competitive. More competitive businesses are able to sell more goods and services to other states and countries, bring more revenue into the state, and hire more employees.

Economic development is about much more than just business and transportation. North Carolina's workforce, their education levels, and the quality of life they enjoy all matter for business attraction to the state. But what brings people to a state in the first place depends in large part on the inflow of money made possible by the sale of those goods and services to outsiders. Transportation facilitates this process -- the state's products are shipped to outside consumers by different modes of passenger and freight transportation. Various modes of passenger transportation allow consumers to visit the state for business, social, and recreational purposes. These relationships and the general importance of transportation to economic development, and determining the economic benefits of transportation projects that enable better results-oriented and society-improving decision-making underlies the focus of this work effort.

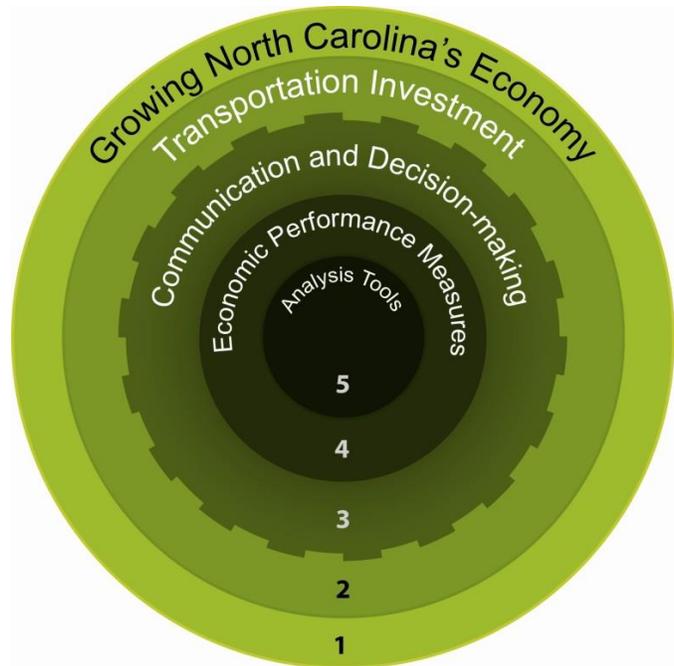
Introduction

Where Do We Begin?

To know where to begin, it is important to know where we are. Going directly to measures and tools without first understanding the context is like trying to solve a problem without understanding the problem. Albert Einstein once said: “If I had an hour to save the world I would spend 59 minutes defining the problem and one minute finding solutions.” The report begins, therefore, with an overview of what economic factors and sectors drive the North Carolina economy. If we want to grow it, we need to understand what the drivers are, and then how transportation investment supports that growth. This is a high level overview that helps frame some of the key economic drivers but does not “drill down” into every facet of economic development in our state. “Turn the cog”-- so to speak – to generate transportation investment, which in turn can facilitate the movement of people and goods, and impact North Carolina’s people and economy -- positively or negatively. Only after we understand what decisions need to be made and who we need to communicate with can we decide on the appropriate measures and tools to accurately evaluate economic outcomes.

This report is structured around a process that is logically connected including (1) North Carolina’s economic and transportation context, and (2) a description of the relationship between the two. Understanding (3) what we need to assess at which stage, and for which stakeholders, is key for decision-making and communication. Knowing what to assess, and for whom, is essential to choose the most appropriate (4) measures and (5) tools. Transparently communicating the results and consequences of economic analysis builds confidence in, and increases buy-in from, taxpayers and elected officials. To support this framework, the report includes a review of how fifteen state DOTs are using economic performance as part of strategic planning, programming and prioritization and tracking department-wide performance. This work effort concludes with a bibliography of 34 annotated summaries of 42 research project reports, papers, and books. These resources were used to develop the topic summaries.

North Carolina’s economic health as related to having and keeping a job is on the mind of every citizen, resident, and elected leader – from Main Street to Blount and Jones Streets. Transportation investment, with proper data, decision-making, and public support can help make that happen. The approaches described in this report can lead to the identification of specific metrics and tools that transportation staff, management, and elected leaders can use to track performance trends over time; consequently, leading to a more efficient and effective NCDOT. Just as important, these approaches can create long-term jobs, productivity, competitiveness, and prosperity for residents, businesses, and other stakeholders.



Introduction

Economic Context (see *North Carolina Economic Development Context* summary)

The Governor of North Carolina and NCDOT Secretary recently reminded the press and public of the state unemployment rate of 9.4%, as contrasted to that of 7.6% for the country. Over the next 10 years, the state's population is expected to grow by over 1.3 million people. During that time transportation funding will decline by \$1.7 billion, based on current funding formulas.

North Carolina's economy continues a slow recovery from the effects of the 'Great Recession.' Manufacturing continues to struggle against a two or more decade slide. Agriculture, too, has declined, but both specialty agriculture and manufacturing niches are emerging. Urban areas are now the economic engines of the state, with growing economies and populations. The Charlotte Metropolitan area remains a locus of the banking and financial service industries. Raleigh and the Research Triangle Park area host a high concentration of information technology companies. Businesses continue to identify transportation, transit, and active transportation options as important considerations for business location decisions. This is particularly true for high tech companies seeking to locate in urban settings.

Retail, health care, communication services, professional services, and construction and finance, are all leading service industry employers and areas of strength in North Carolina's economy. Apparel, electronic equipment, chemical, furniture, and telecommunications sectors are important manufacturing jobs and export sectors for the state. Specialty manufacturing and mills are important exporters of goods to the international marketplace. Moving forward, the state identifies aerospace; aviation; defense; automotive; biotechnology; pharmaceuticals; green and sustainable energy; and financial, information, communication services, and technology as targeted growth areas.

Of all products leaving North Carolina for domestic or international destinations, nearly 82 percent (based on value) are transported by truck while the remainder is transported by rail, air (including truck-air), multiple modes, mail, and other modes. A small portion of North Carolina's international exports (6.2 percent of the total value in 2012) are shipped through the state's two coastal ports: the Port of Wilmington and the Port of Morehead City. The top ports in other states of North Carolina's exports include Norfolk, VA; Charleston, SC; Buffalo-Niagara; and Atlanta, GA.

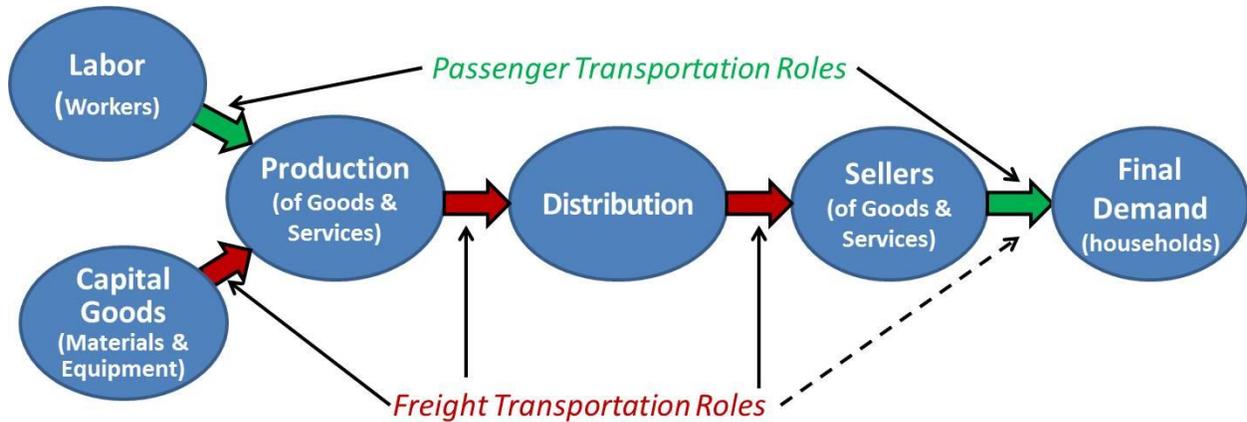
Transportation and Economic Development (see *Relationship between Transportation and Economic Development* summary)

Economic development is the process by which jobs and income are created and maintained, thus increasing wealth and enabling actions that improve quality of life. There are three primary ways that investments in transportation impact the economy:

- *Transportation Industries as an Employer*
- *Transportation Construction & Operations as a Generator of Jobs*
- *Transportation as a Facilitator of Business Growth & Attraction (the greatest impact)*

Transportation generates the *farthest-reaching economic impacts* through its support for *other* industries. By facilitating the mobility of people and freight, transportation plays a paramount role in growing existing businesses, attracting new businesses, and contributing to regional and statewide competitiveness. At its most fundamental level, transportation contributes to economic development by providing businesses with access to the factors of production that allow them to grow (see figure on next page).

Introduction

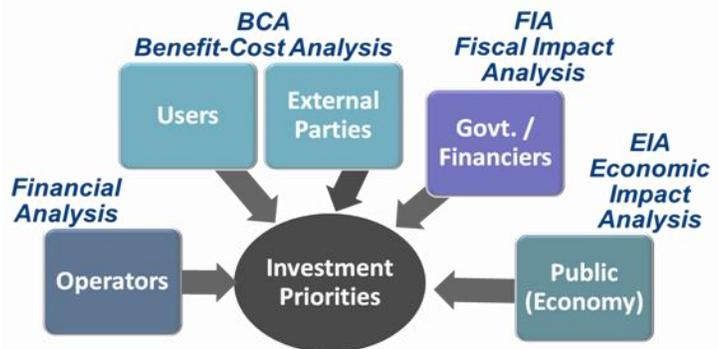


Factors affecting business include service enhancements and productivity as well as location to efficient transportation networks. Transportation investment leads to intermediate results that affect system performance which affect businesses and finally produce economic impacts such as jobs, household income, GDP and output as well as taxes (see summary for thorough explanation). If transportation improvements facilitate economic growth and competitiveness by increasing productivity, however, underinvestment has the opposite effect. Congestion on over-capacity highways can, for example, sacrifice reliability and business productivity by effectively shrinking labor and supply markets.

Communication and Decision-making (see the *Communications and Decision-making* summary)

Transportation investments can affect economic growth in many ways; however, understanding how to use the information to make a difference in our transportation decisions and public understanding of them is another issue all together. It is first critical to understand that the transportation investment process is comprised of many very important steps which include policy and vision, prioritization, alternatives analysis, construction, and asset management.

There are key stakeholders at each phase that may or may not be the same people with the same interest or responsibilities. Each of these stakeholders (see figure to right) has a different viewpoint concerning benefits and costs, as well as roles in the planning and decision making process. These differing perspectives lend themselves to different forms of analysis and produce different needs for communications.



The summary delves into many issues related to when and how to use the different economic impact tools. While the general public tends to most easily understand the concepts of jobs and household income, economists prefer Gross Domestic Product (GDP), or Value Added, because it is the most accurate measure of economic activity actually occurring in a region. Business organizations including the media often like to quote the larger numbers associated with business sales (or output) because they catch people's attention. The point is they are all important and work in tandem but should be properly understood before communicating outside the agency.

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Economic Performance Measures (see *Economic Performance Measures* summary)

To get from a transportation investment to economic impacts there are many measures that are important to track. These measures include direct, indirect and induced effects. First, the transportation project results in quantifiable, directly observed measures including mode choice, volume, speed and distance. These directly observed measures translate into system performance measures including travel time, reliability, connectivity, accessibility and safety. The summary provides information on each of these including the impacted groups, what is being measured and why, example metrics and available resources. These, however, are intermediate performance measures that are critical as input into economic analysis methods and tools that yield business factor economic performance measures including cost, labor market, parts and materials, customer markets, and supply chain logistics -- which in turn get translated to economic outcomes (jobs, income, etc.!).

Tools (see *Tools and Models* summary)

The descriptions of tools are provided in the summary to enable better understanding of their uses, rather than to initiate a comparison of tradeoffs among different tools. Some tools provide information for other tools; others are used in a feedback loop to continue evaluating performance. Therefore, you cannot always substitute one tool for another just as you cannot substitute a screwdriver for a hammer if the screwdriver is what you need.

A performance measure tool for purposes of this effort is defined as: An economic analysis method, usually some type of data analysis or synthesis software program produced by a third party, used by an entity such as a DOT to determine and articulate the likely outcomes of investments stemming from a policy, program, or project. Five primary types or categories of tools are available to assess economic performance of transportation investments: Input-Output Models, User Benefit Cost Models, Economic Impact Forecasting Models, Economic Development Tools, and Land Use Models. They have different intended purposes and work at different scales of business and spatial detail. The summary provides the purpose, use, potential constraints, data needed, common models or tools used, sample products and reference information for each of the five types of tools. Key questions are provided in the summary to help NCDOT identify key considerations for choosing “best fit” tools.

What Other States are Doing (see *What Other States are Doing* summary)

In a resource-constrained environment state DOTs are struggling to understand what strategic transportation investments to make to support growth and spur job creation. Many DOTs have used economic impact studies to communicate to the business community, general public and elected officials regarding the importance of funding transportation investment to maintain a competitive economy. Fifteen state DOTs are profiled in the summary. They utilize economic measures and tools as part of decision-making for long range and statewide strategic plan investments, short-range five- or six-year plan investments, and/or for project prioritization schemes. Some DOTs use economic impact of alternative scenarios for asset preservation strategies as well. Transportation Economic Development (TED) programs are also profiled in this summary to provide insight into how some State DOTs are using economic development grant funding to stimulate job growth.

Introduction

Moving Forward

As stated in the beginning of the introduction this work effort was the first step in assessing best practices for economic transportation measure and modeling for NCDOT. This work was focused on educating and informing NCDOT staff with information readily available to help create a “common mental map” of the key issues that need to be dealt with first to better incorporate economic performance into transportation decision-making. The next step will “drill down” on issues most important to NCDOT through interviews with other transportation agencies and further resource review.

NCDOT is in the midst of major policy modifications. Therefore, the next phase of work will also support the development and deployment of these policies. As NCDOT staff reviews the topic summaries in this report the following questions may be useful to identify the focus on the next phase of work:

- *What types of transportation investments best support growing North Carolina’s economy?*
- *What strategic investment scenarios would be important to compare and contrast in terms of economic impact?*
- *What geographic investment scenarios would be important to compare and contrast in terms of economic impact?*
- *How can NCDOT utilize economic impact analysis and economic performance measures to help justify future and additional funding?*
- *How can NCDOT better understand the economic benefits associated with multi-modal and intermodal investments?*
- *What stage of transportation decision-making phase would most benefit from economic impact analysis? Which phase provides the “biggest gains the quickest”?*
- *Who are the primary stakeholders that NCDOT needs to collaborate with to better evaluate the importance of economic performance and transportation investment.*
- *What economic performance measures should be explored in further detail to support the proposed Strategic Mobility Plan prioritization criteria?*
- *What is important to consider when aligning economic performance measures from statewide planning, to regional planning and prioritization, to project development? How will the economic performance criteria be aligned with current decision-making processes?*
- *What is important to consider when thinking about economic performance and the Department’s Dashboard?*
- *How might NCDOT track economic performance of projects over time?*

A meeting with executive leadership is scheduled for May 28, 2013 to discuss the report information and decide on next steps for the next task.

North Carolina Economic Development Context

Economic development is about much more than just business and transportation; North Carolina's workers, their education levels, and the quality of life they enjoy all matter for business attraction to the state. But what brings people to a state in the first place depends in large part on the inflow of money made possible by the sale of goods and services to outsiders. Transportation facilitates this process—the state's products are shipped to outside consumers on different modes of freight transportation while various modes of passenger transportation allow visiting consumers to enter the state. These relationships and the general importance of transportation to economic development will be the focus of the following sections.

Overview of the North Carolina Economy

North Carolina's largest private industry sectors by employment include retail trade; health care; manufacturing; accommodation services; professional services; construction; and finance. Some of the largest employers in these sectors include Wal-Mart, BlueCross BlueShield, IBM, General Mills, Wells Fargo, and Bank of America. When compared to the nation, North Carolina has a particularly high concentration of workers in several durable and nondurable manufacturing industries, including apparel, electronic equipment, chemical, and furniture, as well as a high concentration in the telecommunications sector.

Economic Trends

In recent decades, North Carolina has shifted to more of a service-based economy as overseas competition has resulted in the loss of many manufacturing jobs. But while the agricultural and manufacturing sectors have both experienced declines, certain heritage industries still make significant contributions to the state's economy and have even seen growth in the wake of demand for organic and local food products and specialty manufacturing products. Key industries that are targeted for growth by the North Carolina Department of Commerce include aerospace, aviation, and defense; automotive manufacturing; biotechnology and pharmaceuticals; green and sustainable energy; financial services; and information and communications technology.

Spatial Concentration

Many of North Carolina's rural areas and small towns have borne the brunt of this employment and population loss while large cities such as Charlotte, Raleigh, and Greensboro have received most of the growth over the last thirty years. The Charlotte and Raleigh-Durham metropolitan areas alone received 45 percent of population growth since 2010 while many counties in the western and northeastern parts of the state lost population during this time.¹ Much of the growth in the Charlotte metropolitan area has been concentrated in the banking and finance industry, where Bank of America is headquartered, while information and technology industries have grown steadily in the Raleigh metropolitan area since the creation of the Research Triangle Park during the late 1950s.

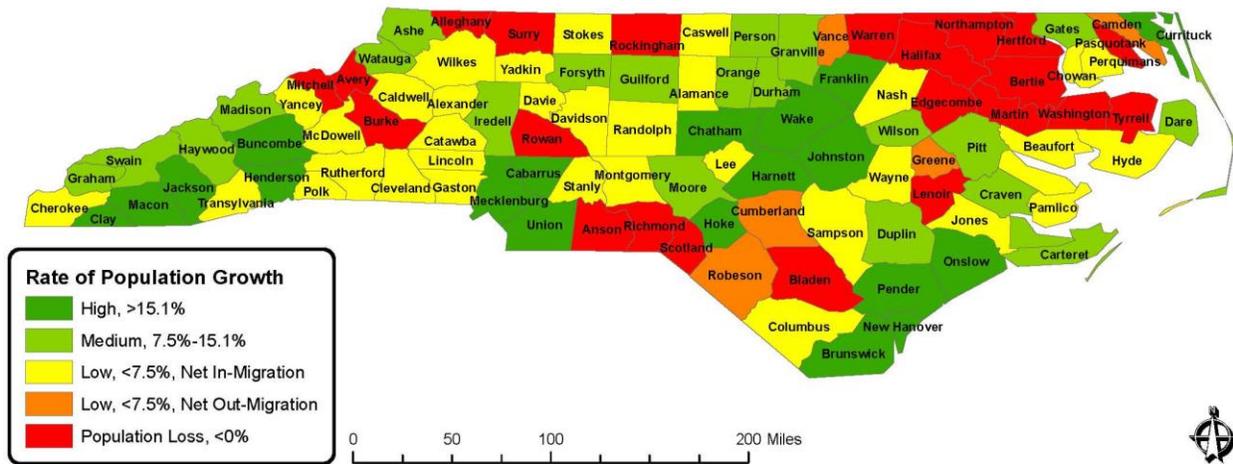
According to projections from the North Carolina Office of State Budget and Management, population loss in the northeastern part of the state is expected to continue through 2020 while the metropolitan counties in the Charlotte, Raleigh-Durham, southeastern, and far western regions will have grown by over 15 percent by decade's end (see figure on next page). Much of the expected state and county-level population growth will be fueled by in-migrating retirees and the relocation of resident retirees. North Carolina already ranks in the top ten among U.S. states by the size of the population over 65, and by 2030, this subgroup is expected to account for 18 percent of the state total.²

¹ Wesley Young, April 5, 2012, "Census shows people concentrating in cities, with widespread population loss in N.C. counties," *Winston-Salem Journal*, http://www.journalnow.com/news/state_region/article_50aee9e2-149f-54c6-ac4e-d68281075478.html.

² See <http://www.aging.unc.edu/infocenter/data/quickfacts.html#19>.

North Carolina Economic Development Context

Projected Population Growth in North Carolina Counties, 2010-2020

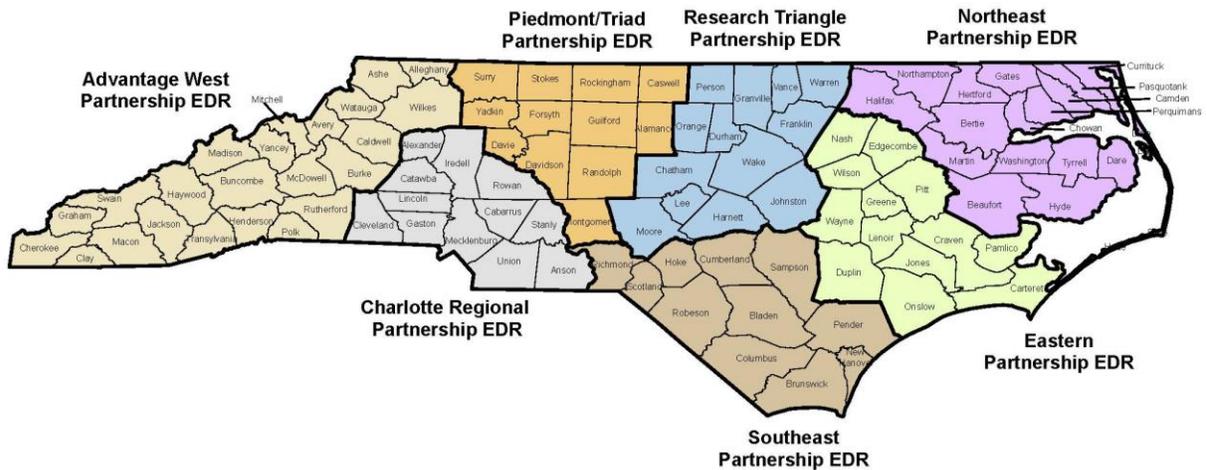


Source:

http://www.osbm.state.nc.us/ncosbm/facts_and_figures/socioeconomic_data/population_estimates/demog/20102020growthmig.pdf

The North Carolina Division of Employment Security (a division of the Department of Commerce) provides labor market information for seven distinct regions of the state (see figure below), but the extent to which economic development programs and planning efforts adhere to these boundaries is unclear.

North Carolina's Seven Economic Development Regions



Source: <http://www.ncesc1.com/lmi/publications/maps/Economic%20Development%20Regions.pdf>

Exports and Export Industries

Export industries are critical to economic development due their ability to bring dollars into the state by selling their product(s) elsewhere. North Carolina's key export industries, as measured by their contribution to the state economy relative to their contribution to the U.S. economy, span several types of specialty manufacturing and mills (see table below). These industries make significant contributions to total value added in the state, and rely heavily on transportation.

North Carolina Economic Development Context

Key Export Industries	2010 U.S. Exports (\$mil)	2010 Int'l. Exports (\$mil)	2010 Value Added (\$mil)	Location Quotient*
Food Manufacturing	\$ 11,511	\$ 1,208	\$ 3,572	0.89
Beverage & Tobacco Product Manuf.	\$ 14,555	\$ 224	\$ 12,360	6.84
Textile Mills	\$ 2,688	\$ 1,584	\$ 2,022	8.20
Chemical Manufacturing	\$ 30,660	\$ 6,356	\$ 10,419	1.70
Plastics & Rubber Products Manuf.	\$ 5,882	\$ 947	\$ 2,738	1.74
Fabricated Metal Manufacturing	\$ 5,074	\$ 816	\$ 3,020	0.92
Machinery Manufacturing	\$ 5,848	\$ 2,795	\$ 2,980	0.97
Computer and Electronic Manuf.	\$ 15,316	\$ 4,749	\$ 7,560	1.35
Electrical Equipment & Appliance Mfg.	\$ 5,182	\$ 1,631	\$ 3,084	2.13
Transportation Equipment Manuf.	\$ 7,526	\$ 3,484	\$ 1,313	0.37
All others	\$ 66,630	\$ 18,425	\$ 343,701	
Total	\$ 170,874	\$ 42,219	\$ 392,770	

*The location quotient measures an industry's share of value added relative to the same industry's share of U.S. value added.

Source: IMPLAN

North Carolina's largest trading partner is Canada, which was the destination for a quarter of the state's merchandise exports during the first half of 2012. The state's next four largest trading partners in order of largest value are China, Mexico, Japan, and Germany, which collectively account for 27 percent of total exports. Top domestic trade partners include Virginia, South Carolina, Georgia, and Tennessee—all neighboring states (see tables below).³

Top Foreign Trade Partners (exports)	Total Value, 2012	Share of Total
Canada	\$3,523,081,451	25%
China	\$1,295,438,997	9%
Mexico	\$1,148,084,259	8%
Japan	\$792,953,714	6%
Germany	\$552,552,339	4%
All others	\$6,705,488,716	48%
Total, all exports	\$14,017,599,476	100%

Top Domestic Trade Partners (exports)	Total Value, 2011	Share of Total
North Carolina	\$205,504	48%
Virginia	\$20,413	5%
South Carolina	\$20,373	5%
Georgia	\$18,926	4%
Tennessee	\$14,503	3%
All others	\$146,140	35%
Total, all states	\$425,859	100%

Source: WISERTrade and Freight Analysis Framework

Measured by value, North Carolina's top export commodities include chemicals; machinery equipment; transportation equipment; computers and electronics; and textiles and fabrics. And while not among the state's largest trading partners, France is the second largest purchaser of North Carolina's transportation equipment products, Hong Kong is the second largest purchaser of computer and electronic products, and the Central American countries of Honduras, the Dominican Republic, and El Salvador are among the largest purchasers of the state's textiles and fabric products.⁴

Transportation's Role in Economic Development

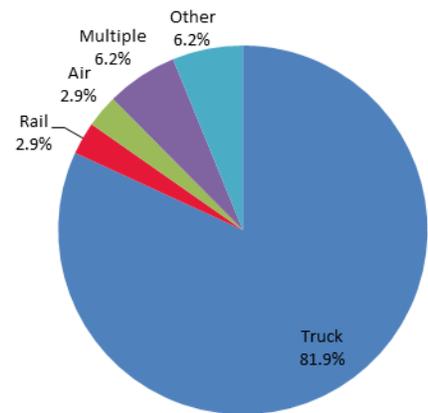
Relationships between transportation and economic development are explained in detail in the next topic summary, but the following statistics highlight the general importance of North Carolina's transportation network to the state's export and service sectors:

³ WISERTrade (2012)

⁴ Ibid

North Carolina Economic Development Context

Of all products leaving North Carolina for domestic or international destinations, nearly 82 percent (as based on value) are transported by truck while the remaining are transported by rail, air (including truck-air), multiple modes, mail, and other modes (see pie chart).⁵ The figure in the Appendix illustrates major freight flows by truck coming to, leaving from, and traveling within North Carolina in 2007.



Modal Split among NC Exports

Source: Freight Analysis Framework (2010)

A small portion of North Carolina’s international exports (6.2 percent of the total value in 2012) are shipped through the state’s two coastal ports: the Port of Wilmington and the Port of Morehead City. In 2012, nearly all export shipments traveled through Wilmington (\$1.7 billion) while the remaining traveled through Morehead (\$55.8 million).⁶ The top ports of North Carolina’s exports in other states include Norfolk, VA (\$4.0 billion in 2012); Charleston, SC (\$2.7 billion); Buffalo-Niagara (\$2.7 billion); and Atlanta, GA (\$2.0 billion).

Several industries that serve both local and visiting populations also make significant contributions to the North Carolina economy and rely heavily on passenger transportation within the state (identified in table below). Among these key service industries, the lodging industry is most dependent on sales to visitors while the scenic and sightseeing transport support industry⁷ is least dependent on sales to visitors. It is therefore critical that transportation infrastructure supports the mobility needs of both visitors and North Carolinians.

Key Service Sectors	Sales Consumed Locally (\$mil)	Sales to Visitors (\$mil)	Total Supply (\$mil)
Retail Trade	\$ 28,790	\$ 3,633	\$ 32,423
Scenic & Sightseeing Transport Support	\$ 1,041	\$ 61	\$ 1,361
Arts, Entertainment & Recreation	\$ 4,109	\$ 833	\$ 4,948
Lodging	\$ 97	\$ 2,260	\$ 2,357
Restaurants & Drinking Establishments	\$ 15,902	\$ 1,080	\$ 17,005

Source: IMPLAN

Economic Development Agencies and Transportation

Transportation is recognized by the North Carolina Department of Commerce as an important component of local economic development through AccessNC™, a location tool providing detailed market access statistics for commercial properties. For businesses opening or expanding in North Carolina, the online service provides a database of distances to rail, highways, international and aviation service, and ports.

On its Thrive in North Carolina web page,⁸ the Department of Commerce also makes reference to, and provides several resources related to, transportation. Thrive’s “Market Access” web page provides detailed

⁵ Freight Analysis Framework Version 3.4, Center for Transportation Analysis

⁶ WISERTrade

⁷ The Bureau of Labor Statistics describes this industry, which use transportation equipment to provide recreation and entertainment services, as local in nature, usually typically involving same-day returns to the point of departure.

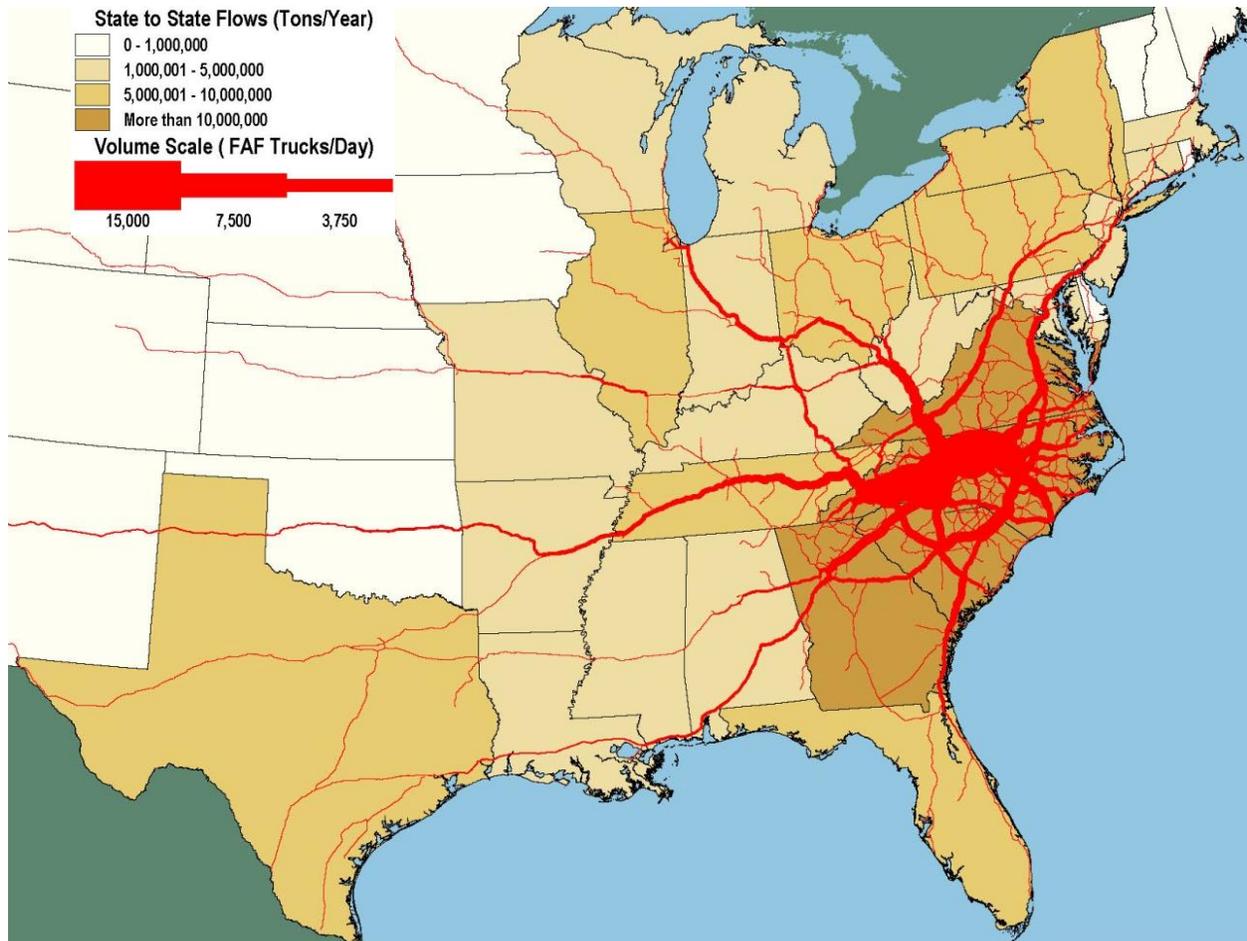
⁸ See <http://www.thrivenc.com/>

North Carolina Economic Development Context

information on the state's airports, ports, rail service, highway access, trucking service, and public transportation sourced from a chapter on market access⁹ in the Department of Commerce Fact Book.

As of this writing there appears to be no formal collaboration between the North Carolina Departments of Commerce and Transportation, but the Department of Commerce's program development in this area may change significantly if a recent proposal by Governor McCrory to shift economic development functions to a non-profit organization is approved.¹⁰

Appendix. Major Flows by Truck To, From, and Within North Carolina, 2007



Note: Major flows include domestic and international freight moving by truck on highway segments with more than twenty five FAF trucks per day and between places typically more than fifty miles apart.

Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operation, Freight Analysis Framework, version 3.1.2, 2011, http://www.ops.fhwa.dot.gov/freight/freight_analysis/state_info/north_carolina/images/hi_res_jpg/nc_trkflow_2007.jpg.

⁹ See <http://www.thrivenc.com/node/945/market-access>

¹⁰ David Bracken and Rob Christensen, April 8, 2013, "McCrory plan enlists private sector to aid NC development," *News & Observer*, <http://www.newsobserver.com/2013/04/08/2810962/mccory-plan-seeks-to-get-private.html#emInl=Politics>.

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Relationship Between Transportation and Economic Development

Economic Impacts of Transportation Investments

Economic development is the process by which jobs are created and maintained, thus increasing wealth and enabling actions that improve quality of life. There are three primary ways that investments in transportation impact the economy:

- *Transportation Industries as an Employer.* Many people are permanently employed by transportation industries, both in the public and private sectors. In 2011, the transportation sector employed over 120,000 people in North Carolina, with nearly half working in the trucking industry; 11 percent working in air transportation; 8 percent working in transit and ground transportation industries; and the rest working in other modes or supporting activities.¹
- *Transportation Construction & Operations as a Generator of Jobs.* Investments in transportation infrastructure also create short-term construction jobs, and can result in long-term maintenance employment after infrastructure is in place. Indirectly, transportation investments such as port dredging or bike lane expansion may generate additional economic activity by increasing the demand for ship or bike production. This impact category, similar to the first, is concerned with transportation as its *own* industry sector.
- *Transportation as a Facilitator of Business Growth & Attraction.* Transportation generates the farthest-reaching economic impacts through its support to *other* industries. By facilitating the mobility of people and freight, transportation plays a paramount role in growing existing businesses, attracting new businesses, and contributing to regional and statewide competitiveness.

While a full understanding the relationships between transportation and economic development requires consideration of all three of these impact categories, the remainder of this topic summary will focus primarily on long-term, economy-wide impacts described under the third category. Measuring the impacts of transportation on the economy using economic impact analysis, it should also be noted, is different than the economic valuation of total benefits, which is the subject of benefit-cost analysis (BCA). BCA may include environmental, social, health, and quality of life benefits. While all of these benefits are important, many do not have a direct impact on the flow of income and job creation.

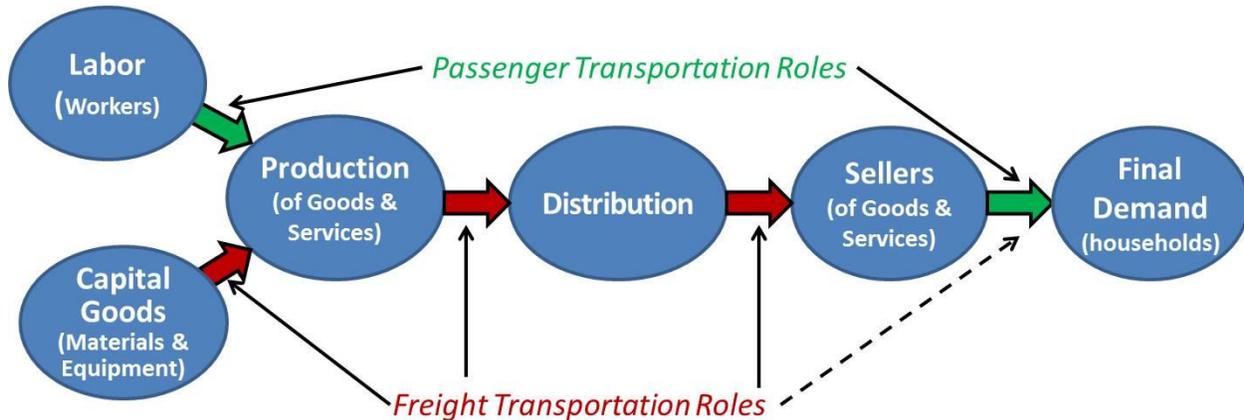
Movement of People and Freight

At its most fundamental level, transportation contributes to economic development by providing businesses with access to the factors of production that allow them to grow (see figure on the next page). Transportation systems deliver inputs (i.e., labor, materials and equipment) to the producers of goods and allow consumers to purchase those goods when they travel to stores or receive deliveries at home. In the case of manufactured goods, the transportation network facilitates the distribution of products through wholesale or retail channels. Services are also a product of labor and capital, and require transportation to meet both local demand (sales to residents) and export demand (sales to visitors).

¹ Bureau of Economic Analysis

Relationship Between Transportation and Economic Development

Transportation Roles



In North Carolina, this process is critical to both the key export industries identified in the North Carolina Economic Context section as well as the service industries that make significant sales to both local consumers and visitors traveling by air or other modes. Products leaving North Carolina for other states or international destinations are heavily dependent on highway infrastructure, for instance, since close to \$12.1 billion of product value (3.2 million tons) left by truck in 2011. Another \$411 million (6,000 tons) left by air (including truck to air) while \$438 million (580,000 tons) left by rail.² Approximately \$1.9 billion (797,000 tons) entered the state by truck in 2011, meanwhile, while close to \$194 million (402,000 tons) entered by rail and \$10 million (247 tons) entered by air. Within the state, virtually all freight travels by truck (\$2.7 billion or 483,000 tons in 2011). Since the average truck carries roughly 16 tons of freight, these values demonstrate the critical role that trucks play.

Passenger transportation also facilitates commerce and economic activity by allowing workers to reach places of employment within a region and consumers to reach stores and services. North Carolina's highway infrastructure, which is the most extensive in the country, and its transit infrastructure, is critical to moving people. In 2011, for instance, North Carolina's public transportation systems were responsible for moving nearly 73 million passengers a total of 90 million miles.³ There are a total of 99 public transportation systems within the state, and while many serve single communities or cities, several provide regional services.

Service Enhancements and Productivity

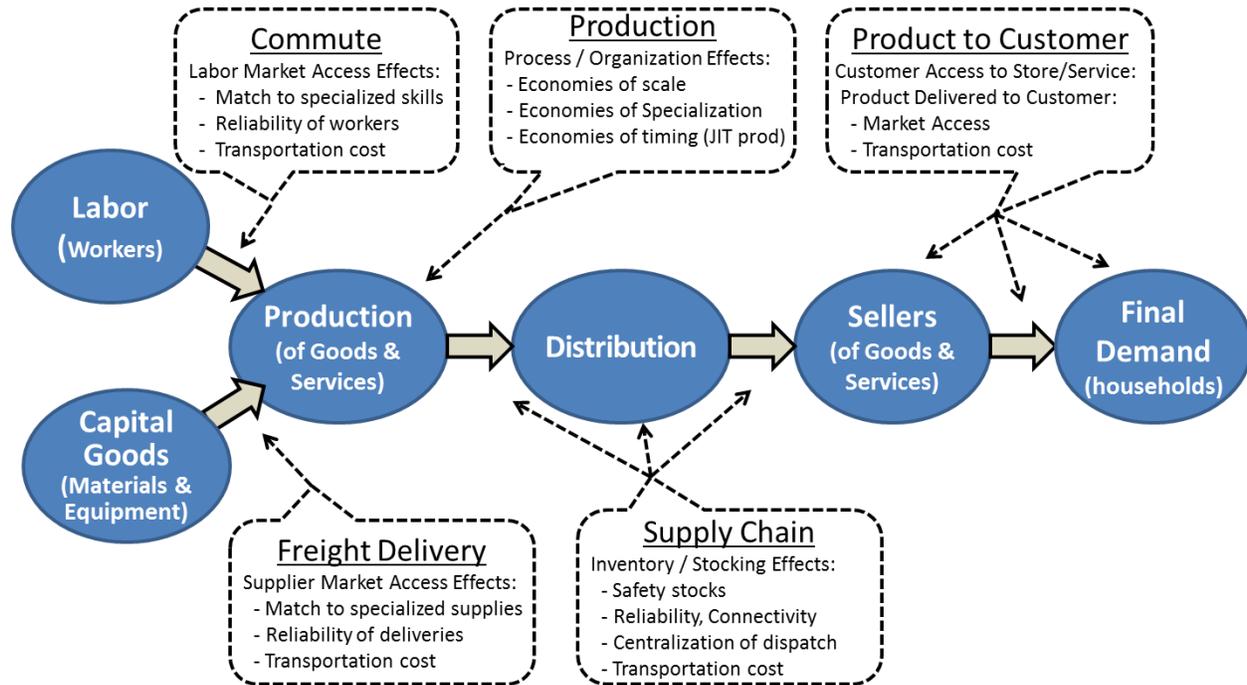
Transportation investments that reduce congestion create routes that are more direct, and improve reliability increase the speed at which people and freight can travel. Faster travel allows producers to hold lower inventories, for instance, and is the critical element that makes just-in-time (JIT) production possible (see figure on the next page). For services such as those provided by the utility or construction sectors (think power line repairs and travel to construction sites), moreover, improved transportation allows contractors to travel farther distances during a single business day (i.e., dispatch centralization), saving time and costs.

² Freight Analysis Framework (2011)

³ Public Transportation Operating and Financial Statistics Reports, North Carolina Department of Transportation

Relationship Between Transportation and Economic Development

Transportation Factors Affecting Businesses



Improvements to freight transportation allow companies to reach customer markets more cheaply and increase the size of those markets, as well as expand their choice of input suppliers. Passenger modes, similarly, allow companies to access a larger workforce while allowing workers to access more employment opportunities. In each scenario, service enhancements caused by improvements in the transportation network lead to more efficient production processes. These efficiency gains may translate into industry cost savings (and, in turn, reduced prices), lead to a greater share of global market sales, or result in expansions to local facilities.

Business Location

For some industries, the dominant location factor for businesses is the cost of transporting the inputs to and outputs from production. As a result, transportation networks can significantly shape the location of industries that are especially sensitive to transportation costs. Resource-oriented businesses in the hardwood sawmill industry, for example, have relatively high costs of transporting their input and thus locate close to timberlands. Conversely, market-oriented businesses such as those in the beverage and tobacco manufacturing sector are more likely to locate near their consumer market as the cost of transporting their inputs is less than transporting their outputs.

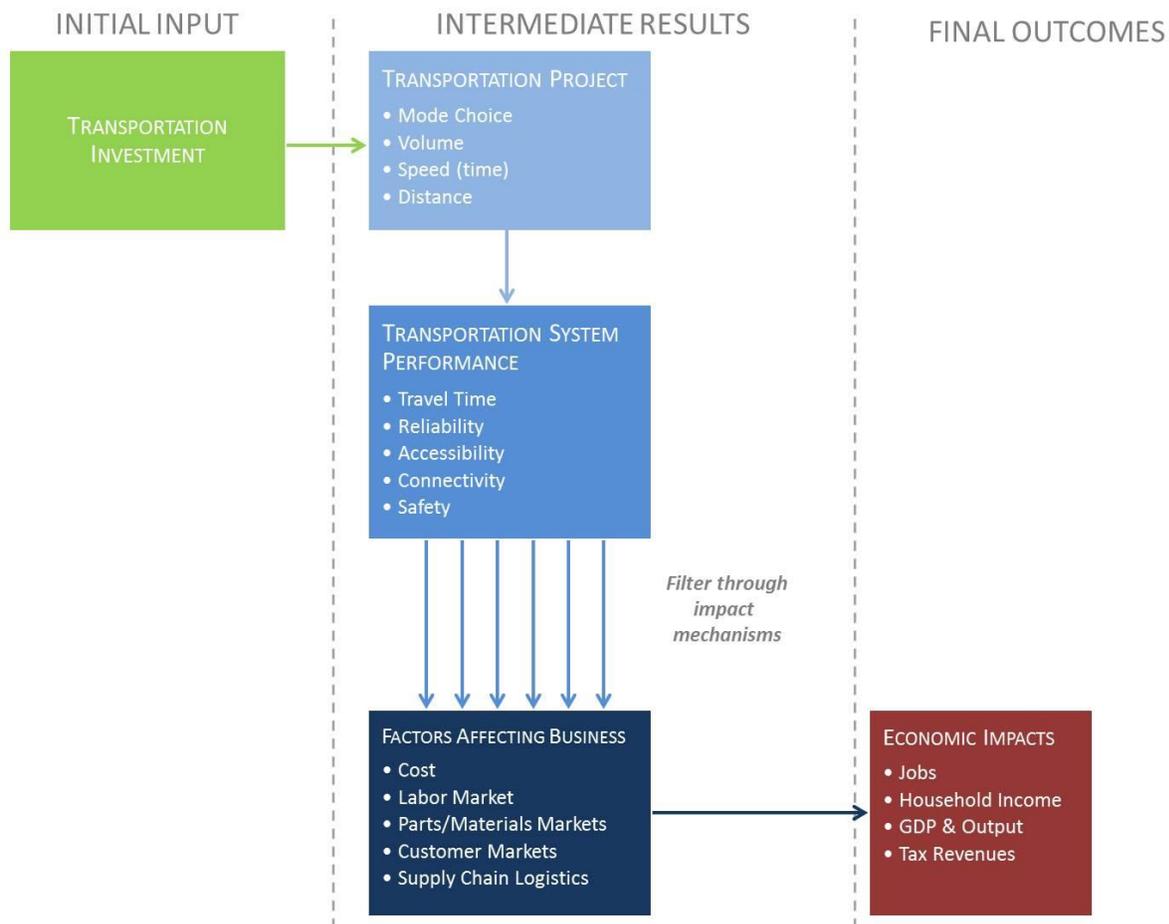
Even businesses in the professional services sector, concentrated in places like the Research Triangle, make location decisions based on their proximity to airports and the access to a high-skilled, mobile workforce they provide, as well as the degree of livability and quality of life a region offers. Investments in transit, bicycling, and walking infrastructure improves livability, and the availability of these modes has been shown to influence business location decisions when employers want to provide enjoyable places to live *and* work for existing and prospective employees.

Relationship Between Transportation and Economic Development

Economic Impacts from Transportation

The link between a transportation project and the economic impacts resulting from it is illustrated in a process familiar to both transportation engineers and the business community (see figure below). Physical performance measures traditionally collected during the engineering phase of a transportation project (e.g., volume, speed, and mileage) are translated into broader indicators of system performance. The combination of mode choice and distance, for instance, determines the extent to which destinations are accessible by system users. The topic summary on economic measures provides more detail on how these performance measures can be calculated.

Transportation Impacts on the Economy



Levels of system performance, then, are considered as factors directly affecting businesses when choosing where to locate and workers when choosing where to live. Where a business locates respective to regional labor and customer markets will invariably affect their productivity and thus the level of jobs, income, and output they generate, while improved accessibility may increase the productivity and reliability of employees through time savings. Even for e-commerce businesses—which may offer services and not a tangible product—access to a specialized and reliable workforce is dependent on transportation. Business and worker productivity is then translated into various economic results using methods of economic impact analysis (discussed in the topic summary on tools).

Relationship Between Transportation and Economic Development

Costs of Underinvestment

The benefits described above increase the productivity of existing businesses but also create the necessary conditions to attract new businesses. If transportation improvements facilitate economic growth and competitiveness by increasing productivity, however, underinvestment has the opposite effect. Congestion on over-capacity highways can, for example, sacrifice reliability and business productivity by effectively shrinking labor and supply markets.

Declines in the quality of roads, bridges, and other forms of transportation infrastructure can have a similar effect. For workers, increased travel times as a result of congestion or poor quality infrastructure can inhibit their ability to work more hours of full operation per day, while travel time delays can also reduce the distance visitors are willing travel to reach tourist destinations. Quality of life, productivity and the amount of discretionary income available to a worker can be impacted if they are not provided transportation options beyond the automobile. What these examples indicate, then, is that both quality *and* sufficiency of the transportation system affect the competitiveness of North Carolina's businesses and workers.

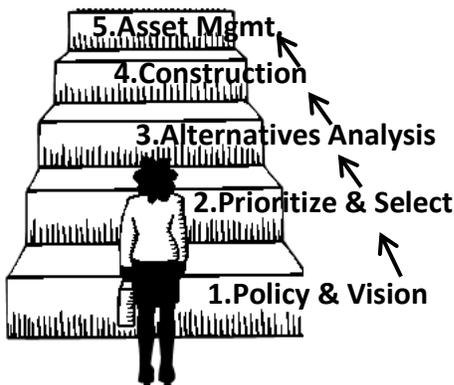
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Issues. Transportation investments can affect economic growth in many ways, as described in the topic summary on transportation-economic relationships. However, there is a totally separate issue which is “How can we use that information to make a difference in our transportation decisions and public understanding of them?”

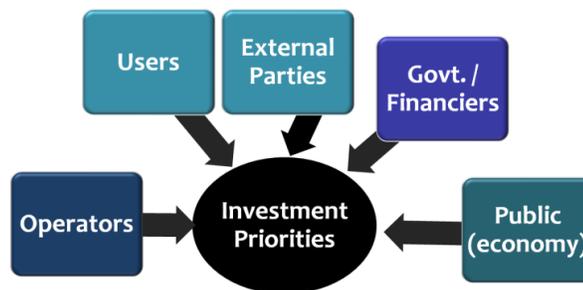
The answer has three dimensions:

- *Stages:* When in the decision-making process does economic impact matter?
- *Stakeholders:* Who are the key players at each stage?
- *Metrics:* What information is important to different stakeholders at each stage?



Stages: The transportation decision-making process can be simplified into five steps, described below and shown in the graphic to the left. Economics is a factor in all of these steps. (1) First, there is policy direction provided by the governor and other elected leaders, which provides DOT leadership a direction for specifying its vision and long-range concept plan. (2) This gives direction for DOT staff to generate a list of desired projects and rank them given a set of criteria. (3) The larger projects are subject to state and federal regulations for alternatives analysis and/or environmental reviews of the available options. (4) Once funds are secured, a project is constructed. (5) After completion, the facility is added to the list of assets which the DOT must manage and maintain.

Stakeholders. There are key stakeholders at each step in the process. We can divide stakeholders into five key classes, each of which involves people with different interests and roles in transportation plans and decision. They are shown in the graphic and described below:



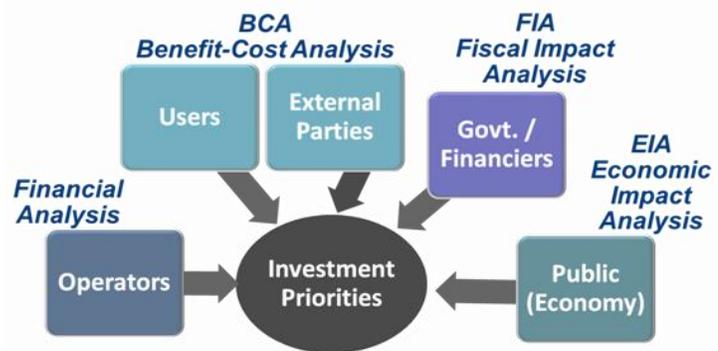
- *Users of the transportation system* – These are car drivers and passengers; bus, airline and rail passengers; bicyclists; pedestrians and freight shippers and carriers. They directly experience changes in travel times, costs (including fares, fees, tolls and vehicle operating costs) and safety. They are the folks directly helped or hurt by transportation decisions, and that can be reflected in traditional forms of benefit-cost analysis and prioritization factors.
- *External parties* – These are surrounding area residents, business owners and workers who may not be traveling themselves, but who are affected by wider changes in access patterns (affecting tourism, job opportunities and truck delivery areas) and changes in the environment (noise, water quality and air quality). Impacts on these parties can show up in several ways, within a

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broader “societal” formulation of benefit-cost analysis, within the criteria for project prioritization, as part of qualitative Community Impact Assessment, or as stakeholders at citizen or community information workshops and project public hearings.

- *Operators* – These are the organizations that provide freight shipping services (air, marine, rail and truck cargo movement), passenger travel services (airlines, rail and transit operators, tourism bus/boat and ferry services) and operation of facilities (including toll authorities, port and airport authorities and rail station operations). Their decisions to operate services depend on financial considerations (revenues and costs) which are very much affected by the availability, quality and cost of using transportation infrastructure.
- *Government agencies and private sector funding partners* – These are the public agencies and private banking organizations that raise money for construction and maintenance of transportation facilities, issue bonds or loans, and legislators who make funding decisions that enable the raising of money for those purposes. Their decisions are affected by both public benefit and fiscal impacts -- which can refer to public tax revenues, public agency operating costs, cash flow and public-private return on investment.
- *The General Public* – In addition to the users and other affected external parties, there is the larger set of state residents who want a better quality of life and more economic opportunity – which means more business investment that will in turn create more and better paying jobs and more income for all. For them, and the state legislators who represent them, economic development impacts can be important.

Economic Tools. Each of these stakeholders has a different perspective or viewpoint concerning benefits and costs, as well as roles in the planning and decision making process. These differing perspectives lend themselves to different forms of analysis and produce different needs for communications. The graphic on the right is an oversimplification, since everyone can have some interest in every aspect of impact, but it does show how different forms of impact analysis are of particular interest to different parties.



Each kind of economic analysis tool (or model) is defined below. It is important to stress that each tool provides a different perspective or frame of reference for assessing benefits, costs or impacts. There is no single right method – each of these types of analysis has a role to play and is of interest to different parties.

- *Benefit-Cost Analysis (BCA)* is a method of comparing a project’s overall benefits and overall costs (and their difference or ratio) on a consistent basis. It can measure changes in transportation system efficiency by focusing just on *user benefits* (time savings, safety and vehicle costs), or it can also more robustly consider wider effects on external parties (environment and productivity of the economy) in which case it represents *societal benefits*. However, it works by turning all considerations into money terms, and then adjusting for the timing of various benefit and cost streams by expressing results in terms of a discounted net present value. To accomplish this, it must make assumptions about the value of saving time, of reducing deaths and of a cleaner environment, as well as the discounting of future effects into

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today’s dollars. This kind of analysis works for technical staff evaluation studies and some public officials find it useful, but the general public often finds the benefit/cost ratio to be a black box concept and they cannot always accept its assumptions.

- *Economic Impact Analysis (EIA)* is growing in popularity as a way of showing how transportation decisions can affect business attraction and business expansion, and thus affect job and income growth. This is very meaningful to the business community and general public, as the job, income and business output concepts are widely understood and appreciated. The general public, as well as elected public officials, often want to see these impacts when making major funding decisions. However, EIA also has some distinct limitations. One limitation is that it only looks at changes in the economy. That means that impacts on people’s personal time and quality of life are not considered unless they can be shown to directly affect the flow of money coming into and out of the economy – which is usually difficult or impossible. The solution that nearly every state has adopted (including North Carolina) is to consider economic impact as one of several factors considered in a multi-criteria rating of projects (discussed later).

The chart below shows how different kinds of benefit-cost analysis and economic impact analysis differ in their coverage of various transportation project impacts.

Coverage of Alternative Benefit and Impact Measures

Class of Benefit	User (Traveler) Benefit	Full User Benefit	Societal Benefit	Economic Development Impact
\$ Passenger Time Savings - personal travel	Yes	Yes	Yes	--
\$ Passenger Time Savings - business travel	Yes	Yes	Yes	Yes
\$ Travel Vehicle Operating Expense Savings	Yes	Yes	Yes	Yes
\$ Travel Safety (Accident) Cost Savings	Yes	Yes	Yes	Yes
\$ Value of Consumer Surplus	--	Yes	Yes	--
\$ Shipper/Logistics/Supply Chain Productivity	--	Yes	Yes	Yes
\$ Market Access & Scale Productivity Gain	--	--	Yes	Yes
\$ Value of Environmental & Health Benefits	--	--	Yes	--
\$ Value of Community, Quality of Life, Mobility	--	--	Yes	--
\$ Income from Business Location Shifts	--	--	--	Yes
\$ Income from Suppliers, Consumer Spending	--	--	--	Yes

There are additional ways that economic analysis is used to assess project impacts:

- *Multi-Criteria Analysis (MCA)* is a way of considering total benefits and costs of projects that does not require turning everything into money terms. It works by making a list of key decision factors (criteria), measuring them in whatever quantitative or qualitative measure can be done, assigning weights to each factor and then creating a weighted score for each project. The factors may include user benefit, economic impact, quality of life, environment and other policy considerations. Many states use this approach for prioritizing projects. NCDOT also uses a form of MCA in its current highway project ranking process, though it incorporates fewer factors than some other states. (see chart).

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Economic Development Criteria Used in Project Rating Systems

Rating Criteria	OH	WI	MO	KS	NC
Traveler Benefit and Environment					
Travel time, operating cost, level of service	X	X	X	X	X
Safety (accident rate)	X	X	-	X	X
Pollution emissions	X	X	X	-	-
Transportation Drivers of Business Productivity Gain					
Intermodal facilities & multi-modal access	X	(a)	X	(a)	*
Reduce congestion, traffic bottlenecks, volume/capacity	X	X	X	X	X
Connectivity to key statewide corridors & global gateways	-	X	X	(a)	*
Labor market access	-	(a)	-	(a)	*
Predictability (reliability) of travel times	-	(a)	-	(a)	*
Concentration of trucks for goods movement	X	(a)	X	X	(a)
Industry productivity /competitiveness of freight costs	-	X	-	(a)	(a)
Transportation Drivers of Localized Economic Growth					
Industry site access for business development	X	(a)	-	(a)	*
Location in economically distressed area	X	-	X	-	-
Supports cluster development /in-fill/redevelopment	X	-	X	X	-
Supports local economic development initiatives	-	-	X	X	-
Local public support	-	X	-	X	-
Leveraging local private investment	X	-	-	-	-
Economic Growth (Attraction + Expansion) Outcomes					
Jobs(support job growth/reduce unemployment)	X	X	-	-	-
Gross Regional Product (income generated)	-	-	-	X	X

X = factor explicitly included as an element of the rating system;

(a) = factor implicitly included as an element of TREDIS model calculation of job or GRP impacts;

* = factor not currently included, but could be captured by TREDIS if access & reliability are measured

- = factor not formally recognized as a separate element of the rating system, but may still be considered through other elements of the broader project selection process

- Financial Analysis** refers to a pro forma accounting of expectations for incoming revenues, outgoing expenditures, cash flow and return on investment, from the viewpoint of specific parties. They can include railroads, airlines, the trucking industry or in the case of PPP (Public Private Partnerships) – the parties who would build, operate services, collect tolls or fares, and maintain facilities. This is also important because there can be projects that generate total benefits that exceed total costs as a whole, but are still financially untenable because they create negative cash flows for some key parties. Specifically, a project may make sense overall, but nobody can raise the required funds to initially build the project, or no individual party will find it financially feasible to operate services or maintain the facility after it is built without some cross subsidy.
- Fiscal Impact Analysis (FIA)** refers to a special form of financial analysis applicable to government agencies. It involves calculation of the impact a project may have on taxes and other revenues collected by each level of government (e.g., increased income and sales tax as businesses are attracted and jobs grow), and also calculation of the impact of that same project on expenses that will have to be incurred by that level of government (e.g., increased costs of schools and public safety as population is attracted to fill some of the new jobs). This is important for government revenue and budgeting analysis.

How the Decision Stages Matter. Each step in the transportation decision-making process outlined at the beginning of this summary involves a fundamentally different type of decision, involving different parties, with different factors at stake. Thus, the use of economic measurement tools must be adapted

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to fit the situation, so that information on costs and benefits or tradeoffs may be communicated. This is critical to building support for whatever decisions are to be made.

At the initial stage of public policy and visioning, DOT staff can develop illustrative but realistic examples of proposed policies, programs or projects and then screen them for reasonableness in terms of potential magnitudes of costs and benefits. At this stage, the ideas are general and it is only possible to estimate costs and benefits in rough magnitudes. Yet legislators need some idea of the stakes, and the public needs to be engaged for support, requiring some type of “headline appeal.” Some DOTs develop illustrative examples for long range plan concepts and then compare them to “do nothing” or “business as usual” scenarios (using transportation and economic impact tools) to show the magnitude of potential economic impacts involved. This can be done for scenarios involving: (a) improving the system, (b) maintaining the current functionality of the system, or (c) allowing deterioration of the system due to insufficient funding. And economic benefits can also be expressed either in terms of job and income gains that can be achieved, or economic losses that can be avoided, if action is taken.

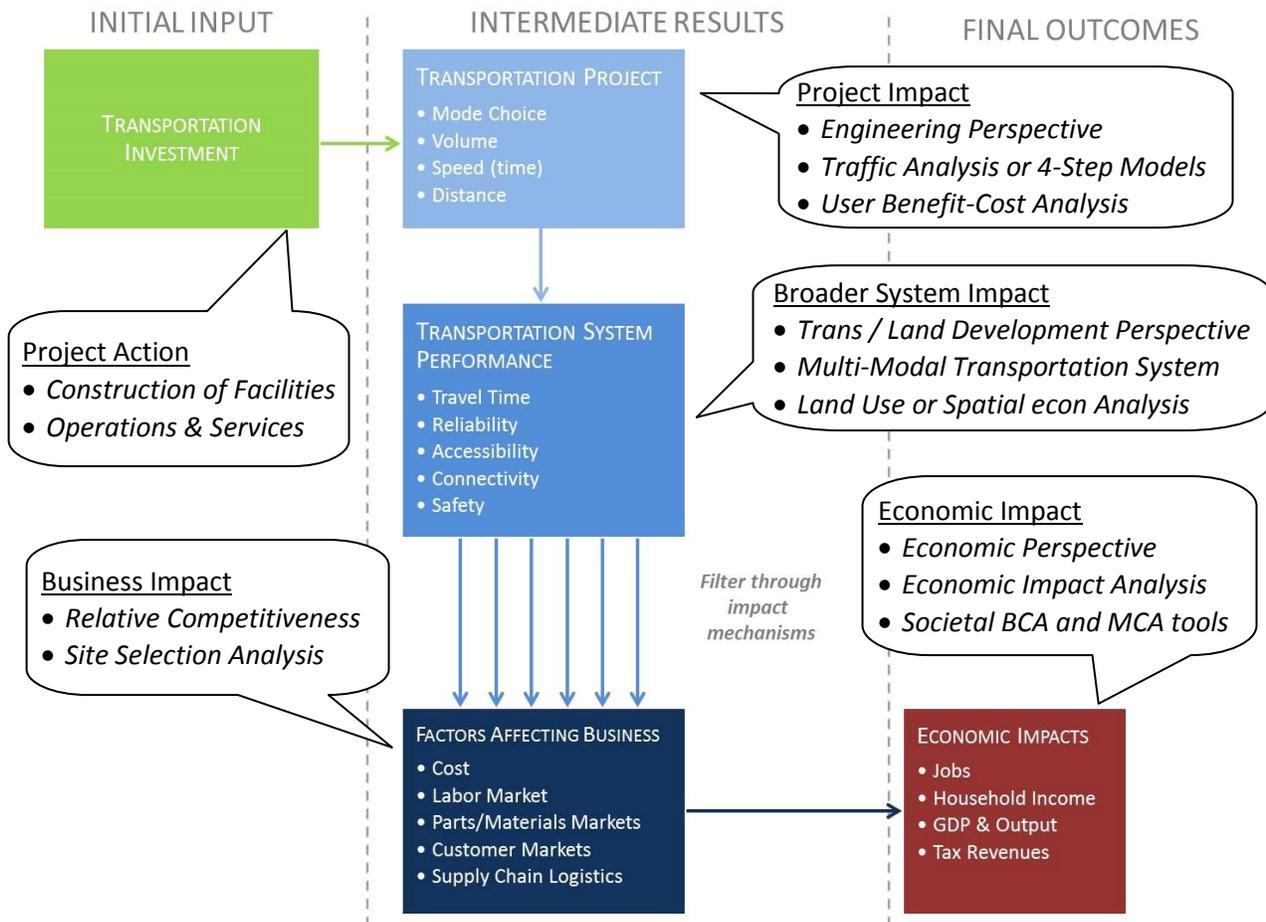
When we move to the stage of prioritization and selection, there often needs to be some public record to show that the process is transparent and above-board. There is a need to explain the prioritization process in ways that resonate, are understood and are accepted by interested parties. At this stage, there are more formally developed cost and benefit estimates and clear tradeoffs. Economic analysis is not only a formal part of the ranking process, but it also can be useful to convey the scale of the economic stakes to outside parties (public and business community) so that they can “buy into” to the process. At this point, local mayors and local chamber of commerce presidents often start to advocate on behalf of projects, so it becomes important to show objectivity through the use of transportation and economic impact tools that are widely used (to generate explanations that can be widely understood).

At the later stage of alternatives analysis and environmental review, wider statewide economic factors must be considered alongside localized concerns of abutters, neighborhood groups and advocates of particular narrow policies. To address this, it can be important to acknowledge all forms of impact but also show how local impacts and statewide benefits must all be considered as tradeoffs. And at this point, available transportation data is usually very detailed (albeit sometimes limited beyond highway modes), so more detailed economic impact and economic benefit analysis can also be done. That can be valuable to aid public discussion and bring it up to a higher level, helping to avoid the trap of allowing unsubstantiated claims and counter-claims by battling proponents and opponents. As an example, NCDOT’s indirect and cumulative effects analysis could be augmented to include an economic analysis component.

Once a project is built, the decision process is not over. There is an ongoing need to manage operations, maintain facilities and to monitor condition and performance. At some point in time, both physical condition and functionality usually start to deteriorate – the former due to aging infrastructure and equipment, the latter due to physical decay, congestion or shifts in use patterns over time. At that point, the decision process goes back to stage 1, as decisions will need to be made about maintaining, improving or allowing functional degradation of facilities.

Telling the Story: How Metrics Apply to Each Decision Stage. The chart which follows illustrates the process of calculating economic impacts and the associated performance measures. It is annotated to show the types of analysis and tools used.

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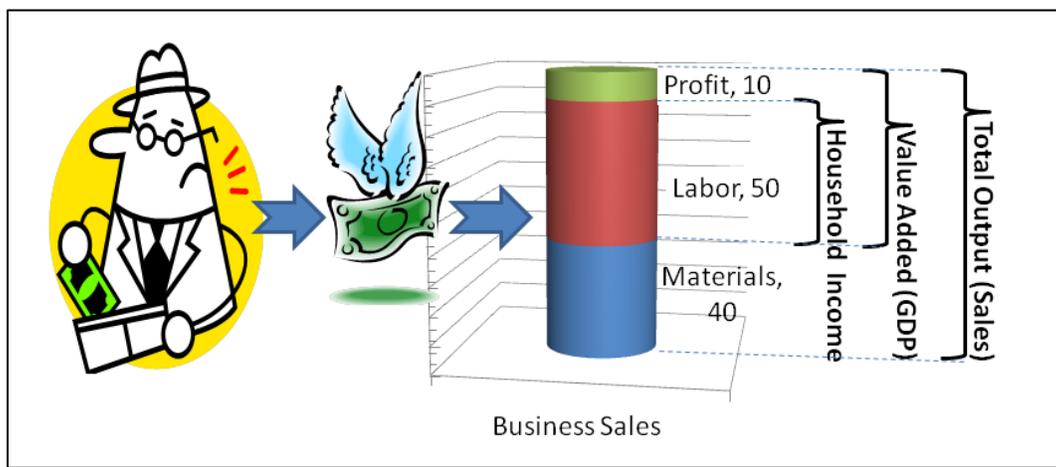
- ➔ The sequence shown in the graphic starts with a transportation project that involves constructing some facilities or opening a transportation service. It has immediate impacts on volume, speed and/or travel distances for existing users, or modal choices. Traffic engineers can estimate and measure those changes, using transportation modeling tools. The results can be used to calculate “user benefit/cost” findings.
- ➔ There are often broader effects on transportation system performance and land use which are related to changes in patterns of access, mobility and reliability. Transportation planners are concerned with these broader impacts. Various multi-modal transportation systems analysis or land use/ spatial development tools may be used.
- ➔ Travel time, access and reliability improvements can lead to expansion in business markets and increased business productivity and competitiveness. Business site selectors track these factors in their site selection tools.
- ➔ Ultimately, there are economic impacts – business growth and attraction which expand jobs and income. There are short-term impacts from construction spending, and long-term impacts from transportation system improvement. The long-term impacts occur because larger markets and more profitable operations increase business productivity, leading to net expansion of existing businesses and net entry of new businesses. Both short-term and long-term impacts percolate throughout the economy, as growing industries place more orders to their suppliers (indirect economic effects) and increased wages add to consumer spending (induced economic effects). Both economic impact

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analysis (EIA) and societal benefit-cost analysis (BCA) can be used to show overall effects. Some economic forecasting and simulation tools can trace through all of these steps, showing how intermediate impacts ultimately lead to more economic growth.

The topic summary on economic measures details how specific performance measures can be employed by a DOT to better understand the impacts shown in the three blue boxes of the *Intermediate Results* part of the diagram.

Measuring Economic Impacts. There are different ways to measure economic impacts, which can be confusing. To understand why, consider the diagram below.



Now in this case, somebody *spends* \$100 to buy a product from a local manufacturer. The *business sales* (or money received) pays for materials and labor needed to make the product, and the remainder may be called *Profit* (or net business income), which may be distributed to owners or reinvested in enhancing the business. The *Wages* paid to workers represents added *Household Income*. The worker wages and business profit together represent *Value Added*, which is technically defined as the total value of *Output* (business sales) minus the cost of materials. The aggregate Value Added is generically referred to as *Gross Domestic Product (GDP)*, or in a statewide context is sometimes referred to as *Gross Regional Product (GRP)*.

So Which Economic Impact Metric Should Be Used? The general public tends to most easily understand the concepts of jobs and household income. Economists prefer Value Added or GDP because it is the most accurate measure of economic activity actually occurring in a region. Business organizations and the press often quote the larger numbers associated with business sales (or output).

What is most important is that all of these measures of business activity tend to move in tandem, and any *one* of them is an acceptable measure of economic impact as long as they are not added together. Unfortunately, members of the press do sometimes try to add worker wages and business sales, thinking that this represents what both parties received. But this is double counting the same money, as illustrated by the graphic.

Another common pitfall is to incorrectly add together impacts occurring at different times. For example, say that a new connector route enables a new business with 100 jobs to be attracted to the state. In

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that case, there would be 100 more jobs in year #1 than would otherwise be the case. Those jobs are assumed to continue on into the future, so there would also be 100 more jobs than would otherwise be the case in years 2, 3, 4, etc. But it would be wrong to say that there are 400 more jobs over four years because it is the same 100 jobs year after year.

Finally, it should be stressed that construction job impacts from building a facility are completely different from the long-term impacts of completing a project and opening up a new road or transit service. The two should never be confused. And while both may be of interest, it is only the long-term benefit of having a completed project that can justify the investment in it.

Major Findings. There are four take-away points for NCDOT from this section:

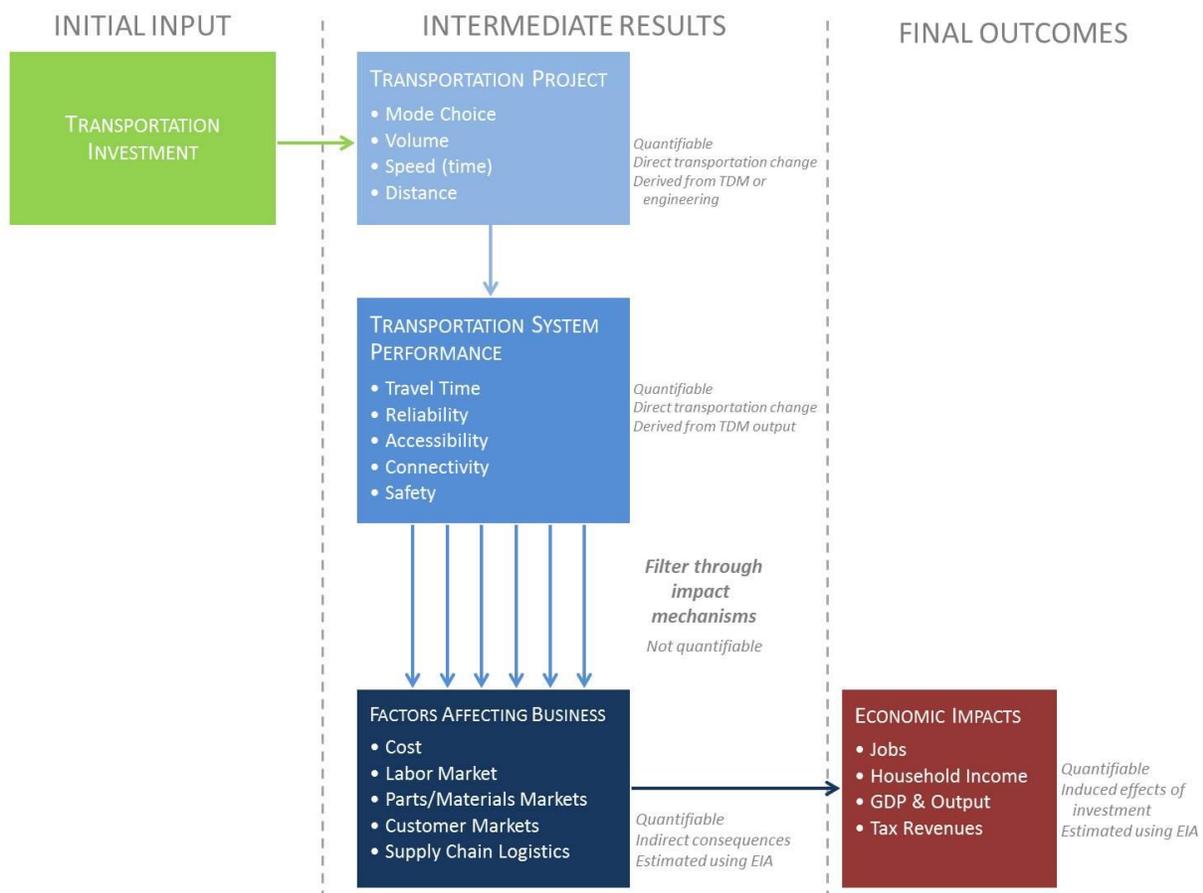
- There needs to be a consistent policy for how economic development is considered in each stage of decision making -- from initial investments that enable economic growth to preservation of resources to avoid economic losses.
- By recognizing the different classes of stakeholders, it is possible to recognize the perspectives of each group, portray benefits and costs from their viewpoints, and then use that information to make fair and equitable decisions.
- There are major advantages to tracking user benefits, broader societal benefits and economic development benefits as separate but equally important considerations.
- NCDOT can potentially gain support for its activities by conveying the ways that it maintains a transparent process with clear goals for project decision-making, so that both the general public and the business community can buy into its values and processes.

Economic Performance Measures

This topic summary describes in greater detail how the *Transportation Impacts on the Economy* diagram shown in the *Relationships between Transportation & Economic Development* topic summary is informed by specific performance measures (or “metrics”, used here interchangeably). Transportation related economic performance measures are often also engineering performance measures. In many cases, these economic performance measures are generated by software models or tools, rather than being measured directly in the physical environment. For example, travel time performance measures are generated by a Travel Demand Model, rather than being directly observed by counting cars or surveying drivers. A more detailed discussion of those tools, along with the assumptions and constraints involved in applying them, is the focus of the tools topic summary.

Looking at the *Transportation Impacts on the Economy* diagram below, each step in the process includes several major components (the bulleted list within each box) that represent specific quantifiable metrics, with the metrics resulting from one step becoming the input to the next step. The initial input is the transportation investment, which does not have any metrics associated with it, and the final outcomes are the economic impacts, which are the results of an economic impact model. The focus of this summary is on the three blue boxes in the intermediate results phase, which contain the transportation metrics that DOTs can measure. On the following pages is a series of tables that address each of the three blue boxes, discussing how each component can be measured or estimated, and how metrics support the overall understanding of the connection between transportation investment and economic impact.

Transportation Impacts on the Economy



Economic Performance Measures

The farther away you get from the initial stimulus of the transportation investment, the more speculative the connection between the steps in the diagram. Two concepts are key to understanding how this happens:

1. **Direct, Indirect and Induced Effects.** Each step in the process is defined as being direct, indirect or induced (shown in gray italics next to each box in the diagram). These terms may be defined differently by different people, here is how they are defined for this discussion:
 - a. **Direct transportation change.** Physical impacts of the transportation investment. E.g., after a new roadway connection is built, some drivers will have a more direct (shorter, faster) route to their jobs.
 - b. **Indirect consequences.** Changes in the cost of doing business or sales opportunities as a result of the transportation investment. E.g., the more direct route may make it shorter/faster for customers to reach a business, or cut transportation costs for businesses by reducing fuel consumption and shipping time.
 - c. **Induced effects of investment.** Effects driven by the investment. E.g., the business with more customers and/or sales may be able to hire more employees, and those employees will have income that gets spent in the local economy.
2. **Assumptions.** For each component, there may be several alternative performance measures available. For example, safety may be measured by the overall number of fatalities, fatalities per VMT, percentage of crashes with serious injuries, or several others. When you select specific performance measures, you are making an assumption that you are capturing the effects, which may or may not be true. It may be necessary to select more than one performance measure for each component to more fully capture the effects (in the example above, fatalities per VMT as well as injuries per VMT and percentage of alcohol-related crashes). The specific performance measure(s) that is the best choice for a DOT depends on the objective of the analysis (e.g. strategic planning vs. project prioritization) and the data available (quantity, coverage, and accuracy). There are also many assumptions made in the economic impact models, which will be discussed in more detail in next topic summary.

Economic Performance Measures

TRANSPORTATION PROJECT

Sources:

Engineering analysis, sketch planning or a travel demand model

What are you trying to measure?

Direct impacts of transportation change, whether positive or negative, affecting both users and non-users of the transportation investment.

Impacted Groups:*

Users, non-users. Non-user impacts are those experienced by people who are not directly using the new transportation investment. For example, if the investment improves transit service, people who continue to use cars would experience travel time and other benefits because the VMT would decline as some drivers divert to the improved transit service.

What are some possible performance measures?

- Mode choice
- Volume
- Speed
- Variability
- Fees
- VMT/PMT (person miles traveled)
- VHT/PHT (person hours traveled)

What is this information useful for?

These direct measures of transportation change become the inputs for further analysis of impacts, although they do not necessarily represent all of the factors that create economic development impacts.

TRANSPORTATION SYSTEM PERFORMANCE

TRAVEL TIME

Sources:

VHT, speed

Impacted Groups:*

Users

What are you trying to measure?

How long it takes a person to travel from point A to point B. This may be impacted by mode options, route directness, etc. Derived from the outputs of the Travel Demand Model, which determines the traffic volumes, available routes, and speeds that are used to calculate travel time.

What are some possible performance measures?

- Travel time, for peak and off-peak periods
- Truck travel time (routes available for trucks may be restricted)
- Public transit travel time
- Bike/ped travel time (taking into account cut-through options not available to vehicles, as well as barriers for bike/ped travel)

What is this information useful for?

Travel time forms the basis for much of the further economic analysis, since it translates directly to user costs, both material (fuel and other vehicle costs) and the monetary value of time.

Find out more:

Economic Impact Performance Metrics, SHRP2 Project C03, DTFH6 I -06-H-00009, 2011. See pages 3-4.
<http://www.edrgroup.com/pdf/SHRPC03PerformanceMetrics.pdf>

Economic Performance Measures

TRANSPORTATION SYSTEM PERFORMANCE (CONTINUED)

RELIABILITY

Sources:

Travel time, connectivity

Impacted Groups:*

Users

What are you trying to measure?

Variation in travel time for the same trip from day to day (same trip implies the same purpose, from the same origin, to the same destination, at the same time of the day, using the same mode, and by the same route). Reliability may be affected by: physical bottlenecks, traffic accidents, weather, work zones, fluctuations in normal traffic, and special events. Additional factors: breakdown rates for transit equipment; connectivity, which affects the availability of alternative routes when delays occur.

What are some possible performance measures?

Reliability is essentially a modification of travel time. Example metrics:

- 95th Percentile Travel Time: Average trip duration in minutes and seconds for 95% or less of all trips. This measure estimates how bad the delay will be during the heaviest traffic days.
- Buffer Index: The difference between the 95th percentile travel time and the average travel time, divided by the average travel time. This represents the extra time (in minutes or as a ratio) that travelers add to their average travel time when planning trips to ensure on-time arrival.
- Planning Time Index: The 95th percentile travel time divided by the free-flow travel time index. The planning time index can also be understood as the ratio of travel time on the worst day of the month over the time required to make the same trip at free-flow speeds.

What is this information useful for?

Measures of reliability are growing in importance for transportation system users, whether they are commuting, delivering freight or traveling for other purposes; users are particularly sensitive to unanticipated delay. Individuals can respond to unreliability by planning for delays and adding extra buffer times to their schedules. This extra time reduces labor productivity, the size of the labor pool accessible to particular businesses, and personal consumption. Businesses respond to unreliability by changing their pattern of operations, by holding additional safety stock, increasing warehouse space, and/or investing in systems that provide traffic flow information to reduce the impact of unreliability. These additional investments reduce the return on capital.

Find out more:

Evaluating Alternative Operations Strategies to Improve Travel Time Reliability, SHRP 2 Reliability Project L11, pre-publication draft, June 2012. See page 10.

<http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2prepubL11.pdf>

Economic Productivity & Transportation: Task 1, Literature Review, NCHRP 2-24, 2013. See page 61.

http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP02-24_Task1LitReview.pdf

Economic Performance Measures

TRANSPORTATION SYSTEM PERFORMANCE (CONTINUED)

ACCESSIBILITY

Source:

Travel time, mode options, connectivity

Impacted Groups:*

Users, Non-users, Community

What are you trying to measure?

People's ability to reach goods, services and activities, which is the ultimate goal of most transportation activity, except the small portion of travel for which mobility is an end in itself (e.g., jogging, cruising, leisure train rides). Many factors affect accessibility, including mobility (physical movement), the quality and affordability of transport options, transport system connectivity, mobility substitutes, and land use patterns.

What are some possible performance measures?

- Access of persons/households to jobs (e.g., employment opportunities within 30 minutes);
- Access of employers to labor force (e.g., workers within 30 minutes);
- Access of persons to other opportunities (e.g., shopping, school, daycare); and
- Access of persons to alternative modes of transportation, especially transit (e.g., population within one-quarter mile of a transit stop).

What is this information useful for?

By evaluating transportation on accessibility, additional transportation improvement options can be considered (besides roadway, rideshare and public transit), including improved walking and cycling conditions, more accessible land use patterns to reduce travel distances, and telecommunications and delivery services that substitute for physical travel.

Find out more:

Performance Measurement Framework for Highway Capacity Decision Making, SHRP 2 Report S2-C02-RR, 2009. See page 36. http://onlinepubs.trb.org/onlinepubs/shrp2/shrp2_S2-C02-RR.pdf

Evaluating Accessibility for Transportation Planning, Victoria Transport Policy Institute, September 2012. <http://www.vtpi.org/access.pdf>

CONNECTIVITY

Sources:

Networks of roadways, transit, bicycle and pedestrian facilities.

Impacted Groups:*

Users, Non-users, Community

What are you trying to measure?

Density of connections in a network (whether road, transit, bicycle or pedestrian facilities) and the directness of links from origins to destinations. A well-connected network has many short links, numerous intersections, and minimal dead-ends (cul-de-sacs). As connectivity increases, travel distances decrease and route options increase, allowing more direct travel between destinations.

Intermodal connectivity refers specifically to the link between surface transportation (highway or rail) routes and terminals or interchanges for accessing other modes (which may involve surface, air or marine travel). Note that connectivity may be different for freight if some roadways have restrictions on weight or height.

Economic Performance Measures

TRANSPORTATION SYSTEM PERFORMANCE

CONNECTIVITY (CONTINUED)

What are some possible performance measures?

Connectivity Indices can be measured separately for motorized and non-motorized travel, taking into account non-motorized shortcuts, such as paths that connect cul-de-sacs, and barriers such as highways and roads that lack sidewalks. Example metrics:

- The number of segments (links) divided by the number of intersections. A higher index means that travelers have increased route choice; dead-end and cul-de-sac streets reduce the index value.
- Intersection Density: Number of surface street intersections within a given area, such as a square mile. The more intersections, the greater the degree of connectivity.
- Route directness index: Measures the directness of the route based on land use or land parcels along transportation networks to determine area wide connectivity or specific destination-based connectivity. Metrics can be calculated for route quality of individual modes (e.g. road, bicycle, pedestrian).
- Actual travel distances divided by direct travel distances (as the crow flies). If streets are well connected, people can travel nearly directly to destinations, resulting in a low index.

Example Intermodal Connectivity metrics:

- Size/capacity of terminals
- Accessibility of intermodal terminals to industrial facilities
- Level of activity: daily or annual vehicle (aircraft/train/ship) arrivals + departures
- Throughput (use): daily or annual passengers, cargo tons or container TEUs
- Frequency of Service: average wait time between arrivals or departures
- Breadth of connections provided (number of different destinations served)
- Travel time to/from specified employment or population centers

What is this information useful for?

Increased connectivity can reduce VMT by reducing travel distances between destinations and by supporting alternative modes. It can also affect reliability by offering alternative routes when accidents or delays occur, and improve emergency response by allowing emergency vehicles more direct access, more efficient provision of municipal services (e.g. garbage collection, school bus services) and reducing the risk that an area will become inaccessible if a particular part of a roadway is blocked.

Intermodal connectivity can affect both market access and supply chain characteristics: opening up new extensions of labor or customer markets (e.g., express train services can extend labor market areas beyond the area normally achieved via road systems); opening up new scheduling and reliability solutions that involve mode switching (e.g., air services can enable new forms of truck/air interchange and support growth of just-in-time processing).

Find out more:

Roadway Connectivity, TDM Encyclopedia, Victoria Transport Policy Institute, Updated 5 January 2012.
<http://www.vtpi.org/tdm/tdm116.htm>

Economic Productivity & Transportation: Task 1, Literature Review, NCHRP 2-24, 2013. See page 50.
http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP02-24_Task1LitReview.pdf

Economic Performance Measures

TRANSPORTATION SYSTEM PERFORMANCE (CONTINUED)

SAFETY

Source:

Safety statistics tracked by DOT

Impacted Groups:*

Users, Community

What are you trying to measure?

The ability for users of the system to reach their destination safely on any given trip. This is typically measured through the record of crashes or incidents along a particular roadway or at a specific intersection.

What are some possible performance measures?

Select multiple metrics in this category to provide a clear understanding of both the scale of the problem (absolute numbers) as well as the rate (number per mile or per capita). Include injuries as well as fatalities because there are approximately 60 injuries for every fatality. Injury data are not yet collected as consistently as are data on fatalities, and there are problems in adjusting for the seriousness of different types of injuries. Example metrics:

- Number of fatalities or injuries (actual)
- Fatality or injury rate per 100 million VMT or 100,000 population
- Number of alcohol-related fatalities
- Proportion of alcohol-related compared to all fatalities
- Alcohol related fatality rate per 100 million VMT

Social costs can also be quantified, see FHWA resource below for a recommended amount to use in estimating these.

What is this information useful for?

Transportation projects can improve safety through improved facility design and/or reduced overall VMT. There are social costs associated with accidents, which would also be reduced.

Find out more:

Motor Vehicle Accident Costs, U.S. DOT, FHWA, Dennis C. Judycki, 1994.

http://safety.fhwa.dot.gov/facts_stats/t75702.cfm

Performance Metrics for the Evaluation of Transportation Programs, NTPP, 2009. See page 17.

<http://bipartisanpolicy.org/sites/default/files/BPC%20NTPP%20Metrics%20fnl.pdf>

* **Impacted Groups:**

Users: Those directly using the transportation investment, whether drivers, transit riders, bicyclists or pedestrians.

Non-users: People who are not directly using the new transportation investment, but who use other parts of the transportation system and could be indirectly affected by the transportation investment.

Community: Community benefits are experienced by the entire community within the project area, not just a select group, such as users or non-users. Beneficiaries include people who live, work, or visit the area.

IMPACT MECHANISMS

Impact mechanisms are the means by which a business decides how to respond to changes. They are the logical step between system performance and productivity results, which can be understood theoretically, but which are difficult or impossible to measure directly. The mechanisms are built into the Economic Impact Analysis model.

Economic Performance Measures

Find out more: *Economic Productivity & Transportation: Task 1, Literature Review*, NCHRP 2-24, 2013. See sections starting on pages 8 and 39. http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP02-24_Task1LitReview.pdf

FACTORS AFFECTING BUSINESS

Factors:

- Cost
- Labor Market
- Parts/Materials Markets
- Customer Markets
- Supply Chain Logistics

Source:

Economic Impact Analysis

What are the effects?

The factors listed above are all effects that either reduces the cost of operating a business or increase sales opportunities, or both. Some examples:

- Transportation system performance characteristics can affect logistics costs (and hence productivity) through changes in travel time, reliability, and allowable vehicle sizes and weights. That, in turn, can affect supply chains by changing the spatial pattern of business locations, the timing of work shifts, inventory stocking practices and vehicle fleet deployment.
- Transportation interventions can play an important role in supporting the overall efficiency and flexibility of labor markets, through better matching of people and skills to jobs. For workers, faster commuting possibilities or access to transportation options can permit easier transfer and increase the range over which they can search for jobs, while for employers it can improve the size and diversity of the pool of potential applicants.
- Transportation improvements may enable a business to serve a wider customer base, thus allowing the business to employ higher capacity equipment and technologies that reduce the unit cost of production. These scale economies may be enabled by changes in spatial access patterns or intermodal connectivity, or the frequency and speed of transportation services.

How can they be estimated?

These factors are estimated as part of the Economic Impact Analysis modeling process. In the absence of a model, there are some performance measures that can proxy to show the effects. These proxies are:

- Travel time or cost reduction
- LOS improvement
- Freight Productivity
- Reliability Index – Freight Delivery
- Volume/Capacity
- Congestion Relief
- Same-Day Delivery Market
- 45-min Labor Market Boundary
- Access time to International Gateway
- Multi-Modal Impact
- Intermodal Connectivity
- Connections to Network
- Access time to Intermodal Terminals

Find out more:

Economic Impact Performance Metrics, SHRP2 Project C03, DTFH6 I -06-H-00009, 2011. See pages 11-12. <http://www.edrgroup.com/pdf/SHRPC03PerformanceMetrics.pdf>

Economic Productivity & Transportation: Task 1, Literature Review, NCHRP 2-24, 2013. See section starting on page 21.

http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP02-24_Task1LitReview.pdf

Tools and Models

There are a handful of different *types* of tools and models available to assess economic performance of transportation investments. They have different intended purposes and work at different scales of business and spatial detail. Before NCDOT can consider which types of tools should be used to apply economic performance measures, it is necessary to first consider which performance metrics (outlined in the *Economic Performance Measures* topic summary) are most applicable. This allows for identification of the best-fit tools to help advance the preferred measures.

The description of tools provided here is intended to enable better understanding of their uses, rather than to initiate a comparison of tradeoffs among different tools. Some tools are required to feed other tools; others are used in a feedback loop to continue evaluating performance. Therefore, you cannot always substitute one tool for another just as you cannot substitute a screwdriver for a hammer if the screwdriver is what you need.

A performance measure tool for purposes of this effort is defined as:

- An economic analysis method, usually incorporated into some type of data analysis or synthesis software program produced by a third party, used by an entity such as a DOT to determine and articulate the likely outcomes of investments stemming from a policy, program, or project.

Some key considerations in identifying the best-fit performance measure tools are:

- Will it help the agency meet goals and objectives for performance at a policy, program and project level?
- Can the tool be tailored to articulate outputs at a state, regional and local level? Is that desired?
- What additional inputs are needed to the tool? Does NCDOT have access to the input data or is it available? Are other partners needed to provide the data (e.g. MPOs, other state agencies, local governments)?
- How well does the tool precision versus accuracy in its outputs? Just because the output of a model can be a very exact number (e.g. the travel demand model predicts there will be 75,800 vehicles per day on I-40 in 2035), this does not necessarily mean that the output is accurate (e.g. travel demand models have a +/- 25% margin of error due to the number of variables).
- What level of effort is needed to apply and maintain the tool? Are resources available to do that?
- Can the results of the tool be communicated to a diverse audience? Who are the intended audiences?
- What are the gaps in the existing tools? Does NCDOT desire to fill those gaps with future, perhaps currently unavailable data, to better project an economic outcome?

Below is a summary of the five primary economic impact tools or models used for transportation analysis. These are largely employed by DOTs across the United States. Some DOTs have worked with the producers of these tools to tailor them to local conditions.

For example, NCDOT controls a greater percentage of the local roadway systems than most other states in unincorporated areas across North Carolina. Since this is not a role that most DOTs play, a model tailored to NCDOT's context may need to consider more micro level impacts than the macro level impacts typically associated with evaluating a statewide interstate highway system.

Tools and Models

INPUT-OUTPUT (I/O) MODELS

Purpose:

To show how changes in spending and business operations have broader economic consequences—indirect and induced -- on the rest of the economy. This can include impacts to jobs, income and GDP.

Use:

I/O models can also be used to calculate impacts of transportation facility construction and rehabilitation activities on the state economy. They can also be used to show the contribution of transportation industries and transportation terminal activities (airports, seaports, etc.) on the state economy. And finally, they can be used to show the impact of announced changes in business activity at a given location (e.g., a plant opening or closure). Their relative simplicity has made them popular among transportation agencies to show the role or contribution of transportation activities to the economy.

Potential constraints:

I/O models are static, meaning they have no time component and thus no long-term forecasting dimension. That makes them well suited for reports on the current role of airports, marine ports and railroad activities in the state. But I/O models are less useful for projects that will change future capacity or travel conditions, because they have no internal ability to forecast responses to changes in travel times, transportation costs, market access or other aspects of business competitiveness. (However, if the user has some credible way to generate those business responses externally, then the I/O model can be used to show how they could propagate further impacts throughout the economy.

Data needed:

- Jobs or business sales occurring at a given location (e.g., airport or seaport)
 - Planned spending (e.g., construction)
 - Planned or proposed business expansion or contraction
- Note: I/O models come with data on current employment, income and business sales by industry, for the state and counties.

Common I/O Models

RIMS-II, IMPLAN and EMSI are the most common input-output models. Some I/O models have been developed for more specialized uses, such as a spatial input-output land use model that can feed transportation analysis.

Sample Product:

“108,850 jobs are supported by 72 publicly owned airports throughout North Carolina.”
– 2012 Economic Contribution of Airports in North Carolina

Find out more:

A Guide to State DOT Consideration of Economic Development Potential in Planning, NCHRP 8-36-60, 2007. http://statewideplanning.org/resource_list/a-guide-to-state-dot-consideration-of-economic-development-potential-in-planning/

- Input-Output Models: Page 32.

Tools and Models

USER BENEFIT-COST MODELS

Purpose:

Helps identify, rate and select projects that optimize highway system performance benefit relative to investment costs for motorists. This is done by showing the value of travel time savings, vehicle operating cost savings and collision reduction associated with proposed projects.

Use:

Assess the value of benefits of transportation improvements to users of the transportation system, and compare that to cost. This is most often used for prioritizing projects and selecting those that have benefits exceeding costs. They require either engineering estimates or results of a travel demand model to estimate project impacts on aggregate vehicle-hours and vehicle-miles of travel, by mode. This can be done on a statewide or regional scale and on a corridor level. Benefit-Cost data is often an input into Economic Impact Forecasting Models.

Potential constraints:

Safety, time and emission benefits can apply to all modes. Highway projects may reduce travel time for bus riders as well as car drivers, and transit or bicycle projects may also reduce traffic congestion by reducing road traffic volumes. However, impacts on non-users, including abutters and other area residents, are not counted unless the benefit-cost analysis is broadened to include wider social, environmental and economic factors.

Data needed:

- Change in travel time by mode & purpose
- Change in travel cost by mode & purpose
- Change in vehicle or traveler volume by mode and purpose
- Change in collision rate by mode

Note: Benefit-cost models come with standard factors for placing a \$ value on travel time, vehicle-miles of travel and collision reduction rates.

Common User Benefit-Cost Models

Publicly available models vary by the scale of analysis they inform. CAL-B/C is a spreadsheet model for sketch planning estimates of highway and transit project user benefits. BCA.net is FHWA's web-based tool for more detailed highway project-level analysis. HERS-ST is used to evaluate statewide highway investment needs and project priorities. LCCA is a tool used to evaluate life-cycle costs.

Sample Product:

Option C (bus rapid transit) has a benefit/cost ratio of 1.24, while Option D (light rail) has a benefit/cost ratio of 0.9 – from the Durham Ontario transit strategy plan

Find out more:

Understanding How to Develop and Apply Economic Analyses: Guidance for Transportation Planners, [NCHRP 08-36-101, 2011. [http://onlinepubs.trb.org/onlinepubs/nchrp/docs/nchrp08-36\(101\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/nchrp08-36(101)_FR.pdf)

- User Benefits: Page 7-1.

Tools and Models

ECONOMIC IMPACT FORECASTING MODELS

Purpose:

To calculate changes in business attraction as well as growth over time due to changes in travel time and costs, system access or performance conditions. *Also known as econometric models.*

Use:

Economic impact forecasting models are a more comprehensive economic tool than an input-output model. They incorporate I/O models in addition to being able to calculate changes in household spending and business costs. They can be used for local and regional level analysis of major transportation facility investments and show how economic growth in an area can change if there is a shift in transportation costs or market access. The model can also generate macro-level impacts on tax revenues.

Potential constraints:

Most applicable to large scale investment programs or projects because larger projects are more likely to have a measurable impact on the state's economy. Since these models only look at business impacts, they do not account for improvements in personal travel time or social or environmental factors that affect quality of life. Thus, they need to be paired with other assessment techniques to account for those other (non-business) factors.

Data needed:

- Change in business travel time by mode
 - Change in business travel cost by mode
 - Change in business vehicle volume by mode
 - Change in market access by mode
 - Change in travel time reliability by mode
- Note: economic impact forecasting models come with baseline forecasts of current and future employment, income and business sales by industry, for the state and counties.

Common Economic Impact Forecasting Models

REMI-TranSight and TREDIS are the most common economic impact forecasting models and are customized for DOTs. Both are multi-regional, spatial economic models. More specialized models have been developed by universities for their own use or projects in which they are involved (e.g., INFORUM by the University of Maryland and REAL by the University of Illinois-Chicago).

Sample Product:

Proposed transportation improvements will enable cost savings and productivity enhancement for Virginia residents and businesses, enabling economic growth at an average of \$3.1 billion/year of additional business output. Associated with this economic growth will be an average of over 23,000 more jobs, rising to over 101,000 more jobs by 2035. – from Virginia's Multimodal Transportation Plan

Find out more:

Understanding How to Develop and Apply Economic Analyses: Guidance for Transportation Planners, [NCHRP 08-36-101, 2011. [http://onlinepubs.trb.org/onlinepubs/nchrp/docs/nchrp08-36\(101\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/nchrp08-36(101)_FR.pdf)

- Econometric models: Page 6-6.

Tools and Models

ECONOMIC DEVELOPMENT TOOLS

Purpose:

Designed to assess the relative cost competitiveness of areas for business siting, and hence assist in business attraction and site location decisions.

Use:

Compares potential business locations based on operating costs, market conditions, labor force, land access and transportation access. Economic development agencies use the tool to identify the relative strengths and weaknesses of their area and to identify targets for business attraction.

Potential constraints:

Transportation access component is limited to access to nearest interstate highways and airports. Economic development tools may but often do not provide full analysis on workforce access, multi-modal access to job sites or transportation alternatives analysis.

Data needed:

- Characteristics of planned business facility in terms of type, square feet, employees, etc.

Note: economic development assessment tools come with databases comparing average energy costs, utility costs, tax rates and labor costs among communities or parts of a state.

Common Economic Development Tools

BizCosts, LocationSelector, FacilityLocations, Site Selector Pro and LEAP compare alternative locations for potential business siting decisions.

Sample Product:

Rating of competing states, counties or metro areas in terms of (a) the relative cost of doing business, (b) available incentive programs, (c) regulations, and (d) workforce size and education level. Some tools also calculate the difference in business operating cost between alternative locations.

Find out more:

- BizCosts: <http://www.bizcosts.com/>
- LocationSelector: <http://www.locationselector.com/>
- FacilityLocations: <http://www.facilitylocations.com/>

Tools and Models

LAND USE MODELS

Purpose:

Forecast change in the location patterns of population, employment and business activities within a region, over time. This can directly feed long-range transportation planning and comprehensive transportation planning efforts.

Use:

Enables more realistic forecasts of travel demand by recognizing that transportation access changes will also shift the location of households and businesses, which are themselves trip generators. These models are typically used in concert with travel demand models to integrate transportation and land use forecasting. They can also be used for scenario testing of transportation system outcomes, and to aid land use planning.

Potential constraints:

Incorporates market access measures for shifting business growth within the region, but external macroeconomic models or forecasts are needed to generate estimates of business attraction to the region from outside. The actual level of use of land use scenario planning to measure potential transportation impacts is limited due to silo-effect of DOT analysis vs. regional/county/municipal land use planning.

Data needed:

- Regional population and economic growth forecast (baseline control totals)
 - Zonal data on business and population patterns
 - Interzonal access (travel time) data
- Note: land use transportation models must be calibrated first, using data on demographic and business location patterns, relative access times and costs for travel between zones.

Common Economic Development Tools

PECAS, URBANSIM, MEPLAN, TLUMIP

Sample Product:

The spatial analysis provided by land use models is largely driven by GIS to show how growth patterns can change and, in combination with other analysis tools, can forecast what impacts those patterns could have on trip generation and distribution patterns.

Find out more:

Urban Land Use and Transportation, Hofstra University.

<http://people.hofstra.edu/geotrans/eng/ch6en/conc6en/ch6c2en.html>

Overview of Land Use Transport Models

http://spiekermann-wegener.com/pub/pdf/MW_Handbook_in_Transport.pdf

What Are Other State DOTs Doing?

The information presented on the following pages showcases how several State Departments of Transportation are using economic performance measures and tools as part of economic evaluations to help decision makers ensure their surface transportation systems advance economic growth in their respective states. While State DOTs executives would certainly agree with Maryland Governor, Martin O'Malley; *"Our transportation network and infrastructure is the lifeline of our economy,"* O'Malley says. *"And it's also our connection to the broader global economy. ...Transportation is what allows the flow of economic oxygen,"* the exercise of accurately and reliably accounting for how transportation investment contributes to economic development outcomes during all phases of transportation decision-making is challenging at best. Consequently, few State DOTs have systematically integrated economic performance into *all* decision-making phases from statewide strategic and long range plans through project development analysis and; finally, connecting with asset management decisions. The overall most widely used economic performance measures considered by State DOTs are related to freight; however, this does not fully capture wider economic benefits or represent the multi-faceted economic impacts transportation investment can have on people and places.

In a resource-constrained environment State DOTs are struggling to understand what strategic transportation investments to make to support growth and spur job creation. However, numerous challenges exist including a traditional focus on investment in individual modes, rather than fully examining opportunities for multi-modal and inter-modal efficiencies. Another issue relates to justifying investment in national and international logistics networks when the impacts are so diffused (i.e. border crossing and port links). Other issues include the need to better link the benefits of market access and productivity for business with the benefits of improved livability for residents. It is also difficult to both measure and interpret differences in productivity among different sectors of the economy including accurately accounting for differences between rural and urban growth dynamics. Finally, staff expertise and resources, as well as access to readily available economic data and tools, pose a challenge for many agencies.

Despite these challenges the State DOTs described in the following pages are considered "leading the way" in numerous reviewed literature resources. Many of these DOTs have used economic impact studies to communicate to the business community, general public and elected officials regarding the importance of funding transportation investment to maintain a competitive economy. As an example, after a voter referendum failed in 2002 to allocate additional monies to fund transportation investments, WSDOT began scoring potential projects according to performance-change per dollar spent, ranking the most cost-effective approaches to the state's transportation safety, congestion, environmental and economic goals. After implementing this performance-oriented practice the legislature allowed the state to sell bond issues by increasing the gas tax by 5 cents in 2003 and by 9.5 cents in 2005 (phased in over four years). There is a growing interest among State DOTs to use economic productivity assessments to identify areas for public-private partnerships. Of specific interest to many of these agencies is evaluating tolling and other fee-based activities which might be able to raise additional revenues for transportation improvements with economic productivity analysis.

The fifteen State DOTs reviewed in the following pages utilize economic measures and tools as part of making decisions regarding long range and statewide strategic plan investments, short-range five- or six-year plan investments, as well as prioritization schemes. Some DOTs use economic impact of alternative scenarios for asset preservation strategies as well. The review does not include modal or freight plan economic impact evaluations (with the exception of Washington DOT) because these are too numerous to review within the allotted timeframe for this task. In addition, corridor study economic evaluations and specific measures and tools for project evaluations as part of the environmental review process

What Are Other State DOTs Doing?

were not included in this state review due to time constraints. This information can be undertaken as part of the next task assignment if NCDOT believes the information useful for policy development or process improvement.

Finally, this section ends with a list of Transportation Economic Development (TED) programs around the country. This information was collected from a resource developed by FHWA in 2003. While it is somewhat dated it remains relevant when considering what other states are doing with these programs. Quick internet reviews of these state programs reveal that a majority of these programs are still active today. NCDOT does have a TED-related program but may wish to revamp this program at some point to place more emphasis on how transportation investments stimulate economic growth. These programs often combine DOT funds with funding from private and other public resources.

VIRGINIA DEPARTMENT OF TRANSPORTATION

Virginia's Long Range Multimodal Transportation Plan:

Economic Impact of Transportation Investments in Virginia (2010)

The report includes an economic impact analysis of a no build or maintain scenario to a build scenario for projects included in their six-year investment plan (2009-2014). Both short term and long term direct, indirect and induced effects were calculated using all four modules of a multi-modal economic analysis tool known as TREDIS (Transportation Economic Development Impact System). The model was built upon the unique economic conditions of the Virginia economy including specific flows of imports and exports, and the way transportation facilitates productivity of workers, materials and products.

Summary of Findings

For every \$Million of Capital Investment & Operations Spending

- Short-term effect: 14 immediate jobs in VA during same year of spending
- Long-term effect of capital improvement: 59 job-years over 26-yrs (2.3 per year)

Total Impact of \$33 billion spending on Six-Year Plan

- \$56 billion of business sales in Virginia generating \$29 billion of worker wages
- 468,800 Job-yrs over 6 yrs. (78,100/yr)
- At least \$2.3 billion of state and local tax revenues
- Plus long-term (26 yrs): \$82 billion of business sales; 611,590 Job-yrs (23,500/yr), of which 96% are private sector

Return on Capital Investment (net present value)

- Benefit-Cost Ratio of 4.0 to 1 (total benefit per investment dollar)
- Economic Return Ratio of 3.8 to 1 (gross domestic product per investment dollar)

Forms of Economic Impact Indicators

- *Economic Role of Transportation*: jobs in the state, as well as the level of statewide products and services supported by operation of transportation facilities and services
- *Impact of Transportation Spending*: ongoing spending to operate and maintain transportation activities
- *Benefit of Transportation Investment*: reflects the value of user benefits over what would occur without improvement and includes value of time, expense, safety, reliability and/or access improvement for users
- *Economic Return on Investment*: Calculates the ways in which transportation spending leads to effects on incomes received, expenses incurred, and productivity of operations by households and businesses in the state. These factors affect economic competitiveness.

What Are Other State DOTs Doing?

VIRGINIA DEPARTMENT OF TRANSPORTATION

- *Impact of Future Scenarios for Strategic Planning*: Helps define new initiatives in transportation policy, funding and finance that may be needed to bolster statewide economic development
- *On-going Performance Tracking*: Can be used as a dashboard to track progress in meeting both transportation and economic goals.

2011 Transportation Performance Scorecard, Office of Intermodal Planning and Investment Economic Vitality

- *Expenditures on SWaM Businesses*: Percentage of transportation agencies' discretionary expenditures on small, women and minority businesses
- *Shipments Through the Port of Virginia*: Volume of freight shipped through the Port of Virginia in shipping containers.
- *Port of Virginia Market Share*: Port of Virginia share of freight shipped through East Coast ports, by volume
- *Transportation Sector Economic Contribution*: Real dollar value of the transportation sector's contribution to gross state product
- *Commercial Airport Enplanements*: Number of enplanements at Virginia's air carrier airports
- *Transportation Sector Employment*: Number of workers employed by Virginia's transportation sector

OHIO DEPARTMENT OF TRANSPORTATION

Transportation Review Advisory Council (TRAC) Policy and Procedures (2008)

TRAC was established in 1997 by the Ohio General Assembly with the responsibility of developing and implementing a project selection process for major new capacity projects greater than \$5 million which do one or more of the following: increase mobility, provide connectivity, increase the accessibility of a region for economic development, increase the capacity of a transportation facility, or reduce congestion. Ohio uses a multi-criteria rating process for prioritizing projects. The report summarizes principles for selecting the scoring criteria and how to use them as well as provides guidance on the process used to score projects.

Transportation Factors (55 Points)

Road Metrics

- Volume to Capacity Ratio: (10 points)
- Safety: Crash frequency, density, severity, and crash rates (10 points)
- Truck Percentage: (5 points)

Public Transit and Passenger Rail Projects

- Peak Hour Transit and Intercity Rail Ridership: (20 points)
- Reduction in Vehicle Miles Traveled: (5 points)

Intermodal Freight, Water Port and Rail

- Reduction in Truck Traffic: (5 points)
- Intermodal Freight Congestion: V/C for different modes of transportation that support freight movement (20 points)

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OHIO DEPARTMENT OF TRANSPORTATION

All Modes

- Public Return on Investment: Benefit/Cost ratio including reduction in delay (value of time), reduction in vehicle operating costs, crash reduction factors, air quality and economic development (up to 20 points)
- Air Quality: Emission Reduction: reduction in fuel consumption (2.5 points) and ozone precursors (2.5 points)
- Intermodal Connectivity (5 points): A project will receive points if it connects two or more modes of transportation (ex. park and ride lots; public road or rail service into ports, airports, or transit centers; road/rail connections to other intermodal facilities; and accommodations for mobility and safety of two or more modes of transportation such as automobiles, bicyclists, pedestrians, and transit vehicles, working together.

Community Economic Growth and Development Factors (30 points)

- Adopting Appropriate Land Use Measures: Includes an adopted comprehensive land use plan, land use plan is coordinated with the transportation plan, zoning in place is appropriate for the project, and is part of the MPO long range plan. (8 points)
- Positioning Land for Redevelopment: Higher points are awarded to areas in which a higher percentage of the land being served by the project is “developed” land. (7 points)
- Improving Access for Business Development: Points will be awarded for projects that provides access to existing businesses; improves the movement of goods; improves workers’ access to job centers (5 points)
- Improving Investment and Employment Opportunities: Demonstrate potential for increased land values and employment as a result of the project (i.e. serve an Ohio Job Ready Site, private investment in project or real estate served by the project, etc.) (5 points)
- Considering Factors of Economic Distress: Points awarded to areas with higher unemployment and poverty rates. (5 points)

Project Sponsor investment as percentage of total project cost (15 points)

- Creation of Tax Increment Financing (TIF) district and other value capture tool with revenue dedicated to the project’s finance. (5 points)
- Local investment as part of the project finance (up to 15 points if 20% from local investment but not to exceed more than 15 points total)

MAINE DEPARTMENT OF TRANSPORTATION

Connecting Maine: Planning Our Transportation Future (2010)

Statewide Transportation Long Range Plan 2008 – 2013

The report summarizes Maine DOT’s vision, mission, and goals and helps identify how funds should be allocated to investments to gain the best return on transportation investments. Goal 3 in the Plan includes promoting economic vitality and competitiveness through transportation investment. Maine’s economic drivers include forest products, paper and agriculture along with emerging economic sectors in biotechnology, tourism, service providers and the “creative economy” which all depend on an effective transportation system to compete successfully in the marketplace. Goal 3 is supported by the following 10 objectives:

- Invest in highways and bridges key to Maine’s economy
- Provide freight shipping choices
- Invest in airports where air travel is key to the Maine economy

What Are Other State DOTs Doing?

MAINE DEPARTMENT OF TRANSPORTATION

- Invest in public transit in support of travel to work, access to business centers, and tourism
- Provide transportation options to and within tourist and recreational areas of Maine
- Improve transportation efficiencies between areas that support natural resource industries and industrial centers
- Promote traditional and emerging business (e.g., research and development) through investments in innovative technologies
- Invest in quality community centers
- Invest in visitor facilities that are eligible for federal and State highway funding and are associated with Corridors of Regional Economic Significance for Transportation
- Encourage mutually beneficial partnerships

Economic Analysis of Transportation Investment

Changes in the Maine Economy From Strategic Investments in the Transportation System (2008, Included in the above Plan as Appendix 3)

The analysis proceeded in three stages with two different economic tools. The Department first identified a series of investments in the highway, transit, and freight transportation systems and estimated what effects those would have on the flow of vehicles, goods, and services in Maine. Second, the model TREDIS was used to assess the economic impact from changes affecting the road network (highways and transit) from transportation projects. As part of the second stage the Maine DOT statewide traffic demand model was used to estimate the changes in vehicle hours traveled (VHT), vehicle miles traveled (VMT) and the percent of traffic subject to delays (congestion) from projects then TREDIS was utilized to estimate transportation cost savings to different industries. In addition, changes in household spending were translated into other consumption sectors. Also, transit investments were analyzed to include economic impacts associated with bicycle tourism activities from improved bicycle transportation facilities throughout the state. An estimated \$17.65 million over the study period was generated for these tourism activities and distributed among the regions based on population. Finally during stage three, the economic changes were analyzed using a general econometric model of the Maine economy developed by Regional Economic Models Inc. (REMI). The changes were calculated in terms of jobs and gross state product (GSP).

The analysis included a “strategic investment” scenario designed to make key improvements to the transportation system that will result in the year 2030 in a network that is significantly more efficient and a “constant performance” scenario, in which the Department invests just enough in transportation to keep the system at the current level of efficiency. The analysis also included maintaining the current funding levels. The analysis resulted in the difference between gains from strategic investments in highways and losses from maintaining current funding amount to 7,800 jobs and more than \$500 million in Gross State Product over two decades.

Transportation Economic and Land Use System (TELUS)

Maine DOT applies a modified version of TELUS to prioritize strategic projects at the regional scale. TELUS is simple multi-criterion decision support tool that helps transportation agencies make decision trade-offs between non-comparable goods, such as safety and environmental protection. The modified TELUS model used by Maine DOT allows the agency to prioritize projects considering impacts across a wide range of domains by estimating the relative impact of a project (i.e., major negativity effect, moderate negative effect, minor negative effect, no effect, minor positive effect, moderate positive effect, or major positive effect) on specific indicators that are organized by impact domain. The four

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domains used in Maine DOT's modified TELUS model are: 1) Economic Vitality; 2) Safety and Security; 3) Enhancements; and 4) Transportation System Sustainability. The indicators used by Maine DOT specifically addressing economic impacts (i.e., under the economic vitality domain) are summarized below. It should be emphasized that practitioners do not need to estimate specific quantities for each indicator; rather, practitioners need only to estimate the direction and relative strength of the expected impact and TELUS weights these responses accordingly to develop an aggregate score.

- **Promotes general economic development:** increases number of jobs; retains current jobs
- **Improves or enhances tourism:** increases number of tourists; enhances tourist spending
- **Improves or enhances the movement of freight and services:** increases efficiency; reduces costs
- **Improves or enhances access to jobs and opportunities:** reduces commuter travel time and expenses
- **Provides enhanced or new capacity, mobility or accessibility to the transportation system to move people:** offers modal choice/diversity
- **Enhances the range of freight service options available to local business:** improves roads and bridges structurally and functionally; offers modal choice/diversity
- **Improves intermodal connectivity for freight:** offers modal choice/diversity
- **Improves heavy haul truck network, e.g., working forests, farms and waterfronts:** improves roads and bridges structurally and functionally
- **Impacts Pine Tree Zone:** increases new businesses; stimulates economic development opportunities

KANSAS DEPARTMENT OF TRANSPORTATION

Transportation Infrastructure Investment and the Kansas Economy (2007)

This report includes a summary of several studies conducted to understand the economic impact of transportation investment on the Kansas economy. Kansas has been examining the economic benefits of their highway investments for 15 years. The report states, "Transportation- along workforce education and training, a business-friendly regulatory climate, and entrepreneurial initiative – is the fuel for the engine that drives economic prosperity across Kansas". The report includes five case studies that present post economic evaluative data to demonstrate how transportation investment has "paid off". It also includes recommendations for a new framework for Kansas Economic Assessment Tool (K-TEA) to improve the state's transportation project selection process. Finally, the report includes an assessment of the economic benefits of KDOT Highway Preservation Funding program.

Case Studies

Five case studies were evaluated post construction to analyze the economic impact from a combined \$231 million in investment among the five projects. Both long term and short term were included in the evaluation and revealed that the investment generated about \$51,000 jobs and produced \$6.1 billion in additional economic value added in 2006. *The five case studies included:*

- US 400 Parsons Bypass – Helping Transform a Rural Town's Economy (Opened 2004)
- K-96 Northeast Wichita Bypass- Maintaining Steady Growth (Opened 1993)
- Interstate 70 and 110th Street Interchange: Bringing National-Scale Development to Kansas (Opened 2001)
- Interstate 435 and Nall Interchange- Retaining a Major Kansas Employer (Opened 1997)

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- Interstate 70 and Commerce Parkway Interchange – Supporting New Manufacturing Jobs (Opened 1995)

Key lessons learned from the case studies include:

- Local Economic Development Planning Leadership is Vital
- Economic Growth Requires a Long-Term Prospective
- Strong Prospects Are Key to a Project's Success

Kansas Economic Assessment Tool (K-TEA) 2008

In 2008 a working group was formed to KDOT to develop recommendations to improve the project prioritization process by integrating economic impact analysis into the decision-making process. This was the precursor to K-LINK, the expanded prioritization process. This was prompted by the Long Range Transportation Planning (LRTP) effort in which agency stakeholders strongly suggested “economic growth” as one of the three guiding principles for the next LRTP. The K-TEA tool was guided by the following principles:

- *Examine Predicted Economic Impacts for Selected Project Types:* projects that add capacity or improve access have the greatest long term economic growth impacts in contrast to maintenance of the system projects which sustains but does not necessary grow the economy.
- *Focus Analysis on Impacts to Jobs and Income Growth:* in order to capture economic development benefits economic impact must go beyond the engineering-oriented cost benefit analysis methods that measure user savings associated with reducing congestion and examine broader benefits associated with better access in the future to labor markets, suppliers and customer markets.
- *Avoid Comparing “Apples to Oranges”:* the scale of economic impacts from mega projects (high cost urban type projects) is on a different order of magnitude to smaller capacity improvement projects; and therefore, should not be compared against one another. Project cost should be used to group similar projects for comparison.
- *Favor Net New Job and Income Growth to the State, and Retention of Threatened Jobs:* projects that shift benefits from region of the state to another should be valued as much as those that create net new economic growth.
- *Use Information about Economic Impacts to Assist Decision-Making:* economic impacts should be considered along with other considerations including engineering, community and fiscal factors.

Recommended Elements for the Economic Analysis Framework:

- Establish Pre-Requisite Project Eligibility Criteria which includes:
 - New Capital Investment
 - Proof of Transportation Need
 - Evidence of Strong Local or Regional Support
 - Modest Minimum Dollar Cost Threshold
- Group Projects by Construction Cost (small, medium and large)
- Model Projected Jobs, Income and Investment Impacts: use “off the shelf” regional economic model to translate project-level travel time, safety, and accessibility changes into:
 - Additional regional output
 - Jobs added
 - Additional household income
- Use Qualitative Information to Round Out Analysis of Economic Impacts
- Create Composite K-TEA Scores for Projects Based on both Quantitative and Qualitative Information

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The K-TEA and KDOT's project programming process includes a two part program "Core Projects" and "Economic Opportunity Projects". The core projects include a predictable stream of projects to preserve and maintain the system while the economic opportunity projects create opportunities to leverage emerging economic development needs. The process includes five steps:

1. Priority Formula Used to Generate Initial List of Projects
2. Local Consult Used to Add and Refine Initial Project List
3. Use K-TEA Analysis to Determine Projects with Greatest Economic Merit
4. Follow Up Consult with Locals
5. Kansas Transportation Advisory Panel Review

Key economic related criteria used as part of their multi-criteria prioritization process include:

- Supports cluster development /in-fill/redevelopment
- Supports local economic development initiatives
- Public Support
- Concentration of goods movement
- TREDIS output includes the following metrics:
 - Intermodal facilities & multi-modal access
 - Connectivity to key statewide corridors & global gateways
 - Labor market access
 - Industry productivity /competitiveness of freight costs
 - Predictability (reliability) of travel times

Economic Benefits for KDOT Highway Preservation

This report conducted in 2008 uses TREDIS to evaluate the difference in economic impacts of two different scenarios: 1) current level of funding for highway preservation is continued into future years and 2) funding is substantially reduced in future years. First the road pavement and bridge conditions were analyzed then user travel impacts were analyzed and translated into travel time, vehicle operating costs and accident rates. Lastly the TREDIS model calculated how user impacts affect households as well as business costs and productivity for different sectors of the Kansas economy. The economic modeling of impacts associated with a 60% reduction in funding by 2020 resulted in a loss of 12,000 jobs and \$670 million per year in gross state product, including \$460 million per year in less labor income than would occur if funding continued at existing levels.

Transportation - Leveraging Investments in Kansas (T-LINK) 2010

During the completion of KDOT's 10-year Comprehensive Transportation Program, there was heightened interest in the direction of future of transportation investments. Consequently, KDOT's T-LINK Task Force created a three-prong approach for scoring possible highway projects and then pilot tested the approach. The Task Force issued its "New Approaches for Transportation" report in January 2009. In the report, the T-LINK Task Force affirmed the importance of transportation in providing "support [for] the economic priorities of Kansas," saying that "while previous investments in transportation have provided significant benefits, more attention must be paid to the interaction between transportation investments, jobs retention and growth of the Kansas economy." The Task Force also called for use of "economic impact analysis" during project selection, "continue[d] use of local consultation" to gather stakeholder input, and creation of an "advisory group [that] could offer advice on emerging issues and project selection. The three prongs include preservation, modernization and expansion. Expansion projects include a 25% weighting for prioritization. The TREDIS model is used

What Are Other State DOTs Doing?

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by KDOT to predict economic impacts. It portrays the Kansas economy based on customized county-level economic data about employment patterns, business activity, and freight movements by type, amount and value. For each project, it also includes information on local economic conditions collected by KDOT's area engineers from local officials and economic development experts.

This information is combined with projections KDOT engineers make (based on regional travel model data where available) about project-level changes in congestion, travel times, travel distances, or accessibility. Based on outputs from TREDIS, points are calculated by KDOT equally for a project's performance according to the following sub-criteria:

- Anticipated change in study area jobs by 2030 – this may include jobs created by contingent development due to the project; jobs created or retained as a result of improved economic productivity due to shorter and more predictable travel times; and jobs created or retained as a result of expansion in markets due to improved travel speeds or improved access; and
- Anticipated change in net present value of study area GRP/safety benefits by 2030 - this may include GRP added due to contingent development due to the project; GRP added due to improved economic productivity caused by shorter and more predictable travel times; GRP added due to expansion in markets caused by improved travel speeds or improved access; and safety benefits caused by a reduction in injuries and fatalities on safer roads.

Kansas T-WORKS Program 2011

KDOT's Economic Development Set-Aside Program was significantly enhanced under the state's transportation program T-WORKS. Passed by the Kansas Legislature last May, 2010, T-WORKS boosts funding and expands the scope of the program to include rail, aviation and transit projects as well as highway projects. In addition to expanding the program to all transportation modes, changes include:

- Use of an economic modeling tool called TREDIS to better project a project's economic impact. This allows for more strategic decision-making.
- An increase in funding to \$10 million a year. Addition of an immediate opportunity component that allows KDOT to make funding decisions quickly when a community has a narrow time frame in which to act on an economic opportunity.
- Creation of the Economic Development Advisory Panel, which will to review applications and provide guidance in the selection process

Kansas tracks the following measures as part of this program:

- **Direct jobs:** Net new jobs created by the new or expanded business
- **Indirect jobs:** Net new jobs created in other businesses supporting the new or expanded business; also includes induced jobs, which are net new jobs created by increased new worker spending
- **One-time jobs:** Construction jobs during the life of the project

"Projects are selected based on a process that begins with a cooperative application submitted by a local government and a local business. KDOT evaluates the direct job creation, capital investment, and overall economic impact of the proposed project. KDOT staff then recommends funding, and a multiagency Economic Development Advisory Panel reviews proposed funding. The final funding decision is made by the Secretary of Transportation."

What Are Other State DOTs Doing?

MINNESOTA DEPARTMENT OF TRANSPORTATION

Annual Minnesota's Performance Report, 2011

This report is the fourth edition and describes trends in the condition and service levels provided by Minnesota's transportation systems. The report summarizes the plans, investments, strategies and innovations MnDOT and its partners are using to optimize performance as well as eighteen performance measures to track progress on nine policy goals from the Minnesota Statewide Transportation Policy Plan. MnDOT also conducts an annual Omnibus survey to measure Minnesotans' satisfaction with MnDOT's major services (snow plowing, smooth roads, signage, etc.). Recently, MnDOT has studied what Quality of Life means to Minnesotans. Transportation as one of the 11 major factors contributing to QOL and the study ranked specific transportation products and services that contribute to QOL and the satisfaction scores for each. This information is used to help MnDOT understand its customers, improve its services and make appropriate investment decisions.

Economic Considerations/Measures

While MnDOT does not have an explicit direct policy goal on economic competitiveness its overarching Department's mission includes supporting Minnesota's economy and quality of life. Therefore, several of the policy goals do include performance measures that could be evaluated for economic impacts. These are as follows:

National and Global Connections

- Airline Annual Available Seat Miles from MSP on scheduled commercial flights
- Port Shipments to and from MN Great Lakes & river ports: annual tonnage
- Shipments on Minnesota Railroads: annual tonnage from, to and through Minnesota

Statewide Connections

- Interregional Corridors: Greater MN, % of Miles +/- 2 mph of Target Speed (55, 60 or 65 mph) or faster
- Aviation Access: % of Minnesota population within 30 minute drive time of an airport with paved and lighted runway

Twin Cities Mobility

- Twin Cities Urban Freeway System Congestion: % of miles below 45 mph in AM or PM peak
- Clearance Time for Metro Urban Freeway incidents: 3 yr. average
- Annual Rail and Express Bus Transit Ridership: Express buses (all providers), light rail, commuter rail

Greater Minnesota Metropolitan and Regional Mobility

- Greater Minnesota Bus Service Hours: Public transportation

Community Development and Transportation

- ADA: Accessible Pedestrian Signals, % of state highway intersections with APS
- Bike, Walk and Transit Share of commuter trips: large Minnesota metro areas

Traveler Safety

- Minnesota Traffic Fatalities: All state and local roads

What Are Other State DOTs Doing?

WISCONSIN DEPARTMENT OF TRANSPORTATION

Transportation Projects Commission(TPC) : Major Highways Project Evaluation Process

This report provides an overview of the Administrative Rule Trans 210 process which outlines how projects are to be evaluated and recommended to the TPC. The Department has assembled a task force of staff experts in highway design, construction, planning, economics, environmental analysis, and economic development to compile and analyze information that is to be used for the evaluation process for major projects. Major projects are defined as highway segments with a level of service worse than C in the design year and portions of highway that exceed the statewide average crash rate for similar highway types. As well as projects that are more than \$5 million; add one or more lanes greater than 5 miles; construct at least 2.5 miles of new or relocated highway; or improves an existing 4-lane highway more than 10 miles to meet freeway standards.

“Enhancing Wisconsin’s Economy” is one of five Department goals. The economic measure is weighted at 40% of the composite score and is comprised of the following:

- Identify Existing Business Attributes (25%)
- Identify Transportation Facilities that Provide Connections (25%)
- Degree to which the transportation project (50%):
 1. Increases productivity
 2. Accommodates growth business sectors
 3. Facilitates exports that bring in outside dollars

The score also considers another 5% to community preparedness defined as including one of the following:

- Existing economic development organization
- Industrial Park or available sites along the corridor
- Proximity to college or technical center
- Comprehensive plan with economic development component that includes transportation project area

The TREDIS tool is used to generate the economic impact results including:

- Regional data: value added & employment by industry
- Transportation dependency for supply chain, by industry
- Inter-industry trade and buy-sell relationships
- Productivity, Connectivity
- Economic Growth, Exports

MONTANA DEPARTMENT OF TRANSPORTATION

Montana Highway Reconfiguration Study (2005)

Montana’s Highway Economic Analysis Tool (HEAT: User-Manual 2005)

In 2001 the Montana State legislature and Governor’s Office directed the Montana Department of Transportation (MDT) to conduct a study examining the economic impact of reconfiguring the State’s major two-lane highways. The result of this study was the development of the Highway Economic Analysis Tool (HEAT). The tool was designed to meet the following objectives:

- Identify which transportation investments will benefit specific Montana industries;
- Provide MDT with an analytical toolbox to evaluate economic development impacts of transportation improvements; and
- Quantify the economic impacts of example system improvement scenarios

What Are Other State DOTs Doing?

MONTANA DEPARTMENT OF TRANSPORTATION

The main goal of the analysis was to first have a clear understanding of how different industries (both those currently located in Montana and those targeted by economic development officials) depend on ground transportation. Of those industries that are dependent which ones would likely benefit from transportation investment. The tool also identifies other economic development efforts that complement the transportation investment. This industry-based perspective reflects the “build it and they will come” mantra by identifying first who they are and then figuring out which industries would benefit the most from the investments. The tool consists of three basic components for estimating the economic benefits which include:

- **Transportation Performance Impacts:** Passenger Travel and Freight Commodity Flows
 - Weight, Truck Trips, Origins-Destinations, Types of Goods, Value of Goods
- **Industry Analysis** includes the estimation of three types of direct economic benefits:
 - Reductions in the cost of doing business based on the size of each industry and its dependence on trucking;
 - Net business attraction/retention based on market accessibility factors and industry profile assessments; and
 - Visitor spending effects on the economy (an optional module depending on the nature of the highway improvement). These direct industry impacts are then used as inputs to a regional economic simulation model of the Montana economy to determine the total transportation economic benefit.
- **Economic Benefits**
 - REMI model is used to estimate jobs, income, and gross regional product

Finally, HEAT includes a benefit-cost analysis module to compare economic benefits and costs and help MDT prioritize projects. In addition, HEAT includes a business attraction module and adds these benefits as inputs into the benefit-cost calculation. The Business Attraction Module of HEAT organizes industries to 2 digit standard industrial codes (SIC). This module performs the following three tasks:

- Establishes maximum growth rates constraints for each industry in each county.
- Calculates total growth of a county and for each SIC in proportion to changes in accessibility by highways to various modes, employment and population. This results in an accessibility index.
- Adjust the results for possible redistributions from other parts of the state.

HEAT is recommended to be used within the following decision-making processes:

Long-Range Policy Plan Updates. Use HEAT to do a series of corridor-level analyses, which rank corridors in importance from an economic development perspective, and identify which specific investments have benefits greater than their costs.

Investment Analysis. Within MDT’s Performance Programming Process (P3), use HEAT to estimate economic benefits of various investment strategies.

District Nomination Process: Use HEAT to screen and rank projects that are suggested for selection based on relative economic development benefits. Montana DOT uses currently used the following economic related measures as part of their multi-criteria prioritization process:

- Location in economically distressed area
- Supports cluster development /in-fill/redevelopment
- Supports local economic development initiatives

What Are Other State DOTs Doing?

MONTANA DEPARTMENT OF TRANSPORTATION

Five-Year Transportation Capacity Project (TCP) Development: Use HEAT to examine the set of capacity projects not currently funded, and help prioritize which projects should be advanced in the program. Once the entire program is set, use HEAT to evaluate and then communicate the likely statewide economic benefits to be gained from the program.

Project Implementation: Use HEAT as the standard tool for economic impact assessment for environmental evaluations.

Post Evaluation Economic Impact Case Studies

Montana recently completed five case studies that detail economic impacts associated with each project. Projects include widening projects, new interchanges, new corridors, truck and rail access including a railway segment. Projects range from being completed as early as 1995 to 2009. Jobs created are noted as well as other new development effects.

MISSOURI DEPARTMENT OF TRANSPORTATION

TRACKER: Measures of Departmental Performance (January 2013)

Missouri DOT's mission is to provide a world-class transportation experience that delights our customers and promotes a prosperous Missouri. "Advance Economic Development" is one of the 19 tangible results that are tracked annually through three performance measures: economic return on transportation investment; job creation by government sector industries; and number of jobs and businesses in the freight industry.

Economic Return on Investment

MoDOT works with the state Department of Economic Development to perform economic impact analyses for the state's transportation investments. The analyses are performed using REMI. Through these efforts, the department can provide state and regional estimates to demonstrate economic benefits related to specific projects, corridors and program expenditures. An analysis of the Statewide Transportation Improvement Program provides a summary of economic benefits related to transportation investments over the next 20 years. The 2013-2017 STIP will invest approximately \$4.5 billion into highway and bridge projects across the state. On average, these STIP investments are estimated to create approximately 6,780 new jobs with an average wage of \$33,084 per job. The 2013-2017 STIP projects will contribute an estimated \$781 million of economic output for the state per year totaling \$15.6 billion over the next 20 years. This equates to a \$3.64 return on every \$1 invested in transportation. The 2013-2017 STIP has a lower economic return compared to previous STIPs due to projected decreases in transportation investments going forward.

Job Creation by Government Sector Industries

The tool for estimating impacts of job creation for government sector industries is the regional input output model (RIMS II), which is updated annually by the Bureau of Economic Analysis, a division of U.S. Department of Commerce. The multiplier for transportation employment is 2.72, which indicates that every new transportation job will create an additional 1.72 jobs (a total impact of 2.72 jobs) throughout Missouri's economy. For example, when Missouri increases its investment into transportation and as a consequence the transportation industry adds 100 jobs, there will be an additional 172 jobs created (a total impact of 272 jobs). The latest data shows transportation investments create more jobs than investments in health care, social assistance, educational services, tourism and agriculture.

What Are Other State DOTs Doing?

MISSOURI DEPARTMENT OF TRANSPORTATION

Number of Jobs and Businesses in the Freight Industry

This measure is extracted from quarterly employment data collected by the US Department of Labor and managed and provided by the Missouri Department of Economic Development. Employment and businesses that fall within the freight business cluster. This is a semiannual measure. Although freight tonnage is increasing and the economy is showing some increases, the number of freight related businesses in Missouri continues to decline; however, Missouri did show a gain of 2.13 percent in jobs from July 2010 to July 2011.

MICHIGAN DEPARTMENT OF TRANSPORTATION

Goals, Objectives and Performance Measures Report, 2006

MDOT has four theme based goal areas including Stewardship, Safety and Security, System Improvement, and Efficient and Effective Operations. Each goal area includes objectives for three categories including integration, economic benefits and quality of life. Below are the economic benefit objectives for each of the four goals areas:

Stewardship

- Conduct sound asset management practices to optimize the benefits of preservation investments
- Leverage transportation funding to maximize transportation investment
- Maximize the benefits of transportation investment to the Michigan Economy.

Safety and Security

- Reduce economic losses due to transportation crashes and incidents.
- Manage risk and responsiveness to ensure transportation system and border crossing continuity for passengers freight

System Improvement

- Improve travel time reliability and predictability for passengers and freight.
- Modernize facilities to accommodate the efficient movement of people, goods, and services
- Address congestion to reduce its cost to businesses and the state's economy.

Efficient and Effective Operations

- Collaborate with providers to deliver programs and services better, cheaper, and faster.
- Manage highway access to balance capacity and development considerations.
- Collaborate with private sector to improve the efficiency of intermodal freight and passenger transfers.

Michigan also uses overarching measures to gauge system wide performance which includes economic impacts. The most important measurement of MDOT's impact on the economy is this number of jobs that are sustained due to MDOT spending. The associated metric uses outputs from econometric models to quantify the number of direct, indirect, and induced jobs within Michigan that are attributable to MDOT expenditures. The measure applies to MDOT's 5-Year Program.

Economic Benefits of the Michigan Department of Transportation's FY 2010-2014 Highway Program (2010)

This report summarizes key findings regarding the economic impact of the highway and bridge program based on investment levels presented in the MDOT FY 2010-2014 Five-Year Transportation Program. The analysis utilized the Michigan Benefit Estimation System for Transportation (MI BEST Tool) and MDOT's Statewide Travel Demand Model. The MI BEST Tool facilitates the analysis of the potential effects of transportation related investments on Michigan's economy. The MI BEST Tool was developed

What Are Other State DOTs Doing?

MICHIGAN DEPARTMENT OF TRANSPORTATION

for MDOT and calculates the inputs for the REMI model for simulating the total economic impacts for the investment. The MDOT Statewide Travel Demand Model (TDM) is run using the road network for the no-build and build (improved) network for the specific program years. User benefits are derived from travel time savings and vehicle operating costs (travel efficiencies) using the MI BEST Tool then converted into economic variables including transportation/production costs and consumer spending, which serve as inputs to the REMI model. The REMI model makes the calculation and assessment with regard to economic impact data, user benefits data, or more detailed sector employment benefit data.

Impacts are analyzed for two scenarios: The first assumes that MDOT can match all federal revenues available, the full program. The second reflects a reduced Highway Program investment assuming insufficient state revenues, the reduced program. The MI BEST Tool allows the analyses of the potential effects of transportation related investments on Michigan's economy. The tool prepares the necessary inputs to REMI which include three direct benefit categories :

- *Travel Efficiencies*: Benefits that accrue to facility users after completion.
- *Construction Impacts*: Impacts resulting from the expenditures on local labor and materials in constructing the facility.
- *Operations and Maintenance (O&M) Impacts*: Impacts resulting from the expenditures on local labor and supplies to operate and maintain the facility upon completion.

The travel efficiency gains arising from transportation investments included in the MI BEST Tool include travel time savings, vehicle-operating cost savings, accident-cost savings and emissions cost savings.

These are translated into direct, indirect and induced economic impacts through REMI.

Results of the assessment reveal the following:

Estimated Full Program

An average of 15,500 job-years annually.

\$5.3 billion in personal income.

\$5.1 billion in GSP.

\$32.5 million (2010) to \$69.3 million in travel-time savings to households.

\$29.5 million (2010) to \$51.8 million (2014) Michigan business savings.

Estimated Reduced Program

An average of 10,200 job-years annually

\$3.5 billion in personal income.

\$3.4 billion in GSP.

\$32.5 million (2010) to \$47.6 million in travel-time savings to households.

\$29.5 million (2010) to \$41.9 million (2014) Michigan business savings.

Economic Impact Analysis of Statewide Transportation Investment Packages

MDOT State Long Range Transportation Plan, 2007

This report evaluates the economic impact of several investment packages including a base package for "Business as Usual," three alternative packages, and an "Investing to Achieve the Vision" package. The three alternative packages are designated as "Change the Mix," "Move Ahead" and "Flexible New Revenue" and represent different investment options to cope with the future demands on the transportation system. In order to assess the various investment packages, MDOT used the REMI Model to evaluate each investment scenario. The following table provides the results:

What Are Other State DOTs Doing?

MICHIGAN DEPARTMENT OF TRANSPORTATION								
Economic Impacts of the Investment Packages over the Period 2007-2030								
"Business As Usual" (BAU)	"Change the Mix"		"Move Ahead"		"Flexible New Revenue"		"Investing to Achieve the Vision"	
	Cumulative Impact	Change from BAU	Cumulative Impact	Change from BAU	Cumulative Impact	Change from BAU	Cumulative Impact	Change from BAU
Total Employment (in thousands of Permanent full- time equivalent jobs)	30	30 0 (0.0%)	36	6 (20.0%)	42	12 (40.0%)	43	13 (43.3%)
Gross State Product (in billions of 2005)	\$50.0	\$50.1 \$0.1 (0.2%)	\$58.3	\$8.3 (16.6%)	\$68.7	\$18.7 (37.4%)	\$69.6	\$19.6 (39.2%)
Personal Income (in billions of 2005)	\$38.4	\$38.5 \$0.1 (0.3%)	\$45.1	\$6.7 (17.4%)	\$53.3	\$14.9 (38.8%)	\$54.7	\$16.3 (42.4%)
Personal Travel	\$22.2	\$21.4 -\$0.8 (-3.6%)	\$23.4	\$1.2 (5.4%)	\$27.0	\$4.8 (21.6%)	\$27.1	\$4.9 (22.1%)
Time Savings (in billions of \$2005)								

INDIANA DEPARTMENT OF TRANSPORTATION
Guide to MCIBAS (Major Corridor Investment-Benefit Analysis System) and Its Economic Impact Analysis Component) (1998)
<p>This report provides an overview of all of the aspects of the MCIBAS. In the mid1990s InDOT developed plans for several major intercity corridors including the overhaul of US 31 to bring it to interstate design standards. State legislators questioned the overall benefit of the project; consequently, making Indiana one of the first states to evaluate economic impacts on their projects. MCIBAS was developed to assess the relative costs and benefits of proposed major highway corridor projects. MCIBAS consists of a three components including a traffic impact simulation model, a user benefit-cost analysis processor and an integrated economic impact analysis system.</p> <p>The economic benefits of highway improvements (as estimated by MCIBAS) differ from the travel efficiency value of user benefits. User benefits include only those individuals and businesses that actually use the affected highway corridor. Economic benefits are broader and include benefits from anyone deriving additional income from business growth attributable to the highway improvements. User benefits include all users including out of state travelers where economic impact includes only economic impacts to Indiana residents and businesses. Finally, user benefits are included for any trip purpose whereas economic impacts are only accounted for benefits that increase the flow of money, due to reduced costs (or increased sales) for businesses and/or increased spending income available for individuals. The MCIBAS is built upon the concept of distinguishing four types of economic impacts which include <i>Construction Effects, Business Expansion, Business Attraction, and Tourism Effects</i>.</p>

What Are Other State DOTs Doing?

INDIANA DEPARTMENT OF TRANSPORTATION

MCIBAS estimates direct, indirect and induced effects through a series of modules:

1. Indiana Statewide Travel Model (ISTM)
2. User Benefit Analysis (NET_BC)
3. Economic Impact Modules (Business Expansion, Business Attraction, Tourism)
4. REMI Simulation Model
5. Benefit/Cost Analysis

MCIBAS generates several economic outputs:

- The expansion of existing businesses in the corridor study area, as a result of the transportation system improvement.
- The movement of new businesses into the study area due to higher transportation accessibility and lower business costs derived from an improved transportation system.
- Increased tourism business as a result of increased access to a broader market area.

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

Pennsylvania Mobility Plan: Leading Transportation Change 2006 – 2030 (2007 Report) Direction and User's Guide Documents

PennDOT's mission is to provide the best performing transportation system for people, business, and places. The Mobility Plan includes five goals:

1. Move people and goods safely and securely.
2. Improve quality of life by linking transportation, land use, economic development, and environmental stewardship.
3. Develop and sustain quality transportation infrastructure.
4. Provide mobility for people, goods, and commerce.
5. Maximize the benefit of transportation investments

Each goal has associated objectives and strategies. Goals 2, 4, and 5 all have economic benefit related objectives and associated strategies. As an example Goal 2 includes the following strategies:

- Support economic development by leveraging transportation investments.
- Assign a higher priority to transportation investments that yield economic development, land use, environmental stewardship, and public safety outcomes.
- Promote efficient land use through transportation investment and supporting policies.

Suggested measures related to economic benefits include the following:

- Economic benefits (in dollars) associated with project
- Project supports or fosters job creation (full or part-time)
- Project supports other state investments and community partnerships
- Project improves access to brownfields or previously developed sites
- Project supports recreation or tourism markets
- Change in delay on Core Pennsylvania Transportation System facilities

No information provided on economic analysis tools in referenced documents.

What Are Other State DOTs Doing?

WASHINGTON DEPARTMENT OF TRANSPORTATION

Connecting Washington Strategic Transportation Investments to Strengthen Washington's Economy and Create Jobs (2012)

This report summarizes the work of Task Force comprised of a diverse group of thirty-one members representing business, local government, labor, and environmental interests, with the purpose of creating a ten-year strategy to maintain and improve the state's transportation system. The Investment Strategy is supported by the following four principles:

- Preserve existing transportation systems and services.
- Improve mobility for people and commerce.
- Enhance the safety and efficiency of the transportation system.
- Provide community and environmental improvements that help attract, keep, and expand private businesses and a highly skilled work force

Categories of Investment include:

- *System Preservation* – Investments to repair and maintain our statewide system of roads and bridges, and to operate and maintain ferries and transit services.
- *Strategic Mobility Improvements* – Investments in projects and services that will relieve congestion in specific corridors, improving the movement of people and goods.
- *System Efficiency* – Investments that improve connections among modes (e.g., rail-truck, ferry-transit, car-transit), enhance speed and reliability, and improve the cost effectiveness of our existing transportation system.
- *Safety* – Investments that reduce fatalities and serious injuries across all modes.

\$51 billion in needs have been identified but the Task Force clearly recognized that a level of funding that excessive was not reasonable and; therefore, proceeded to identify “economic clusters” that provide the majority of jobs in Washington's economy: aerospace and manufacturing; agriculture and food processing; construction; research, health, and life sciences; information technology, software, and e-commerce; trade, transportation, and logistics; the military; professional and retail services; and tourism and recreation. The Task Force recommended \$21 billion over ten years and eight action items to preserve the transportation system and make strategic investments in the corridors that hold the key to job creation and economic growth.

The Gray Notebook: Paving The Way: Quarterly Performance Report (February, 2013)

Washington DOT has been tracking their performance for over 11 years in their “Gray Notebook”. Economic Vitality was added as a sixth state DOT policy goal by the Washington Legislature in 2010. The goal is to promote and develop transportation systems that stimulate, support, and enhance the movement of people and goods to ensure a prosperous economy. WSDOT's responsibility is to provide and operate a strong and reliable transportation system that efficiently connects people with jobs and their communities, moves freight, builds partnerships with the private sector, and supports a diverse and vibrant economy. Economic related measures are tracked either on a quarterly, semi-annual, or annual basis. WSDOT tracks the economic performance as a part of their trucks, goods and freight (annually) reporting; rail freight reporting (semi-annually) and general transportation economic indicators (quarterly).

What Are Other State DOTs Doing?

WASHINGTON DEPARTMENT OF TRANSPORTATION

Trucks, Goods and Freight (Annually)

WSDOT identified that truck bottlenecks and their solutions fall in three categories: congested urban interstate highways, state highways in urban areas, and cross-state freight corridors. Truck crossings increased 1.3% at western Washington border in 2011. Container freight through Washington's seaports decreased 2% in 2011 and Washington's freight rail traffic increased 12.97% in 2010. Washington state relies on their Truck Performance program (the only one in the country that systematically analyzes the entire truck freight network) to quantify delay at truck bottlenecks. WSDOT relies on retaining access to data owned by trucking companies. WSDOT has learned that average speed, by itself, does not accurately identify bottlenecks because posted speeds vary along the highway. They have found that the percent of trucks traveling 60% of posted speed is a better measure of poor performance.

WSDOT is working with the University of Washington and Washington State University to develop a benefit-cost methodology to evaluate and prioritize state truck highway and truck intermodal improvements. This will help them meet new federal freight program requirements from MAP 21. WSDOT also tracks state rail volume by commodity as part of their freight rail traffic reporting. Air cargo handled at Washington airports decreased 1/3 % from 2010 to 2011

Freight Rail (Semi-Annually)

The following primary performance measures were reported on in September, 2011:

- The Palouse River and Coulee City Rail System generated 10,253 railcar shipments in 2011, nearly doubling shipments during the first four years of state ownership.
- The Washington State Grain train moved 575 carloads in the second quarter of 2012, a record high for the program's 18-year history.

Lastly, the Washington Department of Commerce awarded \$3.95 million to WSDOT to rehabilitate deficient sections of track on each of the three PCC Rail System branch lines. The PCC Rail System continues to ensure that Washington-grown agricultural products are shipped to market in a safe and economical way, benefiting both farmers and consumers. The increase in utilization by farmers and other shippers has been instrumental in reducing truck shipments on eastern Washington highways.

Transportation Economic Development Update (Quarterly)

WSDOT reports the following information on economic performance quarterly:

- ARRA transportation funding in terms of jobs, employee work hours, and payroll. WSDOT contracts out 74% of this work to the private sector.
- Construction sector employment: Average monthly construction employment reached 140,900 workers in 2012, a 2.5 percent increase from 137,500 workers in 2011.
- Unemployment rate: Dropped below 9% for first time in 4 years
- Taxable retail sales: January 1 through June 30, 2012, totaled \$50.9 billion, an increase of 4.7 percent from the same period in 2011
- Statewide per capita income: Grew from \$41,951 in 2010 to \$45,302 in 2012, an increase of about 8 percent
- Gasoline prices: Up by 1.3%

What Are Other State DOTs Doing?

WASHINGTON DEPARTMENT OF TRANSPORTATION

Washington State Freight Mobility Plan (2011)

This plan includes three categories of measurement that correspond back to their six goals. The Economic Vitality measures are provided for each of these categories for freight below:

Global Gateway Technical Team Freight Benefit Evaluation Results

- Productivity Measures: Volume of imports and exports through ports (air, rail, marine, and border)
- Productivity Measures: Volume of freight through Washington State
- Improves job creation and expansion: Number of long-term jobs created or preserved
- Industrial Land Preservation: Total zoned industrial acres-provides access to industrial land-acreage served by truck
- Comparative Advantages for Washington State Transportation Companies: Travel time velocity and reliability compared to other ports
- Productivity Measures: Tax revenue generated by freight-dependent businesses
- Improves job creation and expansion: Average wage of jobs
- Improves job creation and expansion: Number of transportation and warehousing jobs
- Productivity Measures: Volume of discretionary cargo through ports
- Industrial Land Preservation: Acres with close access to major ports &/or interstate highways
- Comparative Advantages for Washington State Transportation Companies: Evidence of port efficiencies
- Productivity Measures: Delivery time (2-hr ring around urban core)
- Improves job creation and expansion: In high-unemployment area
- Improves job creation and expansion: Number of manufacturing or other high-wage jobs not requiring advanced degrees
- Comparative Advantages for Washington State Transportation Companies: Evidence of 'Green' logistics through WA ports
- Improves job creation and expansion: Time from urban
- Improves job creation and expansion: In high-poverty area
- Productivity Measures: Change in regional GDP related to imports and exports
- Productivity Measures: Value of imports and exports at border crossings and ports

Urban Goods Movement Technical Team Freight Benefit

- Comparative Advantages for Washington State Transportation Companies: Evidence of 'Green' logistics through WA ports
- Comparative Advantages for Washington State Transportation Companies: Evidence of port efficiencies
- Comparative Advantages for Washington State Transportation Companies: Travel time velocity and reliability compared to other ports
- Productivity Measures: Tax revenue generated by freight-dependent businesses
- Productivity Measures: Value of imports and exports at border crossings and ports
- Improves job creation and expansion: In high-poverty area
- Improves job creation and expansion: Number of manufacturing or other high-wage jobs not requiring advanced degrees
- Improves job creation and expansion: In high-unemployment area
- Improves job creation and expansion: Number of jobs
- Improved processing at border crossings
- Serves designated MICs or industrial/employment centers

What Are Other State DOTs Doing?

WASHINGTON DEPARTMENT OF TRANSPORTATION

Rural Economies Technical Team Freight System Benefit Evaluation Results

- Improves job creation and expansion: Number of long term jobs and wages
- Industrial/Commercial Land Access and Availability: Acres with close access to major ports &/or interstate highways
- Improves job creation and expansion: Time from urban freight hub (downtown, port, etc) to regional destinations
- Comparative Advantages for Washington State Transportation Companies: Travel time velocity and reliability compared to other ports
- Comparative Advantages for Washington State Transportation Companies: Evidence of port efficiencies
- Productivity Measures: Volume of imports and exports through ports
- Productivity Measures: Change in regional GDP related to imports and exports
- Productivity Measures: Delivery time (2-hr ring around urban core)
- Improves job creation and expansion: Average wage of jobs
- Improves job creation and expansion: Number of transportation and warehousing jobs
- Productivity Measures: Volume of freight through Washington State
- Improves job creation and expansion: In high-unemployment area
- Improves job creation and expansion: Number of manufacturing or other high-wage jobs not requiring advanced degrees
- Productivity Measures: Volume of discretionary cargo through ports
- Improves job creation and expansion: In high-poverty area
- Productivity Measures: Value of imports and exports at border crossings and ports
- Comparative Advantages for Washington State Transportation Companies: Evidence of 'Green' logistics through WA ports
- Industrial Land Preservation: Total zoned industrial acres
- Improves job creation and expansion: Number of short-term jobs

COLORADO DEPARTMENT OF TRANSPORTATION

Statewide Economic Benefits of Transportation Investment (2007)

In 2006 Colorado DOT reviewed several research studies and conducted focus groups to explore the economic benefits of transportation investment. Consequently, CDOT decided to prepare an economic impact analysis of two funding scenarios. This report summarizes the results of that analysis. Two scenarios were chosen for evaluation: 1) baseline referred to as the "Forecast Revenue" scenario represents investments that can be made with current revenue projections and 2) the "Sustain Current Performance" scenario assumes that Colorado can raise additional funds to keep transportation system performance at current levels. Over the 26-year investment timeframe, the economic benefits of an additional \$48 billion for scenario 2 to be funded yielded \$59.6 billion in travel cost savings and additional income for Colorado residents arising from business expansion and attraction benefits. Quantifiable economic benefits for scenario 2 include:

Reduced Congestion

- 26 hours of time saved (per resident)
- 30 gallons of fuel saved (per resident)

What Are Other State DOTs Doing?

COLORADO DEPARTMENT OF TRANSPORTATION

- \$1.7 billion in travel time savings for households
- \$240 in travel time savings (per resident)
- \$0.6 billion in savings for Colorado businesses

Better Pavement Quality

- \$0.9 billion in reduced vehicle operating costs for households
- \$205 in savings (per vehicle) (\$120 per resident)
- \$0.2 billion in savings for Colorado businesses

Safety Improvements

- 12,100 fewer accidents
- 4,300 fewer accidents involving injuries
- 140 lives saved
- \$0.5 billion in reduced economic losses

General System Improvements

- 10,900 new long-term jobs
- \$0.7 billion in increased personal incomes
- 28,000 additional construction-related jobs

The study used REMI to estimate the productivity gains and resulting business expansion and attraction impacts of transportation investment. Non quantifiable effects were also evaluated based on community of practice research which provided analogous findings that could be transferred to the Colorado context. These included the following qualitative economic benefits:

Increased economic competitiveness

- Increased access to labor and other inputs
- Expanded market reach
- Depends on level of investment in other states

Benefits to Tourism

- Increased visitor days
- Increased out-of-state visitor spending

Quality of life improvements

- Local air quality improvements
- Access to jobs and services
- Improved public transportation in metropolitan areas
- Increased leisure time

Short-term construction impacts

- Up to 29,000 jobs (annual average)
- \$1.0 billion increased personal income (annual average)
- Not included in total economic benefits

Finally the study recommended follow up regional studies for the following reasons:

- Different regions within Colorado have different transportation needs. The Front Range may be interested in reduced congestion while the Eastern Plains may be more interested in job creation.
- Regional impacts may become lost in a statewide study. For example, two hundred new jobs created across Colorado may not be significant, while 200 jobs created in Pueblo would have a large impact on the local economy.

What Are Other State DOTs Doing?

COLORADO DEPARTMENT OF TRANSPORTATION

- Residents and businesses in many parts of the state question whether transportation investments will benefit areas outside of the Front Range. A regional level analysis would help to identify where benefits occur.
- A regional analysis would increase study credibility and support at the local level, particularly where new tax dollars are tied to specific projects.

MARYLAND DEPARTMENT OF TRANSPORTATION

2013 Annual Attainment Report on Transportation System Performance

Maryland DOT has five goals of which “Connectivity for Daily Life” has direct economic related performance measures. The objectives for this goal include:

- Provide balanced, seamless and accessible multimodal transportation options for people and goods
- Facilitate linkages within and beyond Maryland to support a healthy economy
- Strategically expand network capacity to manage growth

Measures used to track performance include (these are not aligned with the specific objective):

- Number of nonstop airline markets served
- International cruises using the Port of Baltimore
- Port of Baltimore foreign cargo and MPA general cargo tonnage
- Annual revenue vehicle miles of service provided
- Average weekday transit ridership
- Percent of information system availability compared to total number of records maintained
- Percentage of State-owned roadway directional miles within urban areas that have sidewalks and percent of sidewalks that meet Americans with Disabilities Act (ADA) compliance
- Percentage of State-owned roadway centerline miles with a bicycle level of comfort (BLOC) grade “D” or better and directional mileage of SHA-owned highways with marked bike lanes
- Percent of freeway lane-miles and arterial lane-miles with average annual volumes at or above congested levels

Economic Impact from Maryland’s Surface Transportation Spending 1997-2006 (2006 Report)

This report focuses on economic impacts related to the way in which MDOT’s highway and transit spending flow through the State’s economy and the number of jobs created by MDOT’s spending on construction, maintenance, and operation of transportation facilities across the State. MDOT’s combined highway and transit outlay towards surface transportation spending over the 1997-2006 period totals over \$20.1 billion over 10 years (adjusting all figures for inflation). The indirect and induced economic impacts of investments were estimated using the IMPLAN statewide input-output model for Maryland. This statewide economic model indicates that this spending will generate a total of \$44.9 billion of business output over the 10-year period. That includes \$16.1 billion in labor income flowing to Maryland workers and supports an average of over 32,703 jobs each year over the 10-year period. Each dollar of spending on surface transportation in Maryland is associated with over \$2.20 circulating in Maryland’s economy. This report did not address the economic impacts of alternative investment strategies.

What Are Other State DOTs Doing?

OREGON DEPARTMENT OF TRANSPORTATION

Least Cost Planning (LCP): Currently renamed Mosaic

LCP is a term coined by the utility industry in the 70's that refers to a comparative decision-making process that leads to the most cost effective solution. The success of using this decision-making process in the utility industry led the Oregon Legislature to pass House Bill 2001 in the spring of 2009.

The Oregon state legislature defined least cost planning for Oregon and directed the Oregon Department of Transportation (ODOT) to develop such a process (Oregon Revised Statutes 184.653):

“Least cost planning means a process for comparing direct and indirect costs of demand and supply options to meet transportation goals, policies or both, where the intent of the process is to identify the most cost-effective mix of options. The Department of Transportation shall, in consultation with local governments and metropolitan planning organizations, develop a least-cost planning model for use as a decision-making tool in the development of plans and projects at both the state and regional level.”

This initiated the earlier versions of the LCP which comprise the following technical considerations:

- Costs and benefits are measured in terms that facilitate the comparison of planning options (such as monetary equivalent units).
- The approach makes use of quantitative and qualitative evidence.
- Impacts on users (for example, commuters using a new transit system along a previously congested corridor) and nonusers (for example, members of the general public who do not travel within the corridor, but may benefit from improvements in air quality in the vicinity of that corridor) are estimated.
- The approach accounts for indirect effects such as changes in local employment and land use.
- Interactions (“synergies”) among planning options are considered.
- The approach explicitly accounts for risks and uncertainty in forecasts and cost and benefits calculations.

There are nine categories as part of LCP: mobility, accessibility, economic vitality, environmental stewardship, safety and security, funding the transportation system, land use and growth management, quality of life and livability and equity. Indicators have been developed for each category. Indicators that can be expressed in monetary terms are included as benefits or costs, in the benefit-cost analysis (BCA). Indicators that cannot be monetized are expressed as, or converted into, scores and weighted with user defined weights in the multi-objective decision analysis (MODA). The following information is presented for the economic vitality and funding the transportation system categories.

Economic Vitality: Does the plan or action contribute to the economic prosperity of Oregon (i.e., growth in employment, production or other high value economic activity)? Specific metrics include:

- Number of jobs associated with action
- Changes in transportation costs by industry
- Changes in employment by industry and wage category
- Changes in productivity from increased connectivity
- Changes in the total value of exports and imports

What Are Other State DOTs Doing?

OREGON DEPARTMENT OF TRANSPORTATION

Funding the Transportation System: How does the plan or action impact public accounts? Impacts include effects on fiscal balances and indebtedness. Specific metrics include:

- Capital costs
- Other life cycle costs
- Share of lifecycle funds that are “new” or “recycled” (from other private and public sector entities)
- Net impact of program on State and Local fiscal balance

Oregon Statewide Integrated Model (SWIM2) 2010

Oregon is one of a couple of states in the country that has invested in the development of an integrated transport-land use model. This model produces results that provide critical information for measuring the Department’s Economic Vitality Category of LCP. The SWIM2 model represents the behavior of the land use, economy, and transport system in the State of Oregon using a set of connected modules that cover different components of the full system, as follows:

- The *Economics and Demographics* module determines model-wide production activity levels, employment, and imports/exports.
- The *Synthetic Population Generator* module samples household and person demographic attributes (SPG1) and assigns a household to an alpha zone (SPG2)
- The *Aggregate Land Development* module allocates model-wide land development decisions among study area a-zones considering floorspace prices and vacancy rates.
- The *Production allocations and Interactions* module determines commodity (goods, services, floorspace, labor) quantity & price in all exchange zones to clear markets, including the location of business and households by beta zone.
- The *Person Travel* module generates activity-based person trips for each study area person in the synthetic population, during a typical weekday.
- The *Commercial Transport* module generates mode split for goods movement flows, and generates truck trips, combining shipments and possible transshipment locations, for a typical weekday.
- The *External Transport* module generates truck trips from input O-D trip matrices representing import, export (within 75 miles) and through movements based on PI and external station growth rates.
- The *Transport Supply* module assigns vehicle, truck, and transit trips (separately) to paths on the congested transport network for a 24-hour period, generating time and distance skims for AM and off-peak periods.

Two optional SWIM2 modules include:

- The *ED-PI Feedback* module is an optional simplified dynamic feedback to that adjusts the ED module’s fixed model-wide economic forecast, considering the statewide composite location utilities by industry from the PI module.
- The *Select Link* module generates SWIM2 highway assignment paths for later use in generating outputs such as select link results, subarea matrices, and route choice results.

What Are Other State DOTs Doing?

OREGON DEPARTMENT OF TRANSPORTATION

2011 Annual Oregon DOT Progress Report (most recent available)

ODOT Goal #3: Mobility/Economic Vitality -- Keep people and the economy moving
Oregon Benchmark #1 Employment in Rural Oregon, and *Oregon Benchmark #4* Net Job Growth
KPM #14: Jobs from Construction Spending: Number of jobs sustained as a result of annual construction expenditures

Data: ODOT Highway Program Office, Highway Division, provides actual (and for targets - projected) construction-related spending data. ODOT Financial & Economics Analysis Section, Central Services Division, uses a widely recognized regional economic impact modeling tool to estimate a jobs-impact factor. The current jobs impact factor is about 12.5 jobs per one million dollars of construction-related spending (2011 dollars). Annual construction-related spending (actual or projected) is multiplied by the jobs impact factor to project the total number of short-term jobs sustained statewide. In order to keep the measure on a consistent year-to-year basis, adjustments are made for inflation.

TRANSPORTATION ECONOMIC DEVELOPMENT PROGRAMS

State DOT/Program	Criteria	Annual Funding
<p>Alabama: Industrial Access Program <i>Objective</i>: To provide public access to new or expanding industries in the state.</p>	<p>(1) The industry must be new (2) It must be an existing industry that is expanding and creating new jobs with new industry investment.</p>	<p>\$ 12 million from Transportation Department budget; FY 2002 total state amount, \$10.1 million; total private capital investment, \$439 million</p>
<p>Arizona: The Economic Strength Projects Program <i>Objective</i>: To fund projects that create and retain jobs, lead to capital investment, and contribute to the economy in the State of Arizona or within the local authority.</p>	<p>(1) Cost of the project; (2) Jobs created or retained, projected capital investment and contribution to the economy of the state; (3) Cost/benefit ratio; (4) Local match funding; (5) Expenditure on local infrastructure relating to the project; (6) Magnitude of the project and its relative value; (7) Specific time schedule for project completion.</p>	<p>\$ 1 million annually</p>
<p>Florida: The Transportation Outreach Program (TOP) <i>Objective</i>: To fund transportation projects that will preserve transportation infrastructure, enhance Florida's economic growth and competitiveness, and improve travel choices to ensure mobility.</p>	<p>(1) Major highway improvements that provide linkage to major highways, bridges, trade and economic development corridors; access projects for freight and passengers; (2) Major public transportation projects, such as seaport projects that improve cargo and passenger movements; aviation projects that increase passenger emplanements and cargo activity; rail projects that facilitate the movement of passengers and cargo.</p>	<p>\$ 60 million annually, grand total \$995 million by year 2010</p>

What Are Other State DOTs Doing?

TRANSPORTATION ECONOMIC DEVELOPMENT PROGRAMS

State DOT/Program	Criteria	Annual Funding
<p>Georgia: The Governor's Road Improvement Program (GRIP) <i>Objective:</i> Fund a system of highways to bring access to the state's smaller communities and promote economic development.</p> <p>Once completed, the GRIP system will bring 75% of Georgia's population within two miles of a four-lane road and 98% of the State's population within 20 miles of a four-lane road. The program will also provide access for oversized trucks (requiring an oversize permit from the Georgia Department of Motor Vehicles) to all cities having a population above 2,000.</p>	<p>GRIP targets nineteen corridors. These corridors are economic development highways consisting of existing primary routes and truck connecting routes. Under GRIP, the corridors will be widened to four lane roads.</p>	<p>\$106 million Total Cost Expended FY 2020</p>
<p>Illinois: The Economic Development Program (EDP) <i>Objective:</i> The EDP program assists highway improvement projects that are needed to provide access to new or existing industrial, distribution, warehousing or tourism developments.</p>	<p>A 50% local match funding and job creation and retention condition. However, commercial and retail establishments are not eligible.</p>	<p>\$14.5 million Total Funds</p>
<p>Iowa: The Revitalize Iowa's Sound Economy Fund (RISE) Program <i>Objective:</i> Promote economic development in Iowa through construction or improvement of roads, streets, and railroads.</p>	<p>(1) Immediate opportunity projects that are related to an immediate non-speculative opportunity for permanent job creation or retention; (2) Local development projects that support local economic development, but do not require an immediate commitment of funds.</p>	<p>\$ 30 million annually</p>

What Are Other State DOTs Doing?

TRANSPORTATION ECONOMIC DEVELOPMENT PROGRAMS

State DOT/Program	Criteria	Annual Funding
<p>Kansas: The Local Partnership Program <i>Objective:</i> The Local Partnership Program's economic development category focuses on highway and bridge construction projects that enhance economic development in Kansas.</p>	<p>The Local Partnership Program funds economic development projects on a maximum of 75% state (maximum of \$2.0 million) and 25% local match basis. The highway or bridge construction projects under economic development funds must have the potential to increase the area's income, jobs, and land values in the surrounding areas.</p>	<p>\$ 3 million annually</p>
<p>Louisiana: The Transportation Infrastructure Model for Economic Development (TIMED) Program <i>Objective:</i> Developed to connect major cities of Louisiana with a four-lane highway; enhance economic development; promote connectivity of bridge crossing; and fund inter-modal enhancements.</p>	<p>80% of the workforce consists of Louisiana residents.</p>	<p>\$100 million expended TIMED funds FY 2002</p>
<p>Massachusetts: Public Works Economic Development (PWED) Grant Program <i>Objective:</i> To fund infrastructure improvement projects associated with local or city government's economic development efforts that would enhance the economic competitiveness of the State.</p>	<p>(a) Jobs to be created or retained as a direct result of the proposed projects; (b) Unemployment statistics for the community or region; (c) Equalized property value per capita in the community as compared to the state average; (d) Average annual wage of jobs created or retained as compared to the average annual state wage; (e) Ratio of public investment to total private investment; (f) An estimate of future economic benefits that may result from the proposed project and the private sector investment related to the project.</p>	<p>\$ 17.1 million total funds</p>

What Are Other State DOTs Doing?

TRANSPORTATION ECONOMIC DEVELOPMENT PROGRAMS

State DOT/Program	Criteria	Annual Funding
<p>Michigan: Target Industry Development category of the Transportation Economic Development Fund (TEDF) <i>Objective:</i> Used to fund highway, road, and street improvements necessary to support the State's economic growth and competitiveness, accessibility to industries, and economic development.</p>	<p>(1) Relate to one or more of the target industries like agriculture or food processing, tourism, forestry, high technology research, manufacturing, mining, office centers of 50,000 square feet or more in size; (2) Will create or retain permanent jobs; (3) Is immediate and non-speculative; and (4) Increase the tax base of the local area and impacts the local economy. In addition, eligible TEDF projects must satisfy a minimum of 20% or more of local match funding.</p>	<p>\$19.9 million FY 2002</p>
<p>Mississippi: The Four Lane Highway Program or Advocating Highways for Economic Advancement and Development Program <i>Objective:</i> To provide a four-lane highway within 30 miles or 30 minutes of every Mississippi resident.</p>	<p>In 1987, the program originally planned to construct 1,088 miles of four-lane highway in three phases by the year 2001 with an estimated cost of \$1.6 billion. In 2002, Vision 21, a needs-based highway program passed by the Mississippi Legislature now includes Phase IV of the AHEAD program and provides for construction of roads within the Gaming Roads program, as well as other needs.</p>	<p>\$ 174 million Total Expended Cost FY 2002</p>
<p>Missouri: The Economic Development Program <i>Objective:</i> To provide a method of funding for transportation projects that will significantly impact the economic development in a given area.</p>	<p>(1) Be a part of the state highway system; (2) Be compatible with the Missouri Department of Transportation (MoDOT) Long-Range Transportation Plan; (3) Possess funds from various other local government or private sources; and (4) Have a written commitment from a corporation or Missouri Department of Economic Development (MoDED) that construction by MoDOT will significantly impact the firm's decision to expand, continue, or locate their operations in Missouri.</p>	<p>\$ 15 million annual cost; \$12.4 million Total fund approved FY 2002</p>

What Are Other State DOTs Doing?

TRANSPORTATION ECONOMIC DEVELOPMENT PROGRAMS

State DOT/Program	Criteria	Annual Funding
<p>New York: The Industrial Access Program <i>Objective:</i> Provides funding for the creation or improvement of highway, bridge, and rail infrastructure that facilitate access to the State's industrial, manufacturing, and research and development facilities. (Retail facilities are not eligible under the program.)</p>	<p>All projects must result in job creation and/or job retention within the State. Award structure is 60% grant and 40% interest free loan repayable over five years. For any Single Industrial Access Project, costs shall not exceed \$1 million of State Industrial Access Program funds or 20% of any annual appropriation, whichever is greater, except in the case of Stewart Airport facilities related to industrial access.</p>	<p>\$ 15 million, total funds expended FY 2002</p>
<p>Oklahoma: Industrial Access Road Program <i>Objective:</i> To provide funds for the construction or improvement of direct access facilities to existing or committed industrial operations or areas.</p>	<p>(1) Industry being served indicating the number of new jobs which will be created; (2) Estimated annual payroll; (3) Number of heavy trucks per day which will serve the industry; and (4) Estimated capital expenditures for construction or expansion of the plant facilities. If the funded facility is not adequately maintained, no future industrial projects will be approved for the county or the areas.</p>	<p>Total State Amount: \$6 million ; Total Private Sector Capital Investment \$470 million</p>
<p>Oregon: The Immediate Opportunity Fund (IOF) Program <i>Objective:</i> To support the location or retention of specific firms in Oregon through the improvement and construction of highways, streets and roads.</p>	<p>(1) Specific economic development projects that confirm job retention and job creation opportunities primarily in manufacturing, production, warehousing, distribution or other industries; and (2) Revitalization of business or industrial centers.</p>	<p>\$ 1 million annually</p>
<p>South Dakota: The Industrial Park Grant Program <i>Objective:</i> To assist the local units of government or communities in the development of new or expanded access for new industries located within industrial parks.</p>	<p>Projects are prioritized for funds on primarily two conditions. Priority one projects include construction of roads within defined industrial parks. The program funds 60% of the cost for priority one projects. Priority two projects include construction of roads that are located parallel to an industrial park or connect a major route or street to an industrial park. The program funds 40% of the cost for priority two projects.</p>	<p>\$ 1 million annually. FY 2002 Total State Amount \$900,000 ; Total Sector Capital Investment \$10.6 million</p>

What Are Other State DOTs Doing?

TRANSPORTATION ECONOMIC DEVELOPMENT PROGRAMS

State DOT/Program	Criteria	Annual Funding
<p>Tennessee: Industrial Access Roads Program <i>Objective:</i> To provide access to industrial areas and to facilitate the development and expansion of industry in the State of Tennessee.</p>	<p>The Department of Transportation undertakes industrial highway construction proposals meeting the industrial highway statute (TCA 54-5-403) requirements from cities and counties. Once the industrial highway construction is completed, it is the responsibility of the local government to maintain the industrial highway. However, if the project is inefficiently maintained, the department of transportation can take over the maintenance and cost, and withholds all funds otherwise allocable to the city and/or county until the project is restored to its proper condition.</p>	<p>\$ 10.8 million annually</p>
<p>Virginia: Industrial Access Roads Program <i>Objective:</i> To provide funds for access road improvements in order to promote industrial development and support expansion of existing industries that create jobs and generate tax revenues within the locality.</p>	<p>A documentation of \$10 of private capital by the industry for every \$1 access road funding is required.</p>	<p>\$ 5 million annual appropriation</p>
<p>Washington: The Rural Economic Vitality (REV) Program <i>Objective:</i> To provide funds for transportation capital investments that benefit economic development in the rural areas.</p>	<p>Rural counties and state community empowered zones are considered the eligible areas for REV projects. Eligible projects include transportation improvements of state highways, county roads, and city streets, job creation and retention by industrial, commercial or tourism industry businesses, freight mobility improvements, and private facility developments.</p>	<p>\$ 3.3 million State Amount</p>

What Are Other State DOTs Doing?

TRANSPORTATION ECONOMIC DEVELOPMENT PROGRAMS

State DOT/Program	Criteria	Annual Funding
<p>West Virginia: Industrial Access Road (IAR) Program <i>Objective:</i> To provide construction and maintenance of industrial access roads to industrial sites within counties and municipalities.</p>	<p>(1) IAR funds are only used for construction of industrial access roads within counties and municipalities to industrial sites on which manufacturing, distribution, processing or other economic development activities, including publicly owned airports, are already constructed or are under firm contract to be constructed; (2) IAR funds may not be expended until the governing body of the county or municipality certifies to the Division of Highways that the industrial site is constructed and operating or is under firm contract to be constructed or operated, or upon the presentation of an acceptable surety or device in an amount equal to the estimated cost of the access road or that portion provided by the Division of Highways.; (3) Up to \$400,000 of unmatched moneys from the fund may be allocated for use in any one county in any fiscal year. The maximum amount of unmatched moneys, which may be allocated from the fund, is 10 percent of the fair market value of the designated industrial establishment. The amount of unmatched funds allocated may be supplemented with additional matched moneys from the fund, in which case the matched moneys allocated from the fund may not exceed \$150,000, to be matched equally from sources other than the fund. The amount of matched moneys which may be allocated from the fund over and above the unmatched funds may not exceed 5 percent of the fair market value of the designated industrial site; (4) Funds may be allocated to those items of construction and engineering which are essential to providing an adequate facility to serve the anticipated traffic.</p>	<p>\$ 3.5 million annually</p>

What Are Other State DOTs Doing?

TRANSPORTATION ECONOMIC DEVELOPMENT PROGRAMS

State DOT/Program	Criteria	Annual Funding
<p>Wisconsin: The Transportation Economic Assistance (TEA) Program <i>Objective:</i> to attract and retain non-speculative business firms and create or retain jobs in the State.</p>	<p>Job creation is an explicit requirement for these grants, and applications are ranked based on cost per job promised (\$5000 maximum), as well as the local unemployment rate and benefits to regional transportation.</p>	<p>Total State Amount: \$7.4 million; Total Private Capital Investment \$385 million</p>
<p>Wyoming: Industrial Road Program (IRP) <i>Objective:</i> to provide state funding to supplement private industrial funding for construction of roadways serving an industrial facility. Thus, the program helps counties and communities with economic development efforts.</p>	<p>This program requires a 50/50 match from private industrial firms, county road funds, or other sources, but not states road funds. Each county may receive IRP funding up to \$1 million per biennium. A county may sponsor one or more projects during a biennium as long as the total IRP funding does not exceed \$1 million for one or more projects.</p>	<p>\$ 4 million per biennium</p>
<p>Appalachian Regional Commission: The Appalachian Development Highway System (ADHS) and Access Road Program <i>Objective:</i> to build Appalachian corridor highways through isolated parts of the Appalachian region and link up with the interstate system. The Access Road Program aims to connect the region's businesses, communities, and residents to the ADHS and other parts of the region.</p>	<p>Local Access Road funds may be used for preliminary engineering, right-of-way, and/or construction. Local access road funding is not allowed on reconstruction of roads previously built with ARC local access road funds. Projects are administered in agreement with the state ARC alternate and state DOT.</p>	<p>\$ 450 million annually</p>

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Bibliography

1.

NCHRP Project 2-24 Economic Productivity & Transportation Investment -- Task 1 Literature Review, Stakeholder Perspectives and Framework Outline					
Author(s):	Weisbrod, et al.				
Publisher:	EDRG				
Year:	2013				
Source info:	Prepared for National Cooperative Highway Research Program (NCHRP), Transportation Research Board (TRB), National Research Council				
Web link	http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP02-24_Task1LitReview.pdf				
Workplan Topic	Transportation & the economy	Economic Performance Measures	Trans Decision-making Phases & Communication	Tools	What other trans agencies are doing
	✓				✓

Abstract

This report was prepared to inform NCHRP project 02-24 on economic productivity, which will support the consideration of economic productivity especially by DOTs and other transportation agencies. The report focuses on literature review to inform the NCHRP project goal of developing a methodology and guidance to incorporate economic productivity gains by transportation agencies. It defines key economic terms, such *economic impact* (the total level of *regional* activity including business output, worker income, jobs, value added, etc.); *economic benefit* and *Benefit-Cost Analysis* (income gains, plus social welfare gain including non-monetary benefits and willingness to pay, but excluding spatial shifts of economic activity); and *productivity* (output or production as a result of given input). The report then discusses in detail economic productivity and how transportation can affect the rest of the economy.

Transportation system improvements that drive economic productivity gains include labor (and goods) market accessibility, supply chain and delivery markets performance, intermodal connectivity, and travel reliability. Economic effects assessment should be multi-modal in breadth and include moving both goods and people. An economic analysis framework should not be biased towards specific modes or settings. Analysis should correlate changes in the transportation system to business productivity outcomes, and should be understandable by all stakeholders to support the decision-making process.

The report also includes an overview of the state-of-the-practice in the US and the United Kingdom. The three areas where economic productivity is being considered by various state DOTs are during statewide long range planning (LRTP), alternatives analysis for major projects, and project prioritization. Most agencies that were interviewed identified job growth as the major economic objective for transportation projects. Several states use REMI or TREDIS to calculate economic productivity gains; others have developed their own software. Agencies identified the following three means of expanding consideration of economic productivity analysis in a more programmatic way -- through (1) hiring staff economists to support studies by existing staff, (2) utilizing consultants, and/or (3) working with university experts. The United Kingdom assesses transportation project productivity gains (including "wider economic benefits"), especially through Benefit-Cost Analysis as set forth by the national government. Local governments there have recently focused more attention on local outcomes, including decentralizing funding, which may conflict with system wide planning and prioritization decision-making based on Benefit-Cost Analysis (BCA).

The report states that the multi-faceted nature of transportation related productivity, and the use of ambiguous terms in the US and abroad, are challenges. The report states that two major classes of project

Bibliography

benefits -- access and reliability -- though acknowledged as important project outcomes -- are not commonly included in BCA in the US. The goal of the NCHRP project is to develop a framework to do so.

2.

Understanding How to Develop and Apply Economic Analyses: Guidance for Transportation Planners					
Author(s):	Toni Horst, PhD – Principal Investigator (PI)				
Publisher:	AECOM				
Year:	2011				
Source info:	Prepared for NCHRP Project 8-36, Task 101				
Web link	http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2816 and http://onlinepubs.trb.org/onlinepubs/nchrp/docs/nchrp08-36(101)_FR.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓	✓	✓	✓

Abstract

This guidebook was prepared for NCHRP Project 8-36, and is intended to provide comprehensive guidance for transportation planners about transportation economic analysis. It includes a general discussion of economics analysis, as well as detailed discussion about the primary types of analysis, the planning and project stages when conducted, the types of benefits assessed, key study considerations, and advice for selecting a consultant and managing a study. It provides some examples of what others are doing.

One example is a tool used in the Hampton Roads, Virginia area for project prioritization that assesses *project utility* (ability to solve an existing transportation issue), *project viability* (project readiness), and *economic vitality* (“a project’s ability to support regional plans for future development and economic growth of the region” especially resulting from increased capacity and “increased opportunity”). The measures include travel time savings, labor market access, and whether a project addresses needs of industry and increases opportunity (which is not defined). The outputs are additional information for both decision-makers and the public during the LRTP process in Hampton Roads.

Other applications for economic analysis include project development and transportation programming. The analysis should assess how these activities address transportation issues that will have direct economic impacts, and also help regions fulfill economic goals identified during long range planning. Economic analysis can also inform agency asset management plans, and spot or location studies.

NCDOT Considerations: More explicitly requiring or assisting regions, especially smaller cities and RPO’s, to focus attention on the overall economy of their regions, creates an opportunity for interagency collaboration with other state agencies such as the Division of Community Assistance (DCA) at the North Carolina Department of Commerce. DCA supports such visioning through the creation of land development plans, and land use plans by smaller jurisdictions.

The author provides guidance on the different types of benefits or impacts:

- *User benefits* (direct savings to the user in the form of travel time savings, travel cost, and accidents avoided)
- *Non-user benefits* (transportation benefits accruing to secondary users of an investment, such as auto users benefitting from lower congestion as a result of a transit project)

Bibliography

- *Community benefits* (applies to users and non-users, but extends to the larger community, such as improved access to jobs and recreational benefits along improved corridors)
- *Wider economic benefits* (expanded economic outcomes and productivity).

The report then differentiates between Benefit-Cost Analysis (BCA) and Economic Impact Analysis (EIA). Benefit-Cost usually includes direct user and non-user transportation benefits, monetized environmental and community benefits including labor productivity gains (*agglomeration* or *clustering benefits* – usually associated with improved access to both employees and jobs) and land productivity gains (location based price premium), residual (salvage) value of project assets, and other transportation investments avoided. BCA does not include non-monetized benefits, but even those should be included in summary discussion so that they will not be overlooked by decision-makers. The bottom line of a BCA is a ratio that indicates whether the project returns benefits in excess of the cost of the investment, and allows for the comparison of projects that will result in the greatest return to dollars spent (present dollars). BCA can therefore be one tool used in prioritization. Under BCA, items such as Right of Way acquisitions and direct construction effects such as jobs, and increases in property values are not included. Both are transfer payments that offset other costs and therefore do not represent net gain or loss. BCA is also a key tool in assessing program or project Return on Investment (ROI), which may include measures such as rate of return, pay-back period, and others.

Economic Impact Assessment “examines what changes occur because of the construction and implementation of a project or program and who would be affected by each change.” It includes direct, indirect, and induced (economic) impacts. [Induced economic impacts are sufficient but not necessary conditions for change-in-land-use – in other words, induced economic impacts may or may not result in indirect changes in land use, which natural resources agencies often scrutinize during Department environmental studies]. EIA is not adequate for prioritization purposes because it does not provide a ratio or other measure for evaluating greatest return per dollar spent, nor does it allow for “comparing apples to apples” by calculating impacts at present value. EIA may be best suited for comparing economic impacts of alternatives (including negative impacts) during the environment assessment phase of project development.

When conducting an economic analysis, it is important to identify an appropriate study area, who is going to benefit, and to also determine a time horizon for the study (or the time period for which impacts will be assessed). An important consideration when analyzing economic effects is to adjust for economic shifts within the project or program study area, whether local, regional, or statewide in nature. The goal is to hone in on those impacts and benefits that pass the “but for” test – but for the project, the impacts would not have occurred, *and* do not represent a shift of activity from elsewhere in the study area. The exception is if businesses are able to expand as a result of new access from a program or project.

The report reviews several economic analysis models or programs, including RIMS II, IMPLAN, REMI, and TREDIS (Table 6-1). Each has particular advantages and disadvantages. The author continues with detailed discussion of user, non-user, community, and wider economic benefits, including an interesting case study on walkability in Chapter 9 that indicates positive ROI resulting from such investments.

The report notes that community benefits are best assessed as part of a larger economic study, and not taken out of a larger context. It also emphasizes the importance of including documentation of non-monetized, qualitative, benefits in order for stakeholder and decision-makers to have as much information as possible.

Bibliography

NCDOT Considerations: There is probably the least quantitative data for the “quality of life” or “livability” social science arena. It is however an evolving field for which there are a relatively large number of studies proposed and underway around the country to provide more data to inform decision-makers. A prominent example is quantifying the health impacts of transportation projects, including not only emissions, but also, from the reduced incidence of chronic disease as a result of projects that support physical activity and active transportation.

The area of *wider economic benefits* is also rapidly evolving, including especially agglomeration impacts, land premium impacts, and option value (the price a traveler may ascribe, for example, to an alternative means of travel). The author includes a case study to make a point that highway investment does not always result in economic growth. The report also emphasizes that planning remains a critical component to project outcomes, and that “...economic assessment does not produce information that defines the project or program. Rather, it evaluates the economic outcomes associated with the project or program that are defined through the planning process.” It also concludes that not all projects are suitable for cost effective wider economic benefits analysis – projects that do not change access will not, therefore, result in agglomeration and land premium effects.

Detailed discussion of how impacts should be quantified for both Economic Impact Assessments and Benefit-Cost Analysis follows. Tables 11-1 and 12-1 are mirror images of each other that summarize, at a glance, metrics that are included in EIA and BCA, and what quantifiable measures are appropriate. Chapters 11 and 12 then discuss in detail the data required to conduct each of those two different types of analysis.

The report concludes with discussion on selecting and managing consultants, communicating findings to non-technical audiences, and a thorough glossary. Included are questions to ask during an assessment, tips to assess the reasonableness of a forecast, and some common mistakes. The chapter on communication notes the importance of understanding the perspective of the audience, and also suggests presenting results in multiple formats in order to convey the findings to as many stakeholders as possible.

3.

Economic Impact Performance Metrics, SHRP2 Project C03					
Author(s):	EDRG; Cambridge Systematics, Inc.; Texas Transportation Institute				
Publisher:	EDRG				
Year:	2011				
Source info:	SHRP2 C03: Interactions between Transportation Capacity, Economic Systems, and Land Use				
Web link	http://www.edrgroup.com/pdf/SHRPC03PerformanceMetrics.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓		✓	✓

Abstract

This report is one volume in a series for SHRP2 C03. It collapses impacts into two categories – User Benefits, and Economic Development Impacts (including agglomeration and land value effects). It references the project web-based database, Transportation Project Impact Case Studies at: www.tpic.us. The database contains many examples of tools. The report then discusses economic value of user benefits, economic development impacts in the context of dollar valuations, and identifies data

Bibliography

requirements for each. Both are supported by five case studies from other states, the Appalachian Highway System Completion, and the Northeast Canadian American (CanAm) Connections – each with their own set of performance measures. It notes that a trend in economic analysis expands the definition of freight transportation users to include shippers, operators, and consignees – not just truck drivers. The report differentiates between the long term economic development impact of a project, and the economic impact value (on users) of a project. Economic development impact considers fundamental structural changes in an area’s economy as a result of a project, and change in money flow and jobs. It does not include pass-through travel effects. Economic development changes are a result of the cost of travel, change in access to labor and delivery markets, supply chain and reliability, and/or network connectivity. It notes that construction economic effects of a particular project on a regional basis are often not helpful measures to distinguish one project from another because other alternative projects in a region will likely have similar effects.

4 (a).

Defining Economic Impacts and Benefit Metrics from Multiple Perspectives: Lessons to be Learned from Both Sides of the Atlantic					
Author(s):	Weisbrod & Simmons				
Publisher:	EDRG & David Simmonds Consultancy				
Year:	2011				
Source info:	Paper presented at the European Transport Conference, Glasgow, October 2011				
Web link	http://www.edrgroup.com/pdf/Weisbrod-Simmonds-ETC-Oct2011R.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓			✓	✓

Abstract

This study compares economic analysis techniques in the United States and the United Kingdom (UK). It notes from a UK perspective, that by evaluating economic impacts from a national perspective only, that “...we may be failing to make best use of obtainable information, and may be misinforming local decision-makers about the consequences of their actions for their own constituents.” It goes on to note trends in the US to expand the metrics to include wider economic effects particularly at local levels – especially regarding access to jobs, employees, and delivery markets, as well as other agglomerating impacts such as land value and income impacts. The report goes on to state that while at the federal level the USDOT has traditionally focused on cost-effectiveness, recent federal programs such as TIGER (Transportation Investment Generating Economic Recovery) have expanded economic considerations to include economic competitiveness and a broader range of productivity gains and agglomeration effects. Many states in the meanwhile have developed analysis frameworks that also factor in qualitative considerations, whether through a form of *modified BCA* that also considers regional and local economic development, as well as human and natural environmental impacts (California and Minnesota). Other states (Ohio, Wisconsin, Missouri) have adopted a *Multi-Criteria Analysis* (MCA) method that includes quantitative and qualitative factors that are weighted in a table format; while still others are using a *composite* method that combines an engineering rating, local input (local consult), as well as a model-generated GDP rating (Kansas and North Carolina to varying degrees).

Bibliography

4 (b).

Incorporating Economic Impact Metrics in Transportation Project Ranking and Selection Processes					
Author(s):	Glen Weisbrod				
Publisher:	EDRG				
Year:	2010				
Source info:	Paper Submitted to TRB, July 1, 2010; Revised, November 15, 2010				
Web link	n/a				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓	✓	✓	✓

Abstract

This report builds on the previous report, even though it was published before the prior report. It expands the discussion of the modified BCA two-step process, MCA, and composite economic development ratings system. It notes that the "...local consult score is the most important element, as it accounts for local priorities which reflect societal values that can be politically important. By recognizing local values and desires, it makes the state transportation department more responsive to citizen input." The authors went on to study a group of projects in Kansas using either engineering scores, local consult scores, economic scores, and composite scores. The study discovered that the composite rating "...led to almost as much expected economic impact, while adding greater consideration for additional engineering and local consultation outcomes." The report concludes that for project prioritization the analysis "...suggests that approaches which are the most inclusive in their coverage of productivity and local impact factors are most likely to be more acceptable to the public and more reflective of public values."

NCDOT Considerations: Local input allows for incorporation of criteria that are not always quantifiable. Decision processes that are almost 100% data driven may benefit from local stakeholder consultation, and can help decision-makers avoid surprises during project development that can thwart efficient and timely project implementation.

5 (a) (b).

The Challenge for Public-Private Financing of Transport: Aligning Benefits, Costs and Sustainability					
Author(s):	Weisbrod & Gordon				
Publisher:	EDRG				
Year:	2008				
Source info:	(a) Paper read by Glen Weisbrod, Proceedings of the CODATU International Congress on Transport in the Developing World, Ho Chi Minh City, Vietnam, November 2008; and (b) PowerPoint presentation				
Web link	http://www.edrgroup.com/pdf/weisbrod-gordon-paper-codatu.pdf and http://www.edrgroup.com/pdf/codatu%20presentation.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓			

Abstract

This paper and presentation at an international conference on transportation in the developing world focuses on Public-Private Partnerships (PPP). All entities (users, private entities, and the government) must all benefit, but sufficient performance measures, policy, and regulatory framework are required to be in place for that to happen in a fair way. The paper introduces the concept of "value chain" in which the benefits or returns to all three entities are linked. It defines several examples of PPP's, including:

Bibliography

- *Privatization* (a public facility or service is sold to a private entity, which then operates and maintains it)
- *Private concession* (a private entity pays a fee to set up, operate and maintain the resource, while the government remains the owner)
- *Lease* (the private entity operates and maintains the recourse for a fee, whereas the government invests in and owns the resource)
- *Lease-back* (the private entity invests and constructs a facility, from whom the government leases it)
- *Management contracts* (the private entity operates the facility for a fee for the government).

The presentation notes that risks must be shared by both entities. The paper identifies and defines *synergy value* as “...whenever a combination of parties involving government along with private operators ... combine to create financial or operations capabilities greater than any one party can provide alone.” Exhibit 2 then provides performance measures for private entities, government, and users in the areas of facility design and operation, service provided/obtained, and benefit/impact value. The author emphasizes the importance of social and economic development outcomes as important to balance out benefits, financing, and pricing. Properly set up, utilized, and monitored, performance measures can serve as an “early warning system” to benefit all parties if adjustments need to be made to arrangements or operations. While PPP’s may be especially beneficial to developing nations with numerous needs and constraints, PPP has also become much more commonplace worldwide.

6.

Economic Development Performance Measures and Rural Economic Development in Indiana					
Author(s):	Sharkey and Fricker				
Publisher:	FHWA Joint Transportation Research Program (JTRP), Indiana DOT, Purdue University				
Year:	2009				
Source info:	Study for Indiana DOT to inform urban and rural, and local and state project prioritization				
Web link	http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=2638&context=jtrp				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓			

Abstract

The purpose of this paper was to determine economic performance measures that may assist the Indiana DOT to consider the economic development impact of transportation projects or programs on rural areas, specifically at county scale. A prior project had established four economic development measures that applied to a statewide scale: *net change in employment, net change in income, net change in output, and net change in Gross Regional Product*. In Table 3.1 the researchers identified eight measures (out of an original list of twelve) that they planned to test as part of the project (*business expansion, business retention, number of jobs, total income, average income, output per capital, and absolute amount of poverty in an economic*) at county level. The study was halted, however, after the principal investigator and research associate presented findings from an interview with university economists with expertise in rural development to the Study Advisory Committee. One key rural economist (McNamara) cited studies that indicated that major highway expansions into rural areas (especially those not adjacent to higher populations urban areas) “...do less to stimulate economic development [particularly in the context of attracting new manufacturing and industry] in the newly-served counties than they serve as “escape routes” for residents to access opportunities in larger communities,” and that “...rural communities already endowed with a manufacturing base may find that

Bibliography

spending scarce economic development resources geared toward retaining businesses will produce better payoff's in the long run." The researchers identified and included various quality of life performance measures as part of their research for their study (Table 5.1), and noted that while improved access may not be sufficient to attract new industry, it may improve quality of life such that it nevertheless strengthens the economy of an area. An economic analysis would of course be appropriate to determine the cost effectiveness of the proposed project.

NCDOT Considerations: NCDOT may wish to coordinate with the NC Department of Commerce to conduct additional research on this topic for its applicability to North Carolina.

7.

Socioeconomic Forecasting					
Author(s):	Xiong, Fricker, McNamara, Longley				
Publisher:	FHWA Joint Transportation Research Program (JTRP), Indiana DOT, Purdue University				
Year:	2012				
Source info:	Study for Indiana DOT to evaluate REMI as part of JTRP				
Web link	http://ntl.bts.gov/lib/46000/46600/46658/fulltext.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓		✓	✓

Abstract

This study was conducted for the Indiana DOT to evaluate the quality of the REMI socioeconomic forecasting tool, to evaluate other products, to review a current REMI forecast for the Indiana DOT, and to create an expert panel to support and fine tune economic forecasts for Indiana for the purpose of long range transportation planning. Findings indicated that a previous REMI forecast that had predicted poor economic outcomes for the state looking forward to 2035 had been skewed by recent economic data. The report indicates that other commonly used tools suffer the same anomaly. The report evaluates other popular economic modeling products, which are summarized in Table 3.2. The table includes annual licensing costs and staff operating expenses. It notes that TREDIS "...has the most refined township data analysis level and is the only software that can conduct intermodal analysis." The report includes discussion (Section 4) about determinants of manufacturing and business location decisions, and concludes that transportation infrastructure is a necessary component of that decision. Other factors, however, also play an important role, including access to labor, access to markets, agglomeration, and fiscal (taxes, utility costs, etc.) effects. Other researchers include quality of life in the mix of factors. The report concludes with a discussion of developing and using expert panels to fine tune and verify model predictions.

Bibliography

8 (a).

Economic Effects of Public Investment in Transportation And Directions for the Future					
Author(s):	SSTI, Center for Neighborhood Technology, and deBettencourt				
Publisher:	State Smart Transportation Initiative (SSTI)				
Year:	2012				
Source info:	Report prepared for SSTI – an effort of 19 state DOTs that promotes transportation practices that advance environmental sustainability and equitable economic development, while maintaining high standards of governmental efficiency and transparency.				
Web link	http://www.ssti.us/transportation-scorecard/ScorecardReport.pdf and http://www.ssti.us/transportation-scorecard/scorecard.html				
Workplan Topic	Transportation & the economy	Economic Performance Measures	Trans Decision-making Phases & Communication	Tools	What other trans agencies are doing
	✓	✓	✓	✓	✓

Abstract

This accessible and lay reader-friendly report reviews the state of economic analysis practice at several state DOTs around the country. Its relatively non-technical approach may make it a suitable study for DOT managers and decision-makers that desire an overview of transportation and economic development, including gaps in practice. This report defines economic development as “a transparent process or planned action that results in the retention and creation of sustainable jobs, wealth, and the improvement of quality of life.” The project culminated in a scorecard of economic performance measures and their applicability to transportation decision-making. The electronic scorecard includes embedded links to source data, as well as information about tools that are available to analyzed economic impacts.

The report cites and quotes a study prepared for the Oregon DOT that transportation is but one of many factors that affect economic development. That study even goes so far as to state that “... transportation projects are almost never the *sole impetus* for economic development.” (Emphasis added). Other factors identified include labor force, quality of life, and access to markets and materials [Boarnet, 1997]. Oregon’s finding also supports the concept summarized in the report regarding the steps of stages or comprehensive transportation-economic analysis. That concept takes the shape of a pyramid as follows:

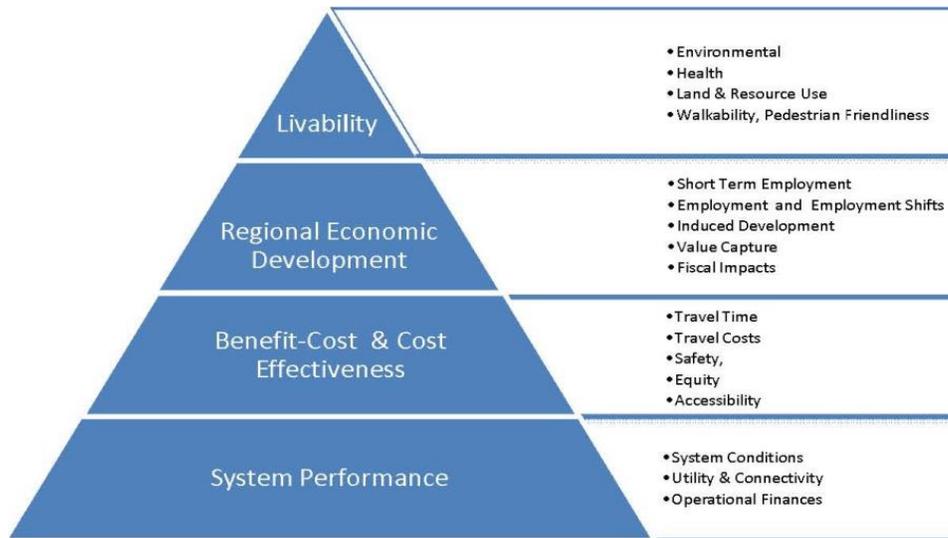


Figure 1. Key economic benefits of transportation.

Bibliography

System performance is the foundation on which other economic impacts and benefits are built, including Cost Effectiveness, Regional Economic Development (and agglomeration effects), and is topped by Livability. This study repeats the messages of the importance of sustainable health outcomes and environmental systems and development, including land and resource use, resulting from transportation planning and projects. In urban areas, walkability and pedestrian friendliness are identified as core quality of life benefits.

Many states factor economic outcomes into transportation planning and decision-making. Nine states actually have economic goals or policies; few have adopted performance measures. The report later cites a study by Todd Litman which states that “transport policies tend to increase economic development if they:

- Increase and improve cost-effective transportation options,
- Result in more cost effective transportation facility and service investments,
- Increase transport system efficiency (reduce total costs or increase total benefits),
- Create more efficient pricing by making prices more accurately reflect marginal costs,
- Create more neutral public policies (such as less distortive tax policies),
- Reduce resource costs, such as the amount of fuel consumed per unit of transport and the amount of land devoted to transport facilities.”

The report also notes that Title VI of the Civil Rights Act of 1964, NEPA, and Executive Order 12898 all “direct” consideration of both social and economic effects during project decision-making.

NCDOT Considerations: Evaluation of planning and project economic effects could provide further documentation and support for NCDOT’s due diligence actions for these three laws and regulations.

The study notes that some states hired staff economists for economic expertise; others did not (but may have economists elsewhere on staff). Several states coordinated with other economic development agencies for assistance. The level of application of has varied over time, mostly as a result of change in state and agency leadership.

NCDOT Considerations: While NCDOT changed its mission statement in 2012, there was not a corresponding modification of department goals and policies to address the new mission statement. To the extent the administration and agency management desire for greater consideration of economic analysis in transportation decision-making, the department should consider reviewing its goal statements, and also consider establishing an economic development policy.

DOT staff interviewed for the study indicated that local officials and the public responded in a positive way to economic benefits of proposed project. Citing surveys by other research projects, *economic prosperity* was identified as a critical measure of performance in the context of sustainability. Other transportation and environmental sustainability related metrics included “... transport options and level-of-service, infrastructure condition, energy intensity, air quality and emissions, land development and conservation, transportation accessibility and affordability, public health and safety, and equity and environmental justice.”

The study notes that nine states reported varying use of performance measures in agency performance tracking and long range planning. NCDOT was one of the nine states. NCDOT utilizes measures that

Bibliography

would be inputs into economic assessments, but had no explicit economic performance goals at the time of the study. Six of 23 responding states indicated the use of some economic measures; only one had both measures and indicators. Several of those six states performance measures applied only to freight; thus freight was the overall predominant economic performance measure. Freight is an important indicator of transportation related economic vitality, however. The Washington (state) DOT has perhaps the most complete measure of freight performance. It is broken up in to three major contexts: Global Gateway (presumably cross-border with Canada as well as ports), Urban Good Movements, and also Rural Economy. The state relies on voluntary GIS tracking of freight trucks, and tracks eight different measures in each primary category: reduction in cost, improved travel time/reliability, safety, economic vitality, environmental impacts, resiliency, and other. There are 20 or more measures for economic vitality for each of the three contexts. The specific measures are shown in Appendix E of the report.

Oregon is also testing incorporating economic vitality into its DOT decision-making process. Economic vitality measures in Oregon include: economic impacts of spending for construction, operations, and maintenance; economic impacts of more efficient transportation services; structural economic effects of more efficient transportation services; and local economic development and revitalization effects.

The report includes discussion of NCDOT's use of TREDIS, which the department utilizes down to the county level. It also notes that NCDOT uses the term "Economic Competiveness" instead of "Economic development", and scores projects at both a statewide and regional (or Division) level.

NCDOT Considerations: The study notes that Florida DOT mapped all environmentally sensitive areas in the state, and indicated that doing so has sped up environmental review. Given project delays attributed to concerns about induced growth effects and potential impacts to natural resources at NCDOT, especially by resource agencies, this finding and an earlier one regarding induced and redistributed growth would lend credence to the importance of recognizing the land use and transportation linkage in North Carolina. This is particularly the case during long range and comprehensive transportation planning at NCDOT, where an effort is underway called Integration. One aspect of the Integration initiative includes assessing potential indirect and cumulative effects of plan alternatives. The initiative includes recommendations for required elements in legislatively mandated land development plans for the purpose of long range or comprehensive transportation planning; however, there are currently no guidelines for land development plans. The extent to which local jurisdictions have implemented land development and land use plans that recognize the presence of protected, endangered, and threatened resources, should result in corresponding project planning efficiencies in the future. Such consideration by NCDOT, especially given the slow economic recovery in North Carolina, may create an opportunity for the department to call for a "summit" of various federal and state agencies to evaluate efforts the department and state are taking to minimize environmental impacts, while simultaneously supporting both federal and state economic development goals. Programmatic agreements regarding cumulative effects could be one of the outcomes.

Three states actually assign weights for economic benefits consideration in project prioritization. Kansas weighs the effect at 25% and Wisconsin at 40%. The third state, North Carolina (at the time of this study), weighs "economic competitiveness" at 10% for Statewide tier assessment (interstate projects), and 5% for regional evaluations (US routes); however, the projects are evaluated at Division scale only

Bibliography

(presumably due to the legislatively mandated “equity formula”), and not on a true statewide geography. Wisconsin is required by legislative mandate to factor in economic impacts.

The one exception regarding economic performance measures relates to several states’ TED (or Transportation Economic Development) programs. The study notes that “most have clear performance indicators that serve as criteria for project selection. Metrics include short term and permanent jobs, average wage, capital investment, industry supported, state cost per job, and money invested in distressed communities. Oregon’s program focuses on reducing the cost of doing business in the state. Minnesota’s program focuses on high wage job creation, and Kansas’ program focuses on projects for all modes that will “...create immediate opportunity to bring new employers or facilities to the state, locate in disadvantaged communities, make capital investment, and create or retain jobs in sectors that have been determined to be important to the Kansas economy: manufacturing, agriculture and food production, and warehousing.” North Carolina did not report on a specific TEDs program.

The report then summarizes Benefit-Cost Analysis, Regional Economic Development (or Economic Impact Analysis), and identifies community effects or impacts as a newer area of assessment.

NCDOT Considerations: NCDOT has incorporated Community Impact Assessment in most Environmental Impact Statements and Environmental Assessments to some degree since the mid-1990’s. The effort was notably expanded starting in 2000, and also applies to most Categorical Exclusion bridge replacements as well. The approach at this time remains qualitative.

It concludes with the following five emerging areas in transportation economic analysis:

- The importance of the geographic unit of analysis
- The role of local fiscal impacts such as property values and sales taxes in supporting investment
- The positive and negative impacts of induced development from investment
- The impact of agglomerative benefits and how and when they occur; and
- The continued importance of community of practice – collaboration and evaluation

It especially notes the practice of combining techniques to fully capture the full array of meaningful factors impacting economic development. The report cited a study that found that purely qualitative methods (expert panels) may tend to underestimate economic development effects (especially induced growth) from projects; whereas quantitative methods sometimes overestimate the effect. It concludes that using input from qualitative expert panels to adjust and verify models may result in the most accurate results.

8 (b) (c).

SSTI Selected Data and Tools for Economic Impact Analysis – the Scorecard and the Scorecard guide					
Author(s):	SSTI				
Publisher:	SSTI				
Year:	2012				
Source info:	(b) Main website and Scorecard (c) scorecard guide				
Web link	(b) http://www.ssti.us/transportation-scorecard/index.html and http://www.ssti.us/transportation-scorecard/scorecard.html (c) http://www.ssti.us/transportation-scorecard/ScorecardGuide.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
				✓	

Bibliography

Abstract

This interactive web tool (scoreboard or matrix) was developed to allow transportation analysts to identify, from a representative sample, possible tools that may apply to various types of economic analysis and various types of transportation impacts. It also identifies gaps in practice and data. It is a one-stop-shop resource for information. The five types of measures and analysis that run across the horizontal axis of the matrix and include *Geography, System Performance, Benefit-Cost and Cost Effectiveness, Regional Economic Development, and Livability*. The indicators for each measure or analysis are directly under. Data and the tools run down the vertical axis on the left side of the scorecard, with websites shown interactively behind each dataset or tool. The scorecard guide describes the measures, analysis, and indicators in greater detail.

9.

Evaluating Transportation Economic Development Impacts -- Understanding How Transport Policy and Planning Decisions Affect Employment, Incomes, Productivity, Competitiveness, Property Values and Tax Revenues					
Author(s):	Todd Litman				
Publisher:	Victoria Transport Policy Institute				
Year:	2010				
Source info:	Policy paper prepared by VTPI				
Web link	http://www.vtpi.org/econ_dev.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓			

Abstract

This study by Todd Litman takes a contrarian approach to the economic benefits and impacts of transportation. It poses that in many contexts the economic costs of transportation are underrepresented, and that economic benefits are often marginal and diminishing, to the extent that costs actually exceed benefits. Important costs that are most often overlooked are parking (often publically subsidized), vehicle ownership costs, and incremental costs of induced travel.

The Executive Summary includes table (ES-1) of economic development impacts. It includes some traditional factors such as project expenditures, transport project cost efficiency and system efficiency, property values and development, and impact to specific industries; but adds the following as well:

- consumer expenditures
- basic access (as opposed to mobility)
- retail and tourism
- land use objectives
- affordability (including transportation and housing)
- wealth accumulation
- other sustainability (social) outcomes

Table 24 in the report describes each factor from above, and identifies evaluation methods and development strategies or outcomes.

Litman notes research that indicates that about 4000 annual vehicle miles travelled (VMT) is an economic threshold after which economic costs exceed benefits. He goes on to say that "...excessive mobility can be as economically harmful as too little." His research supports policies to educate transportation planners about the negative aspects of VMT. He terms mitigation approaches *mobility management* or *transportation demand management*. The report identifies particular strategies in Tables 10 and 11.

Bibliography

He identifies the following as appropriate economic development indicators for economic analyses:

- income
- employment
- productivity (GDP)
- competitiveness (compared to competitors)
- investment
- profitability
- property values
- business activity (sales volume)
- tax revenues
- affordability
- equity
- desired (social) outcomes

Litman goes on to advocate for *accessibility based planning*, and cites techniques such as increasing land use accessibility (apparently through mixed use and density), improving alternative modes of travel, improved logistical management, more efficient pricing (including congestion and parking pricing, tolls, high occupancy vehicle (HOV) lanes, improved mobility substitutes (telecommunications and delivery services) and improved user information. He states that “improving accessibility for disadvantaged groups provides both efficiency and equity and benefits” and in Table 5 includes a list of transportation equity indicators. The report also identifies principles that distort transportation market decision-making, and identifies Least Cost Planning as an important potential reform. It also cites four key economic efficiency principles: user options, efficient pricing, vehicular prioritization (especially for higher value trips including freight and service delivery), more efficient modes, and particularly economic neutrality. Litman cites several studies that support his positions that areas with more transit and less sprawl are more productive, and that denser and more compact development is a more efficient form of land use. Benefits from the latter accrue to businesses, homes, agriculture, and also recreation.

The report concludes with examples and case studies, as well as reform options such as transportation pricing. Litman identifies the characteristics of an efficient transportation system as one that is multi-modal, well designed and maintained, and price efficient including valuing higher value trips over lower value trips.

10.

Economic Competitiveness: Performance Measures for Transportation -- Review of Literature and Best Practices					
Author(s):	Peters, Paaswell, and Berechman				
Publisher:	(New York) University Transportation Research Center (UTRC)				
Year:	2008				
Source info:	Report to inform New York State DOT effort to develop economic performance measures				
Web link	http://www.utrc2.org/sites/default/files/pubs/economic-competitiveness-final_1.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓				

Abstract

This literature review to inform the New York State DOT about economic performance measures explore the relationship between economic activity and transportation. It also surveys the state of the practice at other state DOTs, but the discussion was rather limited other than stating that the lack of uniform measures across DOTs was indicative of the practice still evolving and developing. Several of the studies were rather dated. Much of the literature originated in the 1990’s, and some in the 1960’s. The authors discussed in some detail the findings of a 1990 report (Eberts) that cited studies by Hansen (1965), Looney and Frederiksen (1981), and Costa et al. (1987) regarding *congested, intermediate, and lagging* economies.

Bibliography

- *Congested* economies are constrained by congested transportation systems which are impediments to new activity, for which the solutions are presumably neither simple nor inexpensive.
- *Lagging* economies are notably underserved by costly capital infrastructure and host declining industries or low-production agriculture.
- *Intermediate* economies are areas poised to grow due to a capable workforce, available raw materials, and ample energy supply.

It is those *intermediate* economies where infrastructure investment will, in general, result in the greatest return on investment. The authors suggest that social capital investments (healthcare, education, etc.) may produce a higher return in *lagging* areas. The authors cite studies that question whether infrastructure investment in areas with developed transportation networks will increase employment. They also question whether a transportation system can reduce unemployment and discourage the use of *unemployment* metrics as a reliable economic metric. On the other hand, they cited studies that linked job and income growth to accessibility. The authors also cite a Weisbrod study as documenting that areas that were freight dependent, as well as dependent on a diverse workforce, were those most negatively impacted by congestion. They go on to link project cost effectiveness to job creation, but do not distinguish if they are addressing construction related investments and effects, or project, system, and economic productivity. They close by encouraging NYDOT to develop weighted regional (city or county level) economic performance metrics that would "...reflect the relative importance of the county to the performance of the whole state."

11.

Guidebook for Assessing the Social and Economic Effects of Transportation Projects -- NCHRP Report 456					
Author(s):	Forkenbrock and Weisbrod				
Publisher:	TRB - NRC				
Year:	2001				
Source info:	Guidebook originating from NCHRP Project 25-19, <i>Evaluation of Methods, Tools, and Techniques to Assess the Social and Economic Effects of Transportation Projects</i>				
Web link	http://www.edrgroup.com/library/multi-modal/guidebook-for-assessing-social-a-economic-effects-of-transportation-projects.html				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓		✓	

Abstract

This somewhat technical guidance is a manual of step-by-step techniques for users to assess socioeconomic (with an emphasis on economic) impacts and benefits of transportation projects. It provides the legal and regulatory requirements for assessing of transportation projects effects, as may be required under NEPA, Title VI of the Civil Rights Act of 1964, Executive Order 12898 on Environmental Justice, and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). It provides an overview of each topic, including the transportation issues, and also other special considerations including equity concerns. It then addresses when to do the analysis, the steps in the analysis, methods, resources, and references. The topics assessed are:

- | | | |
|--------------------------------------|------------------------|------------------------|
| • Changes in travel time | • Accessibility | • Visual quality |
| • Safety | • Community cohesion | • Property values |
| • Changes in vehicle operating costs | • Economic development | • Distributive effects |
| • Transportation choice | • Traffic noise | |

Bibliography

As the title indicates, the guidebook is focused on project level assessment. The guidance has a strong quantitative approach, but includes qualitative techniques for all of the factors. The two topics that do not include a quantitative assessment are community cohesion and visual quality. It includes a thorough discussion of documenting distributive effects, or assessing how the project affects various populations within the study area, to low income, minority, and other potentially disadvantaged or underserved populations as may be required by federal and state laws and regulations. The report concludes with appendices on Geographic Information Systems (GIS), survey methods, travel demand modeling, the legal basis for distributive effects, and an informative glossary.

12.

Performance Measures for Freight Transportation					
Author(s):	Gordon Proctor Associates, Cambridge Systematics, et al.				
Publisher:	National Cooperative Freight Research Programs, (NCFRP), TRB				
Year:	2011				
Source info:	Report under NCFRP Project 03 to develop freight system framework, performance measures, and report card				
Web link	http://onlinepubs.trb.org/onlinepubs/ncfrp/ncfrp_rpt_010.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓	✓	✓	✓

Abstract

This report provides a thorough overview of the state-of-the-practice of performance measures for the US freight system and industry, both nationally and among states. It particularly focuses on trucking (primarily interstate and National Highway System, or US routes), Class I rail, and the top 20 (primarily container) ports; though it includes some discussion regarding aviation and waterways. It identifies the challenges of implementation (lack of central coordination of a truly multi-modal industry and network, enormous data needs as well as enormous but fragmented data availability, a lack of national strategy, and a notable difference and lack of consensus among private and public sector stakeholders). While there is a trove of data, it is not linked or evaluated against goals. The report nevertheless delivers a Freight System Report Card as a starting point. The scorecard is based on the Balanced Scorecard model, which "...balance[s] metrics for finances, internal processes, customer satisfaction, and the institution's ability to learn and innovate." The multi-modal surface and maritime transportation report card (Figure S.3) focuses on six major categories -- freight specific demand, system efficiency, system condition, environmental impacts, safety, and investment. It identifies key measures within each of the categories (a total of 29 measures), identifies both 10 year past trends and a 20 year forecast, and includes a brief narrative summary of each. The trends are represented by arrows that may point upward, downward, or neutral, and are color coded green, yellow, and red. Green may be neutral or simply informative, yellow may be indicative of a problem, and red is indicative of a problem. The scorecard is thus a potentially very informative tool for policy-makers and decision-makers and reflects a large amount of more technical and quantitative outputs. That supporting data is included and assessed in accompanying companion reports, which will be of greater interest to those developing planning and engineering details and solutions. It is important to note that various economic performance measures can be leading indicators of future broader economic health that can benefit other government offices, agencies, and leaders and allow for more proactive policy and management actions. A "crosswalk" matrix (Table S.2) identifies the measures used within each category, as well as the decision areas supported, including operations, investment, policy and geographical scope (national, state, MPO). The report notes that "...each state can [use the framework and scorecard to] replicate the analysis for

Bibliography

evaluation of its top bottlenecks and congested links. In addition, within a state, the individual links and bottlenecks can be evaluated and ranked for priority within each MPO's area."

The study describes efforts at USDOT to develop a more comprehensive freight policy. USDOT's initial focus is on a policy *framework*. The objectives are to improve operations, add physical capacity, better align costs and benefits, reduce regulatory and other barriers, proactively identify and address emerging trends, maximize safety and security, and better address environmental (including community) impacts of freight transportation. It then summarizes state DOT use of freight performance measures, and notes that 22 states have state freight offices. The report notes that "mature performance measurement states ... use between 5 and 10 measures ... no two states had the same measures... [and] most of the metrics were not used to calibrate performance of specific state programs."

The report concludes with findings and recommendations relating especially to national level implementation of a scorecard, including keys to successful use of report cards (development a web-based tool, etc.), appendices of freight performance information, state and MPO examples, national state-of-practice, modal state-of-practice, environmental state-of-practice, and stakeholder perspectives.

13 (a) (b).

(a) Benefit/Cost Analysis for Transportation Infrastructure: A Practitioners Workshop (b) Being Clear About Benefit/Cost Analysis (BCA) and Economic Impact Analysis (EIA) (PowerPoint)					
Author(s):	(a) Katherine Turnbull (b) Glen Weisbrod				
Publisher:	(a) Texas Transportation Institute (b) EDRG				
Year:	2010				
Source info:	Proceedings for USDOT sponsored workshop on BCA for TIGER II due diligence requirements				
Web link	http://www.edrgroup.com/library/multi-modal/benefit-cost-workshop.html				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓			✓	

Abstract

This document of the workshop proceedings included presentations from Benefit-Cost and other economic experts, including one from the United Kingdom. Speakers discussed the steps of BCA for transportation projects, and differentiated between BCA and Economic Impact Analysis (EIA). Glen Weisbrod identified travel time, travel costs, and safety as key inputs for BCA, and noted that consumer surplus, quality, and reliability are sometimes also included. Non-users may experience monetized environmental, health, and community benefits, as well as agglomeration of jobs, companies, and employees through improved mobility and accessibility. He notes that "...BCA is designed to ensure efficient use of scarce resources, minimize costs among alternatives that achieve needs, and maximize performance results for given available funding ... [whereas] EIA is designed to stimulate and grow jobs and income where they are most needed, such as distressed areas, and attract quality, well-paying, stable, and secure job growth industries where income can rise over time." He further distinguishes between BCA and EIA through the use of the terms *competitiveness*, *sustainability*, *livability* and *productivity* (in the report and his PowerPoint presentation) as follows:

Bibliography

	BCA	EIA
Point of View or Approach	Economist	Economic developer
Competitiveness	Reducing expenses (can also increase efficient movement of goods, people, jobs)	Improving business capability; retaining and attracting jobs
Sustainability	Environmental (air) quality	Economic sustainability – financial viability of an economic activity
Livability	Enhancing accessibility and mobility reflected in rising property values	Improving an area’s attraction to live and work
Productivity	Market imperfection, generalized costs	Differentiates income and cost competitiveness for different industries

David Lewis spoke to the economic importance of productivity growth – that “the source of real standard of living improvements in our economy is productivity growth, and notes that transportation projects “...can create additional economic value through the provision of better access, reduced travel time, amenities, option value, densification, and agglomeration. Todd Litman pushes for monetizing and including social impacts in BCA, and the development of multi-modal level-of-service performance indicators. Other economists spoke to measuring environmental benefits, measuring costs, and several spoke to the pitfall of double counting costs or benefits.

14.

Differentiating Forms of Economic Impacts: Implications for Transportation Policy					
Author(s):	Glen Weisbrod				
Publisher:	EDRG				
Year:	2008				
Source info:	Presentation at Forckenbrock Series on Public Policy, Transportation Finance, and Economics Conference				
Web link	http://www.edrgroup.com/library/multi-modal/forms-of-impact.html				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓				

Abstract

This PowerPoint presentation, which does not include the supporting notes, focuses on the relationship between research and policy. It defines the relationship between logistic economies and outcomes and notes that transportation system “network enhancements can improve [freight delivery] reliability, enabling broadened warehousing and delivery.” It also emphasizes the importance of assessing *intermodal* connectivity, which can result in system and business operation efficiencies. It is important to note that those intermodal efficiencies may not result in as high a return on investment as when considering only one mode, such as highway. Research for Appalachian Regional Commission (ARC) projects revealed income growth often time lags the initial transportation investment. Delays for rural, *non-distressed* areas income gains may lag project by five to seven years; and eight to 11 years for rural, *distressed* areas.

Bibliography

15.

Key Transportation Indicators: Summary of a Workshop					
Author(s):	Norwood and Casey, editors				
Publisher:	National Academy of Sciences				
Year:	2002				
Source info:	Bureau of Transportation Statistics summary of NRC/TRB 2000 workshop				
Web link	http://www.edrgroup.com/library/multi-modal/guidebook-for-assessing-social-a-economic-effects-of-transportation-projects.html and http://www.nap.edu/catalog/10404.html				
Workplan Topic	Transportation & the economy	Economic Performance Measures	Trans Decision-making Phases & Communication	Tools	What other trans agencies are doing
		✓			

Abstract

The economic subgroup at this workshop identified mobility indicators such as *accessibility*, *impedance*, *bottlenecks*, and *congestion* as important physical measures that are closely tied to transportation economic performance. The group then evaluated the following seven transportation indicators of economic growth:

- Transportation prices
- Transportation contribution to economic growth
- Full supply chain distribution cost relative to GDP
- Transportation productivity
- Transportation capacity utilization
- Transportation infrastructure growth relative to overall economic growth, and
- Transportation and inventory logistics as a fraction of GDP

Table 4-1 reflects the outcome of the workshop economic indicators discussion and summarizes the policy relevance, simplicity, reliability, and timeliness aspects of each. Transportation contribution to economic growth, and transportation inventory logistics as a fraction GDP were two that stood out as being the simplest, and most reliable and timely; although, for the former indicator, rail data appeared available in a timely manner but truck data less so.

16.

Performance Metrics for the Evaluation of Transportation Programs					
Author(s):	Mudge, Maggiore, and Jasper, and the Delcan Corporation				
Publisher:	Bipartisan Policy Center National Transportation Policy Project (NTPP)				
Year:	2009				
Source info:	Paper to inform NTPP report "Performance Driven: A New Vision for U.S. Transportation Policy"				
Web link	http://bipartisanpolicy.org/sites/default/files/BPC%20NTPP%20Metrics%20fnl.pdf				
Workplan Topic	Transportation & the economy	Economic Performance Measures	Trans Decision-making Phases & Communication	Tools	What other trans agencies are doing
	✓	✓			

Abstract

This report opens with discussion about the importance of using performance measures to support better transportation decision-making, and to overcome "... public cynicism about the ability of the transportation community to make progress in addressing the challenges it faces." It emphasizes that performance measures should be modally neutral, focused on the entire transportation program, not evaluated individually, applicable to all states, and recognize and reward self-sustaining revenue courses. The NTPP project identifies five *major goals* for federal policy -- economic growth, national

Bibliography

connectivity, metropolitan accessibility, energy security and environmental protection, and safety. The six *performance measures* should include accessibility to social and recreational resources (including health, education, etc.), accessibility to jobs and employees, network utility, corridor congestion, safety, and self-sustaining transportation investment.

The report identifies accessibility as “... the new mobility”, and suggests a maximum multi-modal utility measure. It goes further to suggest multi-modal accessibility as a proxy for economic benefit, particularly regional peak and off-peak access to jobs and employers. The report goes on to describe measures of national connectivity, and the importance of “...linking small urban and rural areas to the Interstate Highway System...” It also addresses safety and self-sustaining investment metrics and summarizes suggestions for structuring performance based programs at the national and state-level.

17 (a) (b) (c) (d).

(a) Ten Years of Transparency: The role of performance reporting at WSDOT -- Overview and lessons learned 2001-2011					
(b) 2012 Biennial Transportation Attainment Report – Washington’s Transportation System: Goals, Objectives and Performance Measures					
(c) Business Directions: WSDOT’s 2011-2017 Strategic Plan					
(d) Washington State Scenic and Recreational Highways Strategic Plan 2010-2030					
Author(s):	(a) N/A (b) N/A (c) Paula J. Hammond, PE, Secretary (d) N/A				
Publisher:	(a,c,d) WSDOT (b) Office of Financial Management, State of Washington				
Year:	(a) 2011 (b) 2012 (c) 2010 (d) N/A				
Source info:	WSDOT Performance Measurement Library				
Web link	(a-d) sourced from: http://www.wsdot.wa.gov/Accountability/Publications/Library.htm				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
		✓			✓

Abstract

The first of these four reports provides an overview and lessons learned from a decade of performance measurement based management at the WSDOT. WSDOT’s so-called *Gray Notebook* is published quarterly for public and legislative review. This report notes that “the largest impact of measuring and reporting performance results has been the increased confidence of the Governor, Legislature, and the public in the project and programs managed by WSDOT.” It further notes that the system links the department’s strategic plan to both legislative and executive (branch) policy, fulfills federal requirements, and informs multiple internal and external accountability requirements. In 2010, the governor and legislature added *Economic Vitality* to the original five policy and strategic goals and measures, *safety, preservation, mobility* (congestion relief), *environment, and stewardship*. Most management measures and reporting throughout the other reports repeatedly point back to those strategic goals. Notable lessons learned include:

- *Measures will invariably change*
- *Don’t reinvent the wheel*
- *Don’t measure for measure’s sake – it is a means to an end*
- *Start small, but start now*
- *Be passionate and enthusiastic*
- *Maintain quality control at all levels*
- *Continuously update the governor, legislature, media, and public on performance*
- *Strive for performance based resource allocation*

Bibliography

- *Create a sense of urgency*
- *Lead, don't follow – communicate your story instead of responding*
- *Make communication relevant with user-friendly measures, text, and graphs*
- *Hold regular problem solving meeting with management*
- *Ask the “why” questions*
- *Executive management support and ongoing involvement is critical*
- *Recruit for performance reporting; expect hiring competition for department employees*
- *Don't tolerate silos – everyone owns performance*

The report closes with a summary of “performance journalism,” or a style of writing that encourages succinct communication of the salient points in an accessible manner. This is important in order for non-experts -- whether elected, citizen-stakeholders, or others -- to easily grasp the findings and trends.

The second report is a product of a state office reporting on WSDOT performance. It includes a four page graph and text summary of WSDOT progress and status for the safety, preservation, mobility, environment, stewardship, and economic vitality goals. In addition to a five year trend line for at-a-glance understanding of progress, the summary identifies the measures, the objective, and status in just a few words, and includes a simple of overall progress (improving or holding steady, or area of concern. The measurement arenas and specific metrics are as follows:

- *Safety* – traffic fatalities, collision reduction, pedestrian and bicycle fatalities, ferry passenger injuries, and facial recognition license suspensions and record cancellations
- *Preservation* – highway pavement, bridges, and ferry terminals
- *Mobility* – annual hours of delay per traveler, avoided annual hours of delay per traveler, HOT lanes, HOV lanes, drive alone rate, ferries, passenger rail, transit, and walking or biking
- *Environment* – fish passage, stormwater runoff quality, and greenhouse gases
- *Stewardship* – capital project delivery, ferry terminal capital projects, ferry vessels weeks out-of-service, rail capital projects delivery, grade transportation system (public perception), passenger satisfaction – ferry, and passenger satisfaction – rail
- *Economic Vitality* – jobs created, and freight

The graphic summary is followed by a two page expanded summary of each measure or objective that discusses trend analysis, state investment highlights, and contribution success factors.

The third report is the WSDOT's six-year strategic plan, which is made up of the following components: policy goals, objective, strategy, driving forces, performance measures, and accomplishments and results. The 2011-2017 report identifies five key objectives and strategies: *freight mobility, contracting and purchasing, rural economic vitality, public-private and public-public partnerships, and economic vitality planning.*

For rural economic vitality, it is notable that key identified strategies include providing enhanced access to the state's scenic byways, and improving access in and among rural communities, in part though utilizing a Rural Mobility local transit grants program. Also notable was exploring opportunities for public-private developments at ferry terminals, and on vessels, as at safety rest area. For economic vitality the department considers transportation investment effects on regional economic vitality during project prioritization.

Bibliography

The last report was completed before economic vitality had been incorporated into department objectives and strategies, but is an example of a program specific plan that incorporates a narrative summary of performance measures or desired outcomes.

***NCDOT Considerations:** These reports represent a good example that NCDOT staff and management may wish to further review as a mature state DOT performance management model. It is important to note the economic vitality measure at the WSDOT is but one objective of a mature and much more robust performance management program. That program, with its clearly identified policies, strategies, objective, measures, and ongoing monitoring appears to drive most department programs, projects, and operations towards performance based action.*

18.

Critical Analysis of Conventional Transport Economic Evaluation					
Author(s):	Todd Litman				
Publisher:	VTPI				
Year:	2013				
Source info:	Policy paper for VTPI				
Web link	http://www.vtpi.org/crit_econ_eval.pdf				
Workplan Topic	Transportation & the economy	Economic Performance Measures	Trans Decision-making Phases & Communication	Tools	What other trans agencies are doing
	✓	✓		✓	

Abstract

This very recent (March 2013) article by Todd Litman builds on his earlier study (Article #9) and his comments at a FHWA workshop on BCA (Article #13). The study seeks to narrow the divide between planners (who often focus on more *comprehensive* system analysis), and economists (who often focus more on efficiency and economic development). He repeats his criticism of *conventional* transportation economic analysis as overlooking important factors such as accessibility, and for not considering or underweighting parking and vehicle costs, public health and fitness, and others. In Table 1 he evaluates the applicability of 25 different economic evaluation tools for the broad categories: *type of projects used for, scale, user impacts, and economic and other impacts*. There are 37 sub-categories as well that make up the major categories. He later describes accessibility planning in some detail (which he contrasts with mobility planning), and important accessibility considerations and outcomes, such as *motor vehicle travel conditions, quality of other modes, transport network connectivity, and land use proximity*. In Table 2 he addresses how these are considered under conventional methods, and includes suggested measures for comprehensive evaluation. An example includes assessing connections between modes under the category of transport network connectivity. He reviews impacts and costs that are often overlooked including *downstream congestion, parking costs, delay to non-motorized travel (barrier effects), vehicle ownership, mileage based depreciation, indirect environmental impacts, strategic land use impacts, and public fitness and health*. Litman is not opposed to economic development or economic vitality; indeed, he argues that denser, connected, multi-modal, and transit oriented development patterns result in more efficient economic outcomes that would be better reflected and considered in comprehensive system analysis. He states further that transportation options that support those patterns and outcomes would be more fairly considered in the planning and (presumably) prioritization process were conventional analysis not skewed towards more sprawl encouraging measures and transportation planning. He states that higher value trips (such as freight, HOVs, and emergency vehicles) and more efficient modes should be given priority over lesser trips and modes

Bibliography

through market pricing mechanisms. In Table 7 he identifies core economic principles of *comprehensive analysis, economic efficiency, consumer sovereignty, and systems efficiency*. He summarizes the analysis requirements, and pinpoints the shortcoming of conventional analysis in addressing those requirements. Litman then summarizes several key factors that support his view that transportation decisions based on conventional analysis are not fully informed decisions and observes that annual highway rate of economic return has declined in the US since the 1950's and 1960's. He further notes that per capita GDP declines as per capita VMT and road lane miles increase, but that per capita GDP increases with per capita transit ridership, urban density (residents per square mile) and fuel price increases. In Table 9 the report lists the following economic principles, how they are currently considered, and includes a description of optimal practices: *cost based pricing, comprehensive evaluation, consumer sovereignty, economic efficiency, integrated planning, and accessibility based planning*.

19.

A Guidebook for Sustainability Performance Measures for Transportation Agencies – NCHRP Report 708					
Author(s):	Zietsman, Ramani, Potter, Reeder, DeFlorio				
Publisher:	NCHRP / TRB				
Year:	2011				
Source info:	Performed under NCHRP Project 8-74				
Web link	http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_708.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓			✓

Abstract

This reports provides an overview of and guide for incorporating the broader consideration of sustainability performance measures at state DOTs. It is relevant since economic performance is one of the three pillars, or chair legs as described here, of sustainability – the other two being environmental and social. The study is based on principles that define sustainability “...meeting human needs for the present and further while:

- Preserving and restoring environmental and ecological systems,
- Fostering community health and vitality
- Promoting economic development and prosperity, and
- Ensuring equity between and among population groups and over generations”

The book emphasizes starting with what you have, and growing the framework over time. It reviews an example step-by-step process for performance measurement implementation. Table 1 lists key sustainability goals for transportation practice:

- | | | |
|-------------------------|-----------------------------|-------------------------|
| • Safety | • Basic Accessibility | • Equity/equal mobility |
| • System efficiency | • Security | • Property |
| • Economic viability | • Ecosystems | • Waste generation |
| • Resource consumptions | • Emissions and air quality | |

Table 4 is a sustainability measures checklist that agencies can use as a self-assessment tool to determine how performance measures implementation is proceeding in their department. Table 5 is a summary of sustainability efforts at the following states: California, Colorado, Florida, Minnesota, New York, Oregon, and Washington State; and the following MPO and local agencies and jurisdictions:

Bibliography

Chicago Metropolitan Agency for Planning, Mid-Ohio Regional Planning Commission, Metropolitan Washington Council of Governments, Hampton Roads Transit, and Alexandria, Virginia. It also includes a summary from Sweden and the United Kingdom. Table 6 includes a list of available sustainability systems, including FHWA’s Sustainable Highways product, plus seven others.

Appendix B includes tables for each of the sustainability goals listed above, in the context of the following transportation focus areas: planning, programming, project development, construction, maintenance, and systems operations. Each table identifies a key objective, and then lists several measures that agencies may wish to track. The prosperity goal is defined as ensuring “...that the transportation system’s development and operation support economic development.”

Appendix C references a CD-ROM (not available for this review) that contains an Excel based performance measures compendium; while Appendix D includes sustainability performance measures examples. For the accessibility planning focus area, one example links accessibility to jobs, with a measure of the “change in the number of jobs within reasonable travel time (by mode) for region’s population.” Another for the programming focus area includes a measure for “change in travel time (by mode) to schools, health services, grocery stores, civic and public spaces, and recreation due to project.” Two other examples directly related to the economic development and prosperity goal were for planning and programming. The objective for the planning focus area for economic development is supporting “...growth in jobs and income by improving travel efficiency/reducing congestion, with a measures of “change in travel delay (e.g., travel time index) at major freight bottlenecks by mode.” The programming objective is supporting “...growth in jobs and income by improving access to markets and factor of production (labor and raw materials) through programming”, with “change in access to jobs and labor (how many jobs and how much labor can be accessed within various periods of time for an entire region or smaller areas [due to the program]” is the measure. All of the examples in this appendix come from other agencies (FHWA) or states. It includes other examples for project development and systems operations; and the economic feasibility goal. Other appendices include a list of numerous data sources and case studies and rating system summaries.

NCDOT Considerations: NCDOT management may wish to review the deliverables and status of the NCDOT Accountability (previously Sustainability) Blueprint, which includes preliminary groundbreaking work in the area of performance measures for NCDOT.

20.

Highway Infrastructure and the Economy – Implications for Federal Policy					
Author(s):	Shatz, Kitchens, Rosenblum, and Wachs				
Publisher:	RAND Corporation				
Year:	2011				
Source info:	Self-initiated research of RAND under the Transportation, Space, and Technology Program within RAND Infrastructure, Safety and Environment				
Web link	http://www.rand.org/content/dam/rand/pubs/monographs/2011/RAND_MG1049.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓				

Abstract

This research project focuses, especially, on past, present, and future transportation public policy, primarily at the federal level, and particularly regarding transportation and economic effects. It does

Bibliography

not address other national transportation goals, which should be factored into transportation decision-making. It is primarily comprised of a literature review, but includes a unique quantitative and statistical evaluation of many of those studies. The key findings are that there is great variation in economic effects, that effects are very context specific, and many projects have positive and negative “spillover” (through reallocation and relocation) effects on nearby municipalities and states.

The report notes that the USDOT (at least for highway projects) acts in an oversight role, with state DOTs, and local leaders and stakeholders making project planning, prioritization, selection, and project development decisions. Further, given there is a lack of a clear national transportation policy including national priorities, and because of the large number of “stovepiped” or siloed programs (62 surface transportation programs within FHWA alone), limited resources are not likely being used in the most effective or productive manner. Because of much less transportation funding at the federal level, the study recommends that “...the federal government should concentrate its support on projects [and presumably with or without new sources of revenue given the magnitude of overall infrastructure needs in the US] that produce a net economic gain across a wide geographic areas or the nation as a whole, rather than on projects with limited or only local economic effects.” The study identifies such projects as “central network enhancing” and nationally significant. Were federal transportation funding priorities to change to reflect this recommendation, then this would have notable implications for state DOTs in planning, prioritization, feasibility studies, and project development, as well as for state and regional economic development agencies and programs.

The report identifies changes in productivity, economic output, and employment as the primary types of economic effects. It notes that activities that notably improve overall *productivity* may indicate much more limited outcomes for *employment growth* in a study area. The study did not assess construction related economic effects. The highest economic impacts from transportation occurred particularly in the early years of the national highway system, when there were the greatest improvements in mobility – especially benefiting industrial users. Positive effects in the later years have been much smaller and less certain. State-level effects were even less certain, and local project costs may actually exceed economic gains (the report cites a study in North Carolina that indicated that between 1985 and 1997 that highway density (by square mile) did not affect county level employment). Additionally, transportation projects solely resulted in up to one-third of urban area population loss to the suburbs.

It also notes while many studies identify positive economic outcomes, that many fewer assess projects from a Benefit-Cost perspective to determine whether benefits actually exceed costs. Rate of return or return on investment are also important indicators – particularly for, according to this study, comparing the return of public investment as compared to the return of private investment (in whatever industry or activity). Public investment return that trails private investment return indicates a lesser optimal use of those moneys and investments. When public investment trails, then overall economic benefit is not as great as compared to private investment and overall societal benefit is reduced. The study reports that private investment return often exceeds public investment return, including in highway infrastructure. It notes however, that “... public investment can serve as a complement to private investment,” which would indicate that highway infrastructure associated with, or that serves specific private investment activities, will likely result in a greater return than investment in infrastructure that does not.

This study, as did Articles #1 and #2 in this bibliography, speaks to efforts to expand more traditional BCA to include those wider economic benefits, which it describes as “...transportation-infrastructure related economic effects [such as] agglomeration externalities, meaning effects from the increased

Bibliography

22.

THE GEOGRAPHY OF TRANSPORT SYSTEMS -- Transportation and Economic Development					
Author(s):	Rodrigue and Notteboom				
Publisher:	Routledge				
Year:	2013				
Source info:	Textbook				
Web link	http://people.hofstra.edu/geotrans/eng/ch7en/ch7menu.html				
Workplan Topic	Transportation & the economy	Economic Performance Measures	Trans Decision-making Phases & Communication	Tools	What other trans agencies are doing
	✓				

Abstract

Chapter 7 of this textbook utilizes the term *multipliers* especially when discussing effective transportation system benefits. Direct effects are those that save time, and improve access to employees, jobs, and markets. Indirect impacts, on the other hand “impact the outcome of the economic multiplier effects where the price of commodities, goods, or services drop and/or their variety increases.” Indirect impacts include post-construction jobs (supplies, maintenance) that are a result of transportation activity. The authors directly correlate mobility with development. They reference macroeconomic, or national level outcomes, and microeconomic effects of, in this case, transportation on specific economic sectors. In contrast to other authors in this bibliography, they describe parking and sidewalks as “mere convenience[s]” and as “wealth consuming.” Perhaps most interesting is a quick review of transportation history -- specifically where the writers link particular modes with notable historical economic expansions. *Seaports* were key contributing factors to European colonialism and economic emergence (late 16th to 18th centuries). *Rivers and canals* (late 18th to early 19th) facilitated the early phase of industrialization, in part by overcoming a lack of inland access that seaports did not provide. *Railways* in the late 19th century connected countries and even continents, and expanded inland transportation mobility and accessibility even further. *Roads*, and the associated automobile industry provided individualized transportation opportunity. The authors link *airways and information* as facilitators of late 20th century globalization, and describe electronic communication as key to improving logistics and supply chain efficiency and management. They go on to identify *geographic specialization, large scale production, and increased competition and land value* as economic outcomes from transportation. Geographical specialization, which is similar to what others have described as agglomeration, reflect and facilitate the fundamental economic concept of comparative advantage. The great costs or shortfalls of transportation include *mobility gaps, cost differences, congestion, accidents, and environmental consequences*.

23.

The Eddington Transport Study – <i>The case for action: Sir Rod Eddington’s advice to Government (summary of Main Report)</i>					
Author(s):	Rod Eddington				
Publisher:	Department for Transport, United Kingdom				
Year:	2006				
Source info:	Report to government about link between transportation and the UK’s economic productivity, growth, and				
Web link	http://www.thepep.org/ClearingHouse/docfiles/Eddington.Transport.Study%20-%20Rod.pdf				
Workplan Topic	Transportation & the economy	Economic Performance Measures	Trans Decision-making Phases & Communication	Tools	What other trans agencies are doing
	✓		✓	✓	✓

Bibliography

Abstract

This summary of the 4-volume full report is comprised of key findings and recommendations for the government of the United Kingdom regarding the link between transportation and the economy. The conclusions focus on the importance of making transportation decisions based on economic analysis and economic outcomes. Doing so assures that costly transportation infrastructure will serve to contribute, not detract from societal welfare. For that to happen, however, studies must be sufficiently robust to identify and include social and environmental impacts in the analysis. Eddington often refers to the importance of using correct *pricing*, whether as inputs into BCA, or other pricing, such as congestion pricing. The four volumes are:

1. *Understanding the Relationship* – How Transport Can Contribute to Economic Success
2. *Defining the Challenge* – Identifying Strategic Priorities for the UK Transport System
3. *Meeting the Challenge* – Prioritizing the Most Effective Policies
4. *Taking Action* – Enabling the System to Deliver

Key findings by volume follow.

Volume 1 -- Understanding the Relationship

(<http://collections.europarchive.org/tna/20100408160254/http://www.dft.gov.uk/adobepdf/187604/206711/volume1.pdf>)

- New infrastructure that addresses congestion “pinch points” provide a return on investment of five to 10 British pounds sterling for every pound invested (or a Benefit-Cost ratio of 5:1 to 10:1 irrespective of currency)
- Globalization can create potentially significant benefits
- Climate change is accepted science, and when doing economic analysis, analysts must include proper pricing of environmental, social and economic costs of impacts, including climate. Transportation is one of the fastest growing sources of carbon, and also the most costly to reduce
- Undercounting environmental and social impacts will usually result in project economic benefits being overstated
- Developed networks yield incremental economic benefits
- Cities will continue to be economic engines. Effective transportation systems are essential to support the high levels of agglomeration. Eddington notes that “... agglomeration effects add up to 50 percent to the benefits of some transport” plans
- Maintaining and improving the efficiency of the existing infrastructure is critical for populated, densely populated and growing urban areas in order to connect labor and jobs. Thriving urban areas depend on labor availability (as a function of mobility) of specialized work forces
- Effective transportation systems are critical infrastructure for a “globalizing world”
- Greater specialization in urban areas will likely result in greater importation of products produced from areas having economically competitive advantages for those goods
- Efficient ports and airports will be ever more important to support the flow of goods in, as well as out of specialized, productive urban areas
- Transportation will inhibit growth in the most economically successful areas where “demand is starting to outstrip supply” resulting in congestion and reliability problems
- Constructing new infrastructure where there is not sufficient demand can actually hurt local businesses due to increased access by outside competitors

Bibliography

- As others have noted, other factors are often as important as transportation infrastructure in increasing development in underdeveloped areas. Areas that want to improve overall economic performance must also invest in other factors that will improve quality of life, which will influence people's relocation decisions

Volume 2 – Defining the Challenge

(http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/media/39E/E7/eddingtonreview_vol2.0_011206.pdf)

- Funding priorities should focus on reducing congestion in urban areas, inter-urban corridors, and international gateways
- Freight warehousing hubs are most effective when located within one round-trip delivery day
- Public transportation/transit is fundamental transportation infrastructure for the most populated urban areas
- Urban roads experience the absolutely overwhelming largest percent of congestion
- Globalization will likely continue to create demand for international movement of people and goods, irrespective of improvements in the communication system
- Prioritize mobility to international gateways (ports and airports) for people and for goods
- In urban areas where environmental and social costs are prohibitively high, congestion pricing is an essential tool to help manage it
- Focus on the existing network first, but also focus on projects that yield the highest rate of return irrespective of mode

Volume 3 – Meeting the Challenge

(http://news.bbc.co.uk/2/shared/bsp/hi/pdfs/01_12_06eddingtonvol3.pdf)

- Analyzing economic effects and return on investment is essential to making decisions on what to fund
- Utilize congestion pricing in the most congested urban areas
- Bicycle and pedestrian projects can yield the highest rate of return, but are likely insufficient to resolve the greatest transport bottlenecks
- Expanding port and airport infrastructure can yield high rates of return and be more effective than rail in minimizing carbon impacts. Carbon pricing can increase those returns
- Conventional BCA and especially Benefit-Cost ratios (BCR) are likely the most reliable Benefit-Cost techniques, but least accurate for comparing all welfare affects among projects
- BCA and BCR that include agglomeration, employment effects, and reliability provide a more complete picture of project outcomes. Not considering these fails to factor in important economic outcomes that may especially be helpful in assessing projects in or serving urban areas where agglomeration effects tend to be greatest
- The largest projects with newest technology also are the greatest economic risks and have a reduced chance of economic success
- What Eddington refers to as Value for Money BCA/BCR, where social and environmental effects are monetized and factored in, paints the most complete picture but because of fewer methods and supporting data, at present, the certainty of BCR is less sure
- Contrary to some reports in this bibliography, this study showed a high rate of return for many transportation projects
- Project ROI (using the wider economic effects BCR) averaged:

Bibliography

- 6:1 for those projects supporting international gateways
- 3:1 for urban area projects
- 2:1 for multi-mode inter-urban projects, and increases to up to 5:1 for highway centric projects (as opposed to highway and rail)
- When factoring in full environmental and social costs (value for money BCA/BCR), evidence supports a reduction in benefits by approximately one pound for each pound invested, or reducing project benefits under BCR by an average of one point.
 - Urban network impacts can range from +0.75 (additional benefit) to -1.5 (greater negative impact and lesser benefit)
 - International gateways with surface access range from approximately +0.25 benefit to -1.0 impact
 - Inter-urban corridors range from approximately +0.3 benefit to a whopping -3.5 impact
- Smaller, targeted projects offer the highest returns, with returns lowest on the largest projects. A series of smaller projects can yield higher returns than a large project, but it is problem specific – such groupings may not adequately address the need
- Congestion pricing can reduce congestion by 50% or more
- In the case of the UK, it cannot build itself out of its current congestion problems without implementing road and congestion pricing in the short term
- Locations where such pricing is implemented and congestion problems continue is empirical evidence of a need for additional infrastructure investment
- Bus public transit can afford greater flexibility and much quicker responses to shifting needs in urban areas as compared to rail transit
- Eddington notes that one of the greatest impacts of rail is providing ample workers (from adjacent areas) for jobs in densely developed cities which are also characterized by “hugely productive” agglomerating economies

Volume 4: *Taking Action*

(http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/media/39F/10/eddingtonreview_vol4.0_011206.pdf)

- Begin with articulating objectives
- Fully assess all options; maximize the existing network
- Consider full societal and environmental costs in determining benefits and prioritizing spending
- Volume 4 includes expanded discussion of bus transit, including greater coordination between transportation agencies and private operators and between operators (bus transit in the UK is substantially privatized). Franchising of operations can increase competition and improve service and value for users
- Fully consult the public
- Include a framework for challenges to decision-making

Bibliography

24.

Productivity and Accessibility: Bridging Project-Specific and Macroeconomic Analysis for Transportation Investments					
Author(s):	Weisbrod and Treyz				
Publisher:	<i>Journal of Transportation Statistics</i>				
Year:	1998				
Source info:					
Web link	http://ntl.bts.gov/lib/9000/9100/9102/5weis.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓		✓	

Abstract

This article describes “top down” economic analysis as most often applying to a national, or macroeconomic, scale and approach in order to justify overall spending on highway infrastructure. The measures often address state and national change in business cost, output, and productivity. “Bottom up” approaches tend to assess job creation or attracting new businesses. The purpose of this article is to discuss applying national or “global” type analysis to project level studies to better inform state and federal prioritization and decision-making. Overall productivity measures capture an understanding of net project benefits. Business relocation is included as a positive outcome *only* if there is an increase in productivity resulting in a true net benefit. The article notes that current productivity research (at the time of publication) does not appear to adequately address project level aspects [subsequent articles reveal that the state of the practice has since evolved]. The three emerging areas for assessing productivity impacting transportation investment are:

- *reduction in business travel costs*
- *reduction in inventory and logistics costs* (often especially for freight)
- *and by improving accessibility and economics of scale.*

The author notes that user benefit and productivity assessment that does not monetize social or non-business benefits will not capture the *full* economic and social value of an investment. [Other articles and reports in this bibliography point out that it is incumbent on analysts to narratively document non-monetized social effects in order for decision-makers to have the most complete information with which to make decisions].

25.

Choosing Economic Analysis Software					
Author(s):	Weisbrod				
Publisher:	EDRG				
Year:	2013				
Source info:	Website blog post				
Web link	http://www.edrgroup.com/blog/choosing-economic-analysis-software.html and http://www.edrgroup.com/library/economic-impact-analysis/overview-of-economic-impact-models-a-tools-for-transportation-analysis.html				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
				✓	

Bibliography

Abstract

This blog post emphasizes the importance of picking the right economic analysis tool for what you are trying to assess. It then succinctly summarizes the primary tools and their use, as quoted here:

- **Input-output models** are used to show the broader economic role of an existing facility (such as an airport or seaport), or a sector of the economy (such as public transit or trucking industries). They can also show the direct impact of opening, closing, expanding or contracting a facility.
- **Economic impact forecasting models** are used to show how economic growth in an area will change if there is a shift in costs or market access (which can occur if transportation system access or performance conditions changes). They are commonly used to assess the job and income effects of pricing policies, modal shift vision plans and proposed project scenarios.
- **Land use models** (spatial input-output models) are most commonly used for planning purposes, providing a basis for traffic forecasts and infrastructure investment needs forecasts.
- User **benefit-cost models** are used to compare the transportation system efficiency benefits and costs of projects affecting transportation facility or system performance. They may also provide inputs to feed into economic impact forecasting models.
- Economic development tools are used to **identify sites for new business location** and targeted types of business to be attracted to them.

More detailed descriptions and the available programs/tools to conduct such analyses are available at the second web link noted above.

26.

Models to Predict the Economic Development Impact of Transportation Projects: Historical Experience and New Applications					
Author(s):	Weisbrod				
Publisher:	EDRG and subsequently <i>the Annals of Regional Science</i> , December 2007				
Year:	2007				
Source info:	EDRG working group paper; subsequently journal published				
Web link	http://www.edrgroup.com/library/multi-modal/models-to-predict-the-economic-development-impact-of-transportation-projects.html				
Workplan Topic	Transportation & the economy	Economic Performance Measures	Trans Decision-making Phases & Communication	Tools	What other trans agencies are doing
	✓			✓	✓

Abstract

This paper was written to further the notion that “predictive economic impacts models used for decision-making should be sensitive to causal factors and elements of access impact known to make a difference in the effect of transportation projects on regional economic growth and development.” It notes the major effects of transportation on economic activity:

1. Enabling new forms of trade because of change in access
2. Reducing logistics costs (reducing freight losses and increasing reliability)
3. Expanding markets and market diversity and supporting economics of scale
4. Increasing productivity through access to diverse and specialized labor

Bibliography

The report provides interesting historical examples to illustrate these concepts. It later identifies types of factors that analysis should consider (mode and industry cost variations, road facility quality differences, and transportation network and access conditions (or “ease of travel”). The writer explains each of these and also points out the effects of not considering these in analysis. Three major variables can be summed up as follows:

- 3 types of markets: labor, supply materials, and customers
- 3 types of market features: size, cost, and quality
- Variation by mode and industry/commodity

The report then reviews several past and current computer models, and identifies their strengths and weaknesses. It describes states and programs that are more discreetly assessing economic development effects and impacts, including congestion impacts. That group includes Pennsylvania, Tennessee, Oregon, Illinois, and Montana. One system provides information on “access to international gateways as well as intermodal facilities and delivery markets for specific industries and commodities.” Section 6 provides guidance about system capabilities for states that are weighing tool selection:

1. Value of highway systems connectivity and peak period reliability
2. Multi-modal implications
3. Impacts/effects to specific industries
4. Other local growth constraints
5. Distinguish between flow of dollar impacts and non-monetized benefits
6. Consider local, state, national, and global effects
7. Robustness of Benefit-Cost considerations
8. Evaluate models most appropriate for local factors and context

27.

Best Practice Methodology for Calculation Return on Investment for Transportation Programs and Projects					
NCHRP Report 8-36, Task 62					
Author(s):	Cambridge Systematics, Wornum, Hodge, et. al.				
Publisher:	NCHRP				
Year:	2008				
Source info:	Prepared for AASHTO Standing Committee on Planning				
Web link	http://statewideplanning.org/resource_list/best-practice-methodology-for-calculating-return-on-investment-for-transportation/				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓	✓		✓	✓

Abstract

This best practice guide provides detailed and sometimes technical step-by-step methods to conduct ROI analysis for transportation projects. It includes an expanded set of factors beyond those of conventional methods to do so. The process centers on *life-cycle cost analysis (LCCA)*, *travel time reliability*, *economic development and growth factors*, and *public-private partnership projects (PPP)*. For each section, the report reviews the current state-of-the-practice, identifies gaps in data and methodology, and provides recommendations on criteria and concepts for ROI analysis. Table I.1 is a summary of all of the recommendations and guidance for doing ROI analysis, including recommendations, strategies and concepts, and models and data sources. [This bibliography summary

Bibliography

focuses on the economic and development growth chapter in the guide]. The report reviews the relationship of transportation to economic development, discusses current practice, and reviews the various tools and models to measure economic benefits. It then discusses in greater detail transportation related economic effects as reflected by commuter transportation, customer/delivery markets, production process, intermodal connections, and international trade. It also explains how BCA applies to ROI analysis. Performance measures are key inputs into ROI analysis. For measuring economic development benefits, the report identifies four groups of performance measures: *inputs*, *intermediate process*, *core metrics*, and *ancillary metrics*. Input measures include the commonly cited *travel time*, *travel cost*, *change in access*, and *reliability*. The intermediate measures are the three primary mechanisms that stimulate economic growth: *travel efficiency*, *user productivity*, and *competitiveness*. The report recommends four key measures of economic outcomes: *employment*, *personal income*, *GDP*, and *output*. The authors note that all four represent alternative perspectives of economic growth, but that personal income and GDP are the most common used. The report identifies five basic dimensions of economic benefit to residents as *ancillary metrics*, which are rarely used, but which the report states that by including those studies more fully assess project economic outcomes. Those same factors or ancillary metrics often inform elected officials policy interests. The dimensions are *better paying jobs*, *higher growth industries*, *reduced unemployment*, and *retention of young workers*. The report finds that economic development benefits should be factored in to ROI analysis, and suggests capturing those as personal income (or value added). It notes that economic gains are often higher for local area geographies than state or national. It concludes with an example of ROI analysis from Portland, Oregon, and provides guidance for evaluating ROI for PPPs.

28.

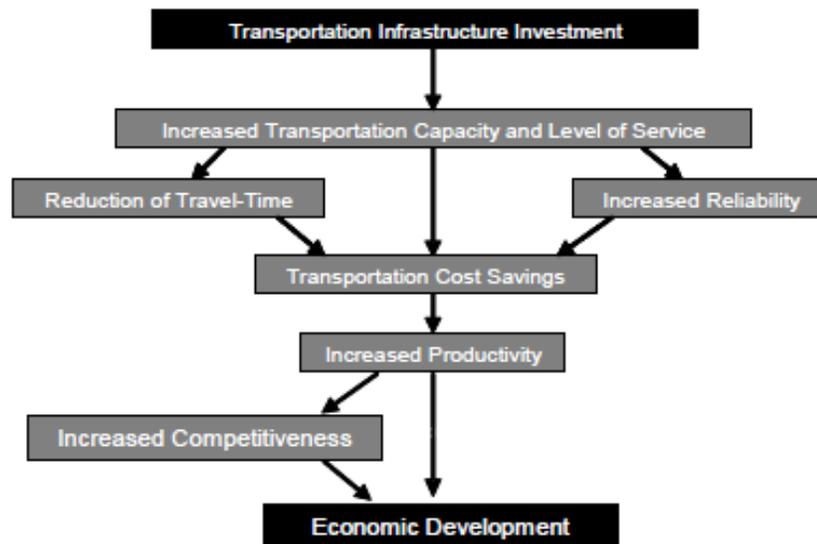
A Guide to State DOT Consideration of Economic Development Potential in Planning					
Author(s):	ICF International and Ang-Olson				
Publisher:	NCHRP, TRB				
Year:	2007				
Source info:	Prepared as part of NCHRP Project 08-36, Task 60				
Web link	http://statewideplanning.org/resource_list/a-guide-to-state-dot-consideration-of-economic-development-potential-in-planning/				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓		✓	✓	✓

Abstract

This study focuses on helping DOTs understand transportation related economic development. It reviews the key concepts, discusses economic development in transportation planning under the public policy arena, and provides a state-of-the-practice summary as of 2007. It notes that 20 or more DOTs have funding programs specifically for economic development. The report reviews economic development concepts and identifies *increased income*, *employment*, *activity choices*, and *stability of jobs and income* as important economic development goals; and also discusses productivity and distributive effects and impacts. It then defines and discusses *regional output*, *gross regional product (GRP)*, *wages*, and *employment* as primary indicators. Figure 1, shown below, provides an intuitive graphic view of the relationship between transportation and economic development.

Bibliography

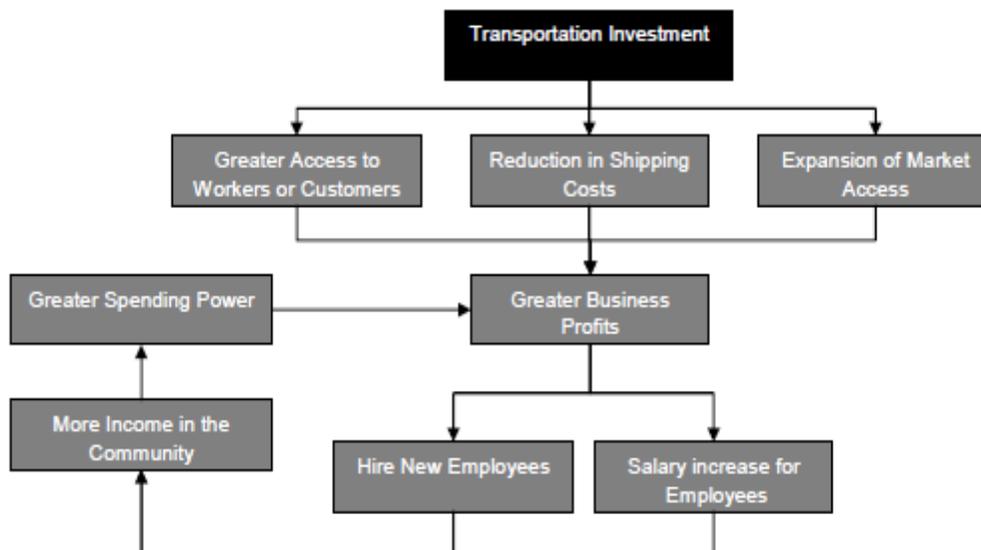
Figure 1: Transportation Investment and Economic Development



The study then goes on to describe the most relevant and measured transportation impacts on economic development and productivity (and as shown in figure 2 below):

- *User (primary) impacts: average travel time, travel time reliability, vehicle operating costs, and safety, and*
- *Economic [non-user] (secondary) impacts or benefits: business productivity, household welfare, and tourism*

Figure 2: Secondary Impacts of Transportation Investment



Discussion of DOT and non-transportation agency roles and interactions between the two follows. Table 1 in the report shows current state approaches to promoting economic development.

Bibliography

Almost three-quarters of responding states reported that their DOT coordinates with external economic development efforts in the state (NCDOT did not at the time). Almost half reported economic development *goals* were part of the investment criteria (NCDOT did not at the time). Almost 70% reported having separate funding for economic development projects (NCDOT did not at the time). Only about one-quarter reported separate funding for economic development areas (NCDOT indicated that it did at the time). A little under half report using economic development evaluations for proposed projects (NCDOT did not at the time). And only one-third reported conducting post-project economic development evaluations (NCDOT did not at the time).

The study includes an overview of quantitative and qualitative assessment methods, and key steps to assess:

- Defining the project (mode, scale, type of system change, and project purpose)
- Analytical scope and definition (base case and alternatives, geographic study area, time period)
- Impacts and indicators (user, [non-user], economic, and societal)
- Simple analysis methods (interviews and surveys, case studies, simple quantitative tools)
- Different quantitative models and methods (input-output, dynamic)

Post-project evaluations can consider *jobs, wages, number of businesses, business volume and sales, populations, capital investment, and property values*. It is critical here to separate out change in those variables that would have occurred with and without the project.

NCDOT Consideration: NCDOT currently qualitatively assesses Indirect and Cumulative effects, especially induced growth/change in land use effects for most projects. This should not be confused with economic direct, indirect and induced effects because the use of the terms direct and indirect means something different to economist than land use and environmental planners. The NC DENR Division of Water Quality often requires NCDOT to conduct quantitative Indirect and Cumulative Impacts water quality modeling studies for project permitting for projects that have an explicit economic development purpose and need. Policy and programmatic requirements for the department to consider economic outcomes should not trigger a 'carte blanche' requirement to conduct these costly studies. Projects funded by sources specifically to support economic development may trigger the requirement. Economic development studies may inform ICE and ICI studies and reduce the time and resources required to conduct these studies, thereby reducing time and cost. If the department moves forward to expand consideration of economic effects and outcome by transportation projects, it may wish to communicate and coordinate with relevant state and federal natural resource agencies to develop programmatic agreements regarding ICE and ICI requirements, including under what circumstances a quantitative study would be required. In addition (as previously mentioned), the Integration effort may also create an opportunity to develop those programmatic agreements. The NC Wildlife Resources Commission, one of the agencies involved with NCDOT projects, has developed a Green Growth Toolbox. The toolbox includes land use and land development planning techniques and measures to address the presence of protected, endangered, or threatened resources in a study area. It is also an important resource that the department can cite, where applicable, especially to address project ICE issues and concerns for resource agencies. In addition, it is important to note that local land development plans required for Comprehensive

Bibliography

Transportation planning, to the extent they are robust and fully consider protected, endangered, and threatened natural environmental resources, may also contribute to the conversation in an important way.

29.

Integrating Travel Demand Model, Traffic Simulation Model and Benefit-Cost Analysis (BCA) for Project-Level Alternatives Analysis					
Author(s):	de Araujo, An, Casper, and Roberts				
Publisher:	ITE				
Year:	2012				
Source info:	Paper presented at 2012 Institute of Transportation Engineers conference				
Web link	http://www.ite.org/conference/compendium12/pdf/CB12C2703.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
			✓	✓	✓

Abstract

This paper presents a case study for project level economic impact assessment during the alternatives analysis phase of the project development process. It presents four alternatives as interim or short term fixes for a highly congested urban interchange at I-25 in Colorado Springs. A much more costly Single Point Urban Interchange (SPUI) was identified as a long-term solution at the time of this analysis. The project incorporated travel demand modeling and traffic simulations as tools to assess various level-of-service outcomes and provide data required for BCA and BCR analysis.

The cost of the more traditional interchange alternatives, including improvements to other local facilities near the interchange were \$7.1, \$9.2, and \$16.2 million. The BCA considered vehicle operating cost savings, time and reliability savings, value of personal time savings (especially regarding work commute travel time), logistics cost savings, and environmental benefits.

The lowest BCR of 3.66 was associated with the least costly \$7.1 million project. The BCR for the \$16.2 million project indicated a higher ROI of 4.46. The BCR of 7.00 for the \$9.2 million project was almost twice that of the least expensive alternative, and was 63% greater than the BCR for the most expensive alternative.

NCDOT Consideration: The Department should consider conducting pilot economic analysis for select projects for consideration during alternatives analysis. Projects in urban areas have a large range of potential alternatives with varying costs and benefits; a handful of those projects would provide an opportunity to determine the potential benefits of project level economic impact analysis. Since negative natural environmental impacts will often be lower in urban areas, choosing urban interchanges may simplify that aspect of a pilot analysis.

Bibliography

30.

Economic Analysis Primer					
Author(s):	FHWA				
Publisher:	FHWA				
Year:	2003				
Source info:	FHWA generated primer oriented towards state DOTs and local officials				
Web link	http://www.fhwa.dot.gov/infrastructure/asstgmt/primer.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓		✓	✓	

Abstract

This primer provides an overview of several economic analysis tools applicable to transportation planning and project decision-making, and discusses the most relevant transportation analysis methods such as traffic modeling and forecasting to supply data to the economic analysis tools. The economic analysis tools are: *Life-Cycle Cost Analysis (LCCA)*, *Benefit-Cost analysis (BCA)*, and *Economic Impacts Analysis (EIA)*. It identifies possible tools and programs for conducting analyses as the end of each relevant section. The primer introduces risk analysis, including sensitivity and probabilistic analysis to qualify the results of various analysis techniques. The report recommends use of the economic analysis tools to support the Transportation Asset Management initiative at FHWA (at the time of publication). The report first defines and provides examples and guidance for adjusting past costs for inflation, and discounting future costs to present value. It goes on to describe LCCA, and suggests uses for life-cycle cost analysis for project decision-making, infrastructure maintenance and management, value engineering, and work zone planning. It notes that in order to use LCCA, all alternatives must achieve the same level of benefit; otherwise, other tools should be used. Table 1 lists example cost factors commonly used for LCCA.

BCA is of most use when determining whether a project is a good public investment (where the benefits exceed the costs) and answers the questions if it should be implemented at all. It can also provide insight as to when a project should be implemented by answering the question ‘does a project’s benefits exceed its costs *now*,’ or based on appropriate projections, ‘would it be a better investment several years from now?’ And for selecting projects, what competing projects and alternatives return the greatest benefit as compared to the cost, assuming that all other factors are equal, and also considering available funds to actually implement a project. It’s possible for one alternative to return a higher benefit, but at a much higher cost that exceeds available funds. Table 2 identifies common transportation costs and benefits for BCA. It identifies non-user impacts (costs) as externalities. The report also reminds that FHWA suggests as a standard that for BCA that only initial costs be included in the denominator; whereas future maintenance and rehabilitation costs, along with other user costs, should be included in the numerator. Those costs would actually be entered as negative benefits and offset positive benefits. It also advises that if economic analyses are prepared for a project that they always be include in NEPA and environmental documentation; whereas, the only documentation from a NEPA document that might find its way into a BCA would be in the form of initial project costs, such as environmental mitigation or ROW costs. Also of interest to DOTs, the primer suggests that the level of BCA effort should be commensurate to the project “... cost, complexity, and controversy” and to use minimal effort when assessing “routine projects.” It also suggests that, depending on particular DOT agency policies and goals that BCA *may* be used to compares groups of projects with similar characteristics, such as geography or density. An example would be comparing rural to rural, and urban to urban. It concludes with a brief overview of economic impact analysis and its focus on regional or local effects of a project, such as jobs, wages, business activity, tourism, housing, and migration patterns. It notes that BCA data is often an input into EIA.

Bibliography

31.

The Innovative DOT – A handbook of policy and practice					
Author(s):	Smart Growth American and SSTI				
Publisher:	Smart Growth American and SSTI				
Year:	2012				
Source info:	a compendium of policy and practice BMPs from state DOTs for state DOT leaders and				
Web link	http://www.smartgrowthamerica.org/documents/the-innovative-dot.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓		✓	✓	✓

Abstract

The BMP handbook of innovative DOT policies and practice covers the following topics: *revenue sources; revenue allocation and project selection; pricing; increasing transportation system efficiency; improving options for mobility and access; providing efficient, safe freight access; integrating transportation and land use decision-making; and improving DOT processes*. Each section and sub-section includes state-level case studies to demonstrate various state DOT innovative practices.

Most notable to improving decision-making and/or economic effects [for possible consideration at NCDOT] is the chapter on revenue allocation and project selection. It includes the following sub-sections: *revenue and funding flexibility, asset management, performance-based prioritization, off-system investment, and updating funding formulas and implement competitive grant programs*.

Innovative practices and options for revenue and funding flexibility include:

- Eliminate funding silos
- Pool all revenues and resources into a common account to fund the most effective projects
- Evaluate projects according to state legislative or administrative policies and criteria for economic development, job creation, safety, asset preservation, etc.
- Allocate funds on a mode-neutral basis
- Communicate and coordinate with USDOT and FHWA about funding flexibility options
- Create a sub-fund to address unconstrained state priorities
- Implement complete streets polices to allow internal flexibility to address multi-modal project needs

Innovative measures for asset management include assigning economic values to assets and prioritizing maintenance and rehabilitation according to its economic value along with necessary engineering considerations.

For performance-based prioritization, DOTs should consider measures and indicators for (as listed in the report):

- | | |
|---|--|
| <ul style="list-style-type: none"> • Economic growth and development • Effective flow of goods for commerce • Job creation • Safety | <ul style="list-style-type: none"> • Accessibility • Life cycle costs of assets including roads, bridges, and transit • Coordination with local land use policies • Transportation choices for travelers |
|---|--|

Bibliography

Measures and indicators should be integrated into decision-making. (NCDOT's Prioritization 2.0 is cited and described). The reports also suggests to remove barriers to "off-system" investment – on locally owned and maintained roads, for example, when improvements to those facilities provide superior solutions to address specific problems as compared to state maintained facilities. Decision-making to do so should be supported by BCA and provided to FHWA, which has indicated support for such action with justification and ongoing coordination. To improve funding and grant decision-making, funding formulas should be linked to state and agency polices for economic growth and other goals, and grant applications (such as local programs) should have to similarly compete.

Mirroring recommendations from other articles in this bibliography, the report suggests implementing road and congestion pricing programs to use market-based incentives to help address congestion challenges. Options include high occupancy toll lanes, variable and peak period tolls, cordon charges (for congested *areas*), and variable per-mile charges for all roads within an area. It notes that the public should be educated and engaged, that proposals should be supported by analysis and data, and that agencies should report performance outcomes to the public and elected officials. Another pricing option is pay-as-you-go insurance, where insurance rates are tied to miles driven – lower rates for those that drive less, and higher for frequent users.

To increase transportation system efficiency, agencies should consider reforming level-of-service (LOS) metrics to make sure that LOS measures are part of a robust decision making process. For example, one hour of a poor LOS may not justify the cost of increasing capacity. Alternatively, a low LOS in an area characterized by short distance trips may not be sufficient to outweigh improvement costs. Another suggestion was for DOTs to create fully multi-modal LOS measures so the combined utility of *all modes* on a facility is factored into funding and improvement decisions. Other options for this topic include incorporating context sensitive solutions and context driven practical (flexible) design standards. Coordination with local governments regarding street connectivity, as well as access management, can also improve system efficiency at lower costs than necessarily expanding capacity through more costly projects. Transportation demand management through techniques such as ridesharing, telecommuting, flexible work hours, biking, walking, transit assistance, and emergency ride services are all measures that can incrementally improve system efficiency. Last, intelligent transportation systems and system management can also improve efficiency.

Innovative measures to improve options for mobility and access include making urban and metropolitan transit a key partner, supporting statewide transit for job access and economic growth, enacting policies that support complete streets, and actively promoting bike and ped travel.

To support freight access, DOTs should consider greater support for freight rail, intermodal connectivity, and facilitating better communication and coordination between freight and passenger rail. Other innovative measures include clustering freight land uses (freight villages) , developing public-private partnerships to improve pubic buy-in, and using technology to improve freight management.

Though controversial in some states and communities, innovative DOTs proactively focus varying degrees of effort to assure that transportation and land use decisions are integrated. Measures here include policy level actions (particularly with local governments), implementing true scenario planning, improving public facility citing (schools and other infrastructure that impacts transportation efficiency), coordinating infrastructure investments with other agencies, and supporting transit oriented development. Coordinating with other agencies can be particularly fruitful and yield notable cost savings and increased public benefits. Examples include economic development projects, and bike/ped infrastructure near local transit stops. Inter-agency

Bibliography

coordination to improve overall system effectiveness requires the creation of cross-agency structure, the development of guiding principles, and pooling multi-agency discretionary funds to leverage outcomes.

The last area of innovative practice in this report is improving DOT processes, including setting and achieving comprehensive goals (e.g. employment and commerce, equity of access, resource management, etc.), and streamlining project development and delivery processes.

32.

Using Economic Impact Analysis for Transportation Decision-making - Webinar					
Author(s):	TREDIS				
Publisher:	TREDIS				
Year:	2010				
Source info:	Webinar presentation on how state DOTs are incorporating economic impact analysis into their programs				
Web link	http://tredis.com/index.php/resources/webcasts/44-x-webinars/18-transportation-planning-workshop				
Workplan Topic	Transportation & the economy	Economic Performance Measures	Trans Decision-making Phases & Communication	Tools	What other trans agencies are doing
	✓	✓	✓	✓	✓

Abstract

This national workshop highlighted the ways that five DOTs and MPOs are incorporating economic impact analysis into their program planning, project prioritization, and project selection processes. Presenting agencies included Chicago Metropolitan Agency for Planning, Kansas DOT, Pikes Peak Area Council of Governments, and Virginia and Wisconsin DOTs. All of the studies were based on the TREDIS economic analysis software tool. [Information about how agencies are utilizing economic impact information in their decision-making process is applicable regardless of the specific tool]. Notable aspects from each presentation are noted below:

Kansas

Kansas identified a need for additional funding for future transportation needs. DOT decided to survey 900 stakeholders. This led to the establishment of working groups around the state comprised over 125 members. Key findings from both activities included: need for greater coordination with local officials, top priority was preservation, greater flexibility, more responsive project selection, and transportation projects needed to support economic growth. Kansas learned that satisfaction was directly linked to system performance. Stakeholders defined economic impacts. Policy changes moving forward included planning a transportation system that supported statewide economic opportunities, implementation of new business models, and spending targets were established. The new selection process [discussed earlier in this bibliography] for three work types (Preservation, Modernization, and Expansion) would be scored using a range of engineering, economic impacts, and local input variables as shown in the figure here:

	Engineering Data	Local Consult	Economic Impact
Preservation	100%		
Modernization	80%	20%	
Expansion	50%	25%	25%

Bibliography

The outcome was a successful bond referendum, during the middle of a recession, to the amount of \$8.2 billion for a 10 year multi-modal transportation program, with no legislated or earmarked projects.

Chicago Metropolitan Agency for Planning

Chicago MAP utilized economic analysis for their new 2040 plan. It includes a strong transit focus, freight focus, and congestion pricing.

Pikes Peak Area Council of Governments

The Pikes Peak Area COG used three tools to assess economic impacts from various projects: HER-ST from FHWA to evaluate maintenance versus adding lanes; a consultant tool that prepared a Monte Carlo risk assessment; and TREDIS for economic impact assessment, including BCA. [An earlier article in this bibliography discusses an in depth economic impact study of an interchange in Colorado Springs, and how economic data factored into preferred alternative selection].

Virginia

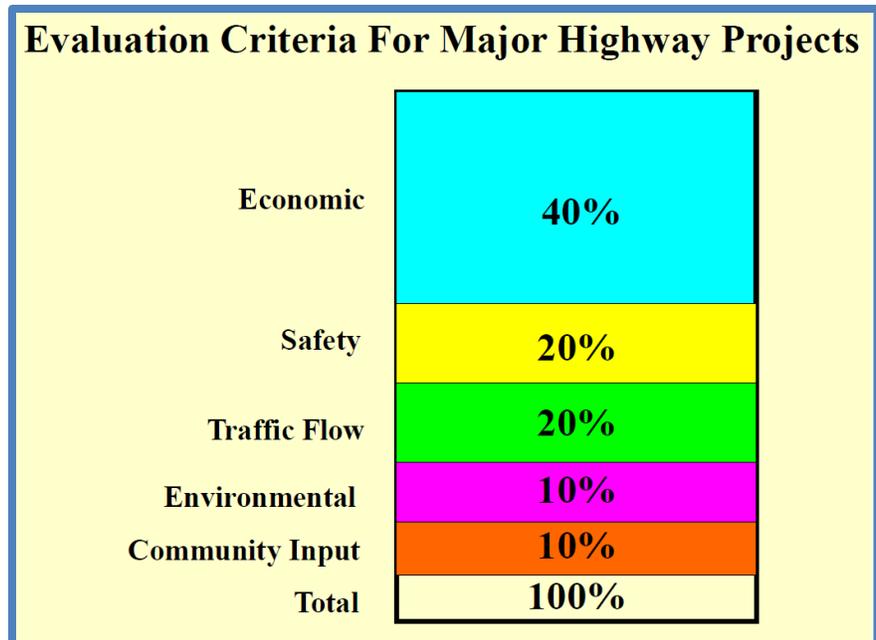
Virginia reported use of multi-modal economic impacts to rank alternative scenarios that included the following modes: highway, rail and public transit, air, and ports. Each modal division was involved the development of the economic impacts study. The study was completed in 2010 and the outputs were incorporated into the Statewide Multimodal Plan.

Wisconsin DOT

The Wisconsin DOT decided to use economic analysis for major highway projects. They first defined major highway projects as follows:

- Total cost exceeds \$5 million AND
- Construction of new, or relocating an existing highway, more than 2.5 miles in length, OR
- Adding one or more lanes greater than five miles in length, OR
- Improving an existing 4-lane highway more than 10 miles in length to freeway standards

The figure here shows their rating criteria:

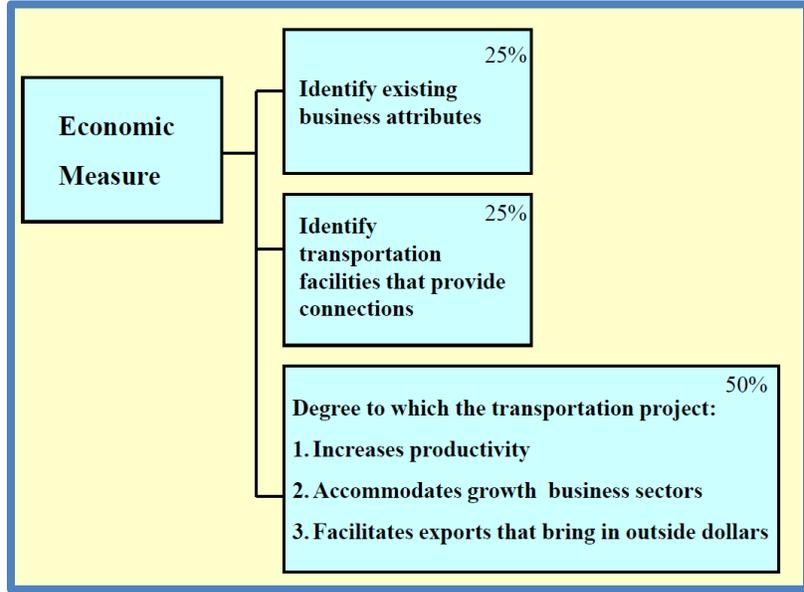


Bibliography

Economic measures were factored as show in this figure:

TREDIS generated the following data for the analysis:

- Regional data – value added and employment by industry
- Transportation dependency for supply chain, by industry
- Inter-industry trade and buy-sell relationships
- Productivity, Connectivity
- Economic Growth, Exports



Based on the rating criteria, Wisconsin DOT makes a decision as to whether construct the project or not.

The webinar can be viewed at the web link above.

33.

Transportation, Jobs, and Economic Growth					
Author(s):	Wachs				
Publisher:	University of California Transportation Center magazine -- Access				
Year:	2011				
Source info:	Magazine article				
Web link	http://www.uctc.net/access/38/access38_transportation_growth.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
	✓		✓		

Abstract

This article states that “while transportation investment can “create jobs,” it can also destroy them.” The author argues that determining if a transportation investment rate of return of exceeds that of other private or public investment is a better way of determining true economic benefit. Assessing productivity, which accounts for economic shifts, provides a truer picture of long term economic development. In the case of economic stimulus, the article states, directing money to operations and maintenance of existing systems is more likely to increase economic productivity in both the short and long term, whereas there is no guarantee that capital investment will. Policy changes should be considered to require economic productivity assessments as part of capital investment analysis in this era of ongoing funding scarcity.

Bibliography

34.

Using Economic Impact Analysis To Develop Supportable Transportation Decisions – Across All Planning Stages					
Author(s):	Weisbrod and Lorenz				
Publisher:	TREDIS				
Year:	2011				
Source info:	Article on www.tredis.com				
Web link	http://www.tredis.com/images/Articles/communicating-eco-impact-results.pdf				
Workplan Topic	<i>Transportation & the economy</i>	<i>Economic Performance Measures</i>	<i>Trans Decision-making Phases & Communication</i>	<i>Tools</i>	<i>What other trans agencies are doing</i>
			✓		

Abstract

This purpose of this article to present a framework for using economic analysis at each stage of transportation planning , and how to communicate the use and benefits of doing so to community stakeholders and elected leaders. It identifies the following four stages:

1. *Public Policy Development and Conceptualization of Strategy Elements*, which is the step that identifies solutions to transportation problems or needs. This stage would often equate to the early stage of long range or comprehensive transportation planning. The article notes that economic analysis (specifically the TREDIS product in this article, but the process is applicable regardless of tool or tools used) can inform stakeholders of *potential* costs and benefits including for non-users, and how the community or region is going to be affected by a project. Conveying the economic “story” in an understandable way is an important aspect of public information and participation.

2. *Strategic Plan Scenarios*, which includes the development, assessment, and communication of various alternatives to address the problems. This stage would equate to the middle to later stages of long range or comprehensive transportation planning. The article notes that “economic impact analysis can be of critical importance in showing how alternative future scenarios can change a region’s or state’s economic future...” At this point it is important to both *educate* and *collaborate* with stakeholders, who can help inform the development of alternatives, as well as inform elements of the economic analysis. It is also an opportunity to build support by educating the public about the decision-making process.

3. *Programming: Project Prioritization and Selection*. This phase includes analysis to identify the most effective alternatives (including economic considerations) within the context of future funding. Urban projects may focus more on congestion and flow, and rural projects may reflect greater connectivity and accessibility. Communication about the economic aspect of the process is important to continue to build understanding and credibility about the process -- especially the more esoteric aspects of economic analysis.

4. *Design: Alternative Analysis and EIS*. At this stage economic assessment can address the project economic costs and benefits, including growth and competitiveness to which many stakeholders can better relate. Economic analysis can help tease out differences between specific project alternatives to identify the cost effectiveness of various alternatives. That data can then be factored into the selection of the preferred alternatives (along with all of

Bibliography

the other effects that are clarified at this point of project development and environmental analysis process).

For each stage the following items are discussed in more detail in the article:

- Objective
- What is known at the start of this step
- Available tools
- Practical use
- Audience and key message considerations