

Transportation's Link to the Economy: Synthesis

prepared for

Jerry Lenzi

**Chief Engineer and Assistant Secretary
Engineering and Regional Operations**

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Transportation Synthesis Reports (TSRs) are brief summaries of currently available information on topics of interest to WSDOT staff. Online and print sources may include newspaper and periodical articles, NCHRP and other TRB programs, AASHTO, the research and practices of other state DOTs and related academic and industry research. Internet hyperlinks in the TSRs are active at the time of publication, but host server changes can make them obsolete.

REQUEST FOR SYNTHESIS:

Jerry Lenzi, Chief Engineer and Assistant Secretary, WSDOT Engineering and Regional Operations, requested a Literature Search and Synthesis of the link between transportation and the economy.

BACKGROUND:

Highways, roads, and public transportation systems contribute to virtually everything of value in our economy and lives—from linking businesses to their suppliers and customers, to bringing jobs, education, health care, recreation, and government services. Economists have explored the economic impact of public investment for over two decades and consistently found that surface transportation systems increase economic output, reduce prices, and raise incomes and profits. Transportation contributes economic returns for virtually every person and business in the country. Studies show that state and national investments in transportation have measurable benefits to the economy.

Databases Searched:

- Transport, available through WSDOT Library
- TRIS Online
- Research in Progress
- Google
- Wisconsin DOT Transportation Synthesis Reports

SYNTHESIS SUMMARY:

Publications and resources have been categorized as follows:

- Transportation and the Economy
- Regional Studies
- Highway Investments
- Freight Investments
- Transit Investments
- Other Transportation Sector Investments
- Methodology Studies

ARTICLES:

Transportation and the Economy:

The Transportation Challenge: Moving the U.S. Economy

Cambridge Systematics, Inc., 2008, for National Chamber Foundation of U.S. Chamber of Commerce, with Boston Logistics Group, Inc., and Alan E. Pisarski

<http://www.uschamber.com/publications/reports/0804transportationchallenge.htm>

Excerpt from Report Summary (p. 4 of PDF): The purpose of the study is to show the linkages between the capacity and performance of the nation's transportation system and U.S. economic productivity, competitiveness, and growth. It highlights the manner in which the U.S. and global economies are changing, how different sectors of the economy depend on transportation, the increasing demands these industry sectors are putting on intermodal transportation systems, and how present-day transportation systems are performing in response to these new demands.

Web Indexes of the Economic Development Research Group, 2007

- **Specialized Benefit-Cost Guides**

http://www.edrgroup.com/edr1/library/lib_guides_special/index.shtml

Links to articles and websites on benefit-cost analyses of transportation projects, including implications of economic development.

- **Transportation and Economic Development**

http://www.edrgroup.com/edr1/library/lib_trans/index.shtml

Links to articles and websites on economic impacts and benefit-cost evaluation of transportation.

Healthy Returns: The Economic Impact of Public Investment in Surface Transportation

Robert J. Shapiro and Kevin A. Hassett, March 2005, APTA

http://www.apta.com/research/info/online/healthy_returns.cfm

Executive Summary: America's highways, roads, and public transportation systems contribute to virtually everything of value in our economy and lives—from linking businesses to their suppliers and customers, to bringing jobs, education, health care, recreation, and government services within every American's reach. Economists have explored the economic impact of public investment for over two decades and consistently found that surface transportation systems increase economic output, reduce prices, and raise incomes and profits. Investing in this extensive network has produced enormous economic returns for virtually every person and business in the United States.

Highway and Transit Investments: Options for Improving Information on Projects' Benefits and Costs and Increasing Accountability for Results

Government Accountability Office, January 2005, *Report No. GAO-05-172*

From Abstract: In this report the Government Accountability Office (GAO) identifies (1) the categories of benefits and costs that can be attributed to new highway and transit investments and the challenges in measuring them; (2) how state, local, and regional decision makers consider the benefits and costs of new highway and transit investments when comparing alternatives; (3) the extent to which investments meet their projected outcomes; and (4) options to improve the information available to decision makers.

Technical Paper #1: the Costs and Benefits of Transportation

Puget Sound Regional Council, January 2002

<http://www.psrc.org/projects/pricing/costsbenefits.pdf>

From Background: Metropolitan regions throughout the United States face the converging challenges of providing for the basic mobility needs of their residents while also attempting to manage growth in personal vehicle travel. Limited public financial capacity for transportation infrastructure investment has encouraged transportation professionals and regional policy makers

to begin discussing the potential benefits associated with reforming the way we pay for, and finance, transportation.

Examples of Best Practices for Communicating the Economic Benefits of Transportation

ICF Consulting, February 2001, *NCHRP 2-22(2) Final Report*

http://www.trb.org/news/blurb_detail.asp?id=8240

From Abstract: NCHRP 2-22 (“Communicating the Economic Impacts of Transportation Investments: Guidance for Transportation Planners and Policy Makers”) [developed] guidance for state DOTs, MPOs, and other transportation agencies to help them communicate effectively transportation’s importance to the economy . . . Accordingly, NCHRP 2-22(2), “Examples of Best Practices for Communicating the Economic Benefits of Transportation Projects,” was commissioned to develop information on strategies and techniques that have been employed in the field, the circumstances under which they were used, and why they were, or were not, successful.

The end product of NCHRP 2-22(2) is a *Best Practices Digest* (published as a separate section, but also replicated in this Final Report as Chapter 4). This *Digest* is based on information developed in four detailed case studies of campaigns to win voter approval of significant transportation projects and, in three cases, the tax increases necessary to pay for them.

Economic Returns from Transportation Investment

D.J. Kulash, 1997, Eno Transportation Foundation, Inc., Washington

Abstract: A recent study of the returns from highway investments in the last 40 years found surprisingly high rates of return in the 1950s and 1960s, the years when the Interstate System was being built. Those rates declined in the two most recent decades. Analysis of these past patterns can help target future transportation investments to achieve the greatest economic impact. In particular, those programs that have the potential to produce network effects are the key. Future investments can produce the greatest economic return if they are targeted to programs that will preserve or expand network capacity. Four areas of the surface transportation program appear particularly well matched to this objective: preservation of the Interstate System; channeling available funds into the National Highway system; targeting investment in intermodal gaps; and developing Intelligent Transportation Systems.

Report on Long-Term Financing Needs for Surface Transportation

American Association of State Highway and Transportation Officials, June 2007, *Report No.’s 9781560513834 and RP-LTF-1*, Washington

Abstract: To keep the U.S. competitive in the global economy, surface transportation investment must be substantially increased over the next two decades and beyond, not only for highways and transit, but also for freight and passenger rail. In the immediate and short-term future, this will require actions to increase revenues supporting the traditional highway and transit funding mechanisms such as motor fuels taxes. In the longer term, as needs continue to grow, because increased fuel efficiency and growing use of alternative fuel vehicles will likely lead to declining consumption of motor fuels, the surface transportation community will need to find new ways to fund transportation investment. This report documents needs and revenues available under current law, identifies short-term, mid-term, and long-term options for surface transportation funding, and recommends specific strategies to meet investment needs.

America’s Traffic Congestion Problem: Toward a Framework for Nationwide Reform Transportation, Traffic, Cities, Highways

David Lewis, HDR, Inc., April 2008, The Brookings Institution

http://www.brookings.edu/papers/2008/04_traffic_congestion.aspx

Abstract: A large and growing burden on the nation’s economy, traffic congestion arises for various reasons, and a need exists for more than one mechanism to combat it. It is most unlikely, however, that serious inroads to address the problem will be made without fundamental reform in

the way consumers are charged for their use of congested highways. Congestion prices are tolls that reflect the economic costs of congestion, including productivity losses from traffic delays, increased accidents, higher emissions, and more. Such prices would help reduce these economic costs, and guide transportation investment resources to their highest and best use—which would include a better balance between highway and transit investment. In addition, such prices would generate revenues to help finance new investment and compensate low-income people and others for who toll payments are especially burdensome. Requiring federal, state, and local engagement, such reform is a necessary step in the development of an effective, efficient, and sustainable highway system for the twenty-first century.

Innovative Planning Approaches 2007

Transportation Research Board, 2007, *Transportation Research Record 1997, Report No. 9780309104234*

Abstract. This collection of 7 papers explores innovative planning approaches. Topics discussed include structures of independent metropolitan planning organizations (MPOs); transportation tax ballot initiatives; transportation planning in major cities and megacities; manual traffic allocation for street networks in small towns; demand forecasting for rural transit; transportation planning with innovative coordination between states, MPOs, and tribes; and estimating user costs and economic impacts of road construction in Federal Lands projects.

Transportation—Invest in Our Future: A New Vision for the 21st Century

American Association of State Highway and Transportation Officials, July 2007, Washington

This paper presents the national transportation vision of AASHTO and its industry partners.

Regional Studies:

Statewide Economic Benefits of Transportation Investment

Todd Pickton, Janet Clements, and Robert W. Felsburg, April 2007, BBC Research & Consulting, Felsburg Holt & Ullevig, Federal Highway Administration, and Colorado Department of Transportation, Division of Transportation Development, *Report No. CDOT-2007-5*

From Abstract. This study evaluates the statewide economic benefits of future transportation investment in Colorado using available data and benefits studies conducted in other states. Objectives of this study are to provide Colorado stakeholders results consistent with their guidance in the Colorado Department of Transportation (CDOT) Economic Benefits of Transportation Research Scoping Study (May 2006) and to identify data needs and other information necessary to perform a future in-depth analysis of benefits by region within the state. This research focuses on the benefits of additional transportation spending above a baseline investment scenario. The scenarios chosen for evaluation represent different levels of investment identified in CDOT's 2030 Statewide Transportation Plan (2030 Plan). The baseline or "Forecast Revenue" investment scenario represents current revenue projections through 2030. The alternative "Sustain Current Performance" scenario represents an additional investment of \$48 billion. This is the level of investment necessary to maintain current transportation system performance levels. Research findings indicate that over the 26-year investment timeframe, the economic benefits of this additional investment amount to \$59.6 billion in travel cost savings and additional income for Colorado residents arising from business expansion and attraction benefits. Of the economic benefits the study team was able to quantify, the benefits exceed the required investment by \$11.6 billion (2005 constant values). Further, by 2030 this additional investment would reduce the time Colorado residents spend in congestion-related delays by 72% compared to the Forecast Revenue Scenario. Better pavement quality would lower annual per vehicle operating costs by 6% and safety improvements would reduce the number of fatalities on public roadways by 14%.

Trends and Conditions Report—2007, Impact of Transportation: Transportation and the Economy

Florida Department of Transportation, Office of Policy Planning, and University of South Florida, Tampa, Center for Urban Transportation Research, June 2007

Abstract. This report addresses the linkages between transportation and the economy as well as how and why the transportation system should adapt to accommodate economic trends. As Florida's economy grows, increased demand for movement of people and goods is putting pressure on Florida's transportation system. The first section of this report discusses the economic trends that influence demand for movement of passengers and freight on the transportation system, and how those trends affect system performance. Investments in transportation infrastructure and services affect the performance of the system, resulting in a broad range of impacts to Florida's economy. The second section of the report illustrates how transportation system performance creates tangible impacts on people and businesses. The movement of people and goods itself accounts for a significant share of economic activity in Florida, which depends directly on how well the transportation system functions. The final section of this report explains the significance of the impacts of transportation investments on Florida's overall economic vitality and economic competitiveness.

Economic Development Effects of INDOT Transportation Projects

Konstantina Gkritza, Samuel Labi, and Kumares C. Sinha, April 2004, Purdue University, Indiana Department of Transportation, and Federal Highway Administration, *Report No. FHWA/IN/JTRP-2006/37*

From Abstract. This study extends the traditional transportation impact framework by examining how different types of highway improvements that have been programmed for implementation in the State of Indiana can affect the state's economy, and how project- and location-specific factors interact to stimulate economic development. Temporal, spatial, and project characteristics are duly considered. The end product of this research is a quantitative tool that can be used at the project development phase by the Indiana Department of Transportation (INDOT) staff to estimate the economic development effects of different types of highway investments and make better decisions regarding highway investment. The study results provide a better understanding of the interrelationships among economic development, type of highway improvement and geographical location, and how investments in highway infrastructure can be ranked and prioritized based on sound economic development criteria.

Economic Benefits of the Michigan Department of Transportation's 2007–2011 Highway Program

Economic Development Research Group, Inc., and the Institute of Labor and Industrial Relations, University of Michigan, June 2007, for Michigan Department of Transportation
http://www.michigan.gov/documents/mdot/MDOT_economicbenefitreport_202828_7.pdf

From Introduction (p. 5 of PDF): The purpose of this study is to conduct an economic benefit analysis of the Michigan Department of Transportation's current Five-Year Highway Program. Through this program, MDOT makes substantial investments in the highway system throughout the state of Michigan, spending approximately \$1.3 billion annually on the preservation, maintenance, and enhancement of the state's road and bridge system.

New Jersey's Links to the 21st Century: Maximizing the Impact of Infrastructure Investment

R.E. Paaswell, December 2002, City College of New York, University Transportation Research Center; New Jersey Department of Transportation; and Department of Transportation

From Abstract. This report addresses the following questions: (1) how do the planned and progressing infrastructure investments affect the accessibility of Northern New Jersey, and how can the changes be quantified? (2) If such changes occur, how and to what extent will they affect land use decisions? How can such decisions be shaped to have maximum positive impact on

economic development, jobs and quality of life for the people in New Jersey? and (3) how can the New Jersey Department of Transportation assist in this decision-making through development of appropriate planning and policy analysis tools? In presenting the results of research on these questions, this report begins by reviewing the parallel development of New Jersey's economy and transportation infrastructure. Next, accessibility is defined and it is shown how accessibility has changed. The heart of this report presents the results of studies showing that improvements in accessibility have a significant impact on economic growth. The relationships between transportation infrastructure improvements and land development are detailed. Finally, a set of analytical tools and guidelines is provided to help shape future projects for maximum positive economic impact, and proposed projects are analyzed in light of these guidelines.

Role of Transportation Accessibility in Attracting New Businesses to New Jersey

Ertekin D. Ozmen, K. Ozbay, and Veras J. Holguin, June 2007, *Journal of Urban Planning and Development* 133(2): 138-149

Abstract: A general research methodology is developed to analyze the factors affecting companies' relocation decisions, and its practicality is tested through an application on a study region that includes 21 counties in New Jersey representing the "destinations" for the new businesses, and New York City and Philadelphia representing the "origins." Within the framework of the suggested methodology, a gravity based business relocation model is developed and calibrated using an iterative approach. The modeling process also involves multi-attribute decision analysis to evaluate the determinants of business relocation process as precisely as possible. Input data includes the number of companies that relocated to New Jersey from New York City and Philadelphia, from 1990 to 1999, and a set of factors that are considered to affect companies' relocation decisions including land prices, safety, land availability, market size, economic stability, and transportation accessibility. The results show that businesses moving from Philadelphia tend to locate deeper into New Jersey than businesses moving from the New York City area. This result might be attributable to the fact that businesses are attracted to the high density of the New York City market and its economic potential, and therefore do not want to relocate as much. Results of the sensitivity analysis and estimated market elasticities also support this finding. This study also demonstrates that the attractiveness index can be represented in a functional form.

The South Carolina Department of Transportation and its Economic Impact on the State of South Carolina

D.L. Schunk, Moore School of Business, Univ. of South Carolina, for the S.C. Dept. of Transportation, January 2003, *Report No. FHWA-SC-02-08*

<http://research.moore.sc.edu/Research/studies/SCDOT/scdotimp2003.pdf>

From Abstract: The many activities of [South Carolina Department of Transportation (SCDOT)] entail a broad range of economic benefits for the state. SCDOT investments in the transportation system result in substantial short-term benefits, estimated at \$2.1 billion of economic output, \$768.6 million in labor earnings, \$91.6 million in recurring tax revenue, and 24,360 jobs annually. Over the longer-term, transportation system enhancements benefit the state's economy via positive impacts on business costs and productivity, labor market access, economic competitiveness, attractiveness to new businesses, residents, and tourists, property values, and long-term tax revenues.

Transportation Improvements Grow Wisconsin's Economy: the Economic Benefits of Transportation Investments

Cambridge Systematics, Inc., February 2003, for Transportation Development Association of Wisconsin, in cooperation with Economic Development Research Group

<http://www.tdawisconsin.org/data/publications/cambridgecomplete.pdf>

From Executive Summary (p. 6 of PDF): This study describes the positive economic impacts of transportation investment in Wisconsin through both quantitative and qualitative research. Recent studies show that state and national investments in transportation have measurable benefits to

the economy. Specifically, transportation investment: 1. Creates jobs while boosting industry competitiveness and productivity; 2. Enhances household wellbeing; 3. Strengthens local, regional, and state economies; 4. Boosts state tax revenues; 5. Facilitates business and leisure travel; 6. Reduces economic losses associated with crashes; and 7. Reduces economic losses associated with congestion.

As businesses respond to the cost savings and accessibility benefits of transportation investments they become more competitive and the benefits reverberate throughout the entire economy. The direct economic effects of transportation investment include improved access to labor and specialized skills; statewide business attraction, expansion, and retention; reduced logistics costs; and greater tourism activity.

Linking Economic Development to Highway Improvements: Pine Ridge Reservation, South Dakota

S. Khan and D. Levy, 2003, *Transportation Research Record 1848*: 106-113

From Abstract: Much of the literature on the economic benefits associated with investments in transportation infrastructure focuses on locations with at least some measure of private-sector economic activity. The focus here is on the Pine Ridge Indian Reservation in South Dakota, an area with extremely limited private economic activity and a transportation network with limited connectivity and accessibility. The study was one of a series sponsored by the Federal Highway Administration to examine linkages between transportation improvements and economic development in rural areas. The Pine Ridge study established a framework for analyzing these linkages and focused the analysis on tourism, a key sector that both offers great potential for economic development and is dependent on improvements in transportation infrastructure. The analysis estimated the potential benefits of the tourism sector and identified the transportation improvements that would be needed to support this sector.

Highway Investments:

Benefits of Highway Improvements on Rural Communities in Missouri: Economic Development Considerations

K.E. Pigg, T. Johnson, J. Gilles, C. Fulcher, and C. Wilson-Orndoff, August 2003, University of Missouri, Columbia, Department of Rural Sociology, and Missouri Department of Transportation, Research, Development and Technology Division, *Report No. RI 00-058*

Abstract: A brief examination is made of the effects of highway improvements on the economic sector of rural Missouri counties. Sixty-five rural counties with four lane highways (maintained by the Missouri Department of Transportation) are included in the regression analysis with multiple indicators of economic change. Results indicate little benefit from highway improvement, as defined for this study, exists for rural counties.

Measuring the Benefits of a Large Public Investment: the Case of the U.S. Federal-Aid Highway System

T.E. Keeler and J.S. Ying, 2002, *Transport Infrastructure*: 386-402, Edward Elgar Publishing, Incorporated, Northampton, MA

This paper presents an analysis of an important component of the benefits of Federal-aid highway infrastructure investments in the U.S. Specifically, the focus is on the effects of those investments since 1950 on costs and productivity of firms in the U.S. road freight transport industry. Using a theoretical and statistical model of regional truck firm costs, the paper documents that the rapid growth of highway infrastructure that occurred between 1950 and 1973 had a strong and positive effect on productivity growth in trucking. Additionally, the results indicate that the benefits of these investments are substantial; large enough to justify between 33% and 50% of the cost of the Federal-aid highway system over this period on the basis of benefits to trucking alone.

Measuring Economic Impacts of Federal-Aid Highway Projects

W.P. Anderson and A.C. Jacoby, September 2000, *Public Roads* 64(2): 37-41, Federal Highway Administration

Summary of Abstract: An ongoing study of the FHWA and the Boston University Center for Transportation Studies seeks to assess direct, indirect, and induced economic effects of highway improvements. Form 47, Statement of Materials and Labor Used by Contractors on Highway Construction Involving Federal Funds, aids this assessment by providing contractor expenditures on federal-aid projects with construction costs exceeding \$1 million. The study is developing a software package that estimates direct, indirect, and induced employment impacts of federal-aid highway program expenditures and state matching funds in order to anticipate national and regional economic effects of highway improvements.

Do Highways Matter? Evidence and Policy Implications of Highways' Influence on Metropolitan Development

M.G. Boarnet and A.F. Haughwout, August 2000, Brookings Institution

Abstract: Growing concerns about traffic congestion and rapid suburban expansion (also known as sprawl) have reignited interest in the ways in which highway spending affects metropolitan growth patterns. This discussion paper extracts the best evidence to date on how highway investments distribute growth and economic activity across metropolitan areas. The paper also offers ideas on how transportation financing and policies can better respond to the various costs and benefits of highway projects in a region.

Appalachian Development Highways Economic Impact Study

Smith (Wilbur) and Associates, July 1998, Columbia, SC

From Abstract: This study focuses on 12 of the 26 ADHS highway corridors that are largely complete and determines the extent to which corridors have helped the Region's economy.

Estimated Economic Impact of Selected Highway Widening Projects in Texas

J.L. Buffington and M.T. Wildenthal, January 1998, Texas Transportation Institute, Texas A&M University; Texas Department of Transportation, Office of Research and Technology Transfer; and Federal Highway Administration, *Report No.'s FHWA/TX-98/1260-4F, Res Rept 1260-4F, and TTI: 0-1260*

From Abstract: This study is designed to [estimate] the during and after construction period effects of three widening projects, each having different widening and locational characteristics. The data collected throughout the construction period and one to three years after construction represents conditions abutting or near the study facilities. The following construction and post construction period impacts were studied: (1) impacts on abutting businesses, residents, and properties; (2) impacts on motorists using these highways; and (3) impacts on the local urban areas or cities involved. The data collected on each of the study projects includes information on abutting business managers' estimation of the construction impact on their businesses and property values, and on the traffic volumes, travel times, and accident rates of the highway. Results indicate that, generally, highway widening projects, regardless of type, produce temporary negative effects on abutting businesses, residents, and property owners during the construction period. Businesses and tax revenues are the most negatively affected, especially for projects requiring considerable right-of-way. However, the local construction expenditures offset much of the negative effects. Also, motorists receive considerable long run benefits in the form of reduced travel time, operating, and accident costs, regardless of the type of widening project. These benefits are reduced some during the construction period and reduced even more when the construction period is extended a considerable amount of time. These results can be used by transportation agencies to prepare environmental impact statements, which are disseminated at public hearings of similar future widening projects and help business owners assess their potential gains and losses resulting from the construction.

A Model-Procedure for Estimating Economic Impacts of Alternative Types of Highway Improvement

M.W. Babcock, M.J. Emerson, and M. Prater, 1997, *Transportation Journal* 36(4): 30-43

While there is universal agreement among economists that government programs whose benefits exceed their costs represent an efficient use of resources, practical application of this economic law has been thwarted by the difficulty of measuring the benefits of public programs. The primary purpose of this article is to present a methodology to measure some of the economic benefits of state highway programs. This study offers a model-procedure to estimate income, output, and employment impacts of specific types of highway improvement within a regional context.

Economic Benefits of Highways

Faircount LLC and American Association of State Highway and Transportation Officials, 2006

From Abstract: This article describes how Interstate highways spur economic growth and change the national economy.

Post Implementation Evaluation Studies

A. Boyce, S. Porter, and V. Kovacevic, April 2003, *Traffic Engineering & Control* 44(4): 146-51

Abstract: A frequently asked question is how accurate are the Highways Agency's procedures for predicting the traffic flows and economic benefits that result from a scheme. This article reports the latest results from the Post Implementation Evaluation Studies, one of several tools used to assess such matters. It concentrates on re-evaluations of major bypasses and also outlines how procedures could be improved and integrated with other ways of assessing the performance of road schemes. Implications for scheme appraisal are discussed.

Freight Investments:

Increasing the Capacity of Freight Transportation—U.S. and Canadian Perspectives: Conference Proceedings

D.S. Ortiz, B. Weatherford, H.H. Willis, M. Collins, N. Mandava, and C. Ordowich, 2007, *Report No. 9780833041258*, Rand Corporation, Santa Monica, CA

From Abstract: A workshop on freight transportation [with stakeholders representing] organized labor; modal freight carriers; federal, provincial, local and state governments; and manufacturers. The workshop discussions centered on the deteriorating performance of the freight transportation system in North America and how to develop strategies for improving freight transportation capacity. Discussions also included regulatory constraints, and the existing and expected economic impacts of freight transportation system constraints.

Analysis of Regional Supply Chain Economic and Environmental Effects of Expansion of the U.S Freight Rail System

Chris T. Hendrickson, H. Scott Matthews, and Gyorgi Cicas, 2006, American Society of Civil Engineers, *Report No. 0784407991, Applications of Advanced Technology in Transportation, Proceedings of the Ninth International Conference, Chicago, IL*, K.C. Wang, B.L. Smith, and D.R. Uzarski (eds.)

From Abstract: This paper analyzes the regional supply chain economic and environmental effects of shifting 10% of intercity freight carried by trucks to rail. Compared to truck, the freight-rail network provides a cost competitive, more fuel-efficient shipping alternative that can also help to reduce roadway congestion. At the same time, the increased demand for rail transportation raises the need for the expansion of the railroad system. The case study assumes that 10 percent of intercity freight moved by trucks in Pennsylvania is shifted to rail, and that this shift requires a 10 percent expansion of the freight-rail system: construction of new tracks, stations, maintenance and repair shops, and manufacturing of new locomotives . . . We estimate the change of total supply chain economic activity, electricity and fuel use, emission of carbon dioxide and conventional air pollutants (CO, SO₂, NO₂, VOC, PM₁₀) induced by the shift between rail and truck transportation in Pennsylvania and the Mid Atlantic economic region (including DC, DE,

MD, NJ, NY and PA). The paper finds that the shift has environmental benefits considering only the transportation sectors of their supply chains. If the railroad infrastructure investment effects are allocated over a period of time, the overall supply chain effects are also positive.

Freight Transportation: Improvements and the Economy

Federal Highway Administration, Office of Freight Management and Operations, 2004, Washington

Abstract. Despite the wealth of information on transportation's contribution to the economy, debate continues on the linkages between transportation improvements and economic performance and the relative strength of these links. Focusing on freight transportation, this report summarizes the results of the Federal Highway Administration's (FHWA's) work on the economic benefits of transportation improvements. In addition to an executive summary, two analytical reports are included as appendices: 1) Economic Effects of Transportation: The Freight Story; and (2) Transportation Infrastructure, Freight Services Sector and Economic Growth: A Synopsis. Three methods—macroeconomic and microeconomic research and general equilibrium approaches—have been employed to study the linkages between transportation and the economy. Each of these is discussed in this report.

Economic Effects of Transportation: the Freight Story

ICF Consulting and HLB Decision-Economics, January 2002

From Abstract: This report describes the linkages between freight transportation and the economy. It is written with a broad audience in mind—an audience that is comprised predominantly of non-economists. It draws on the technical concepts that have been constructed under the Freight Benefit-Cost Analysis (BCA) Study that is being sponsored by the Federal Highway Administration (FHWA). This report describes how an efficient and reliable freight transportation system helps to generate improvements in economic productivity. Using findings from the FHWA's Freight BCA Study, the underlying linkages between freight transport and the economy are reviewed first. Then, the types of factors that drive the efficiency and reliability of freight transportation are discussed. Emphasis is placed on events that have led to significant improvements in truck and rail transport—events that have provided the foundation for the benefits that can be generated via business reorganization. Finally, the detrimental effects of worsening congestion on the productivity of the freight system are reviewed.

Benefit-Cost Analysis of Highway Improvements in Relation to Freight Transportation: Microeconomic Framework

ICF Consulting, Louis Berger Group, Incorporated, and Federal Highway Administration, Office of Freight Management and Operations, February 2001

This paper studies freight-related economic benefits and costs of transportation improvements within a microeconomic context. The paper focuses on whether benefit-cost analyses recognize gains in economic welfare from adopting productivity-enhancing advanced logistics in response to infrastructure improvements. The paper provides an overview of industrial organization in relation to freight logistics, outlines efforts to expand benefit-cost analyses to recognize industry reorganization, develops a complete microeconomic framework, and discusses measurement issues and information requirements.

Freight Benefit/Cost Study: Compilation of the Literature

ICF Consulting, HLB Decision-Economics, Louis Berger Group, Inc., and Federal Highway Administration, Office of Freight Management and Operations, February 2001

Abstract. The Federal Highway Administration wants to develop the ability to identify and measure the full benefits of improvements in freight transportation. More specifically, the agency wants to estimate the costs and benefits of investing in improvements in intermodal links between the highway system and railroads, ports, and airports, as well as in highway corridors where significant volumes of freight move. Although estimating costs may present some difficulties (e.g., cost allocation issues), the real analytical challenge is the estimation of benefits. An important first

step in the development of the Benefit/Cost Analysis framework is a thorough review of previous literature on (1) assessments of the economic impacts of transportation investments, (2) methodologies used to quantify impacts from these investments, and (3) industry experiences that demonstrate how economic agents respond to transportation investments in the field. This report provides a compilation of the literature. The literature review is structured as follows: Section 1 - Introduction; Section 2 - Studies on Economic Growth/Productivity and Social Impacts; Section 3 - Theoretical and Freight Transportation Studies; and Section 4 - Literature on Industry Experiences and Case Studies.

Transit Investments:

Public Transportation Means Business

American Public Transportation Association, 2004

Abstract: Investment in public transportation has proved to be a smart business move by spurring billions in private sector development, raising property values, attracting blue chip companies, and revitalizing flagging central business districts. The document uses the Dallas Area Rapid Transit (DART) and Merolink in St. Louis as examples of how a capital investment in public transit has sparked a chain reaction in business activity that far exceeds the initial investment.

The Initial Economic Impacts of the DART LRT System

B.L. Weinstein and T.L. Clower, July 1999, University of North Texas, Center for Economic Development and Research, for Dallas Area Rapid Transit

Abstract: This report presents the findings of a study to identify and measure the initial economic impacts of the Dallas area rapid transit (DART) system, with a focus on property values and retail sales. It reviews academic and professional literature on rail transit and property values; looks at changes in taxable values between 1994 and 1998 for properties located near DART stations as well as a sample of commercial, industrial and residential properties in comparable neighborhoods not served by DART; examines the impacts of DART rail on commercial, real estate, in particular occupancy and rental rates for office, retail and industrial properties; and looks at the growth of retail sales since DART went into service.

Public and Community Transportation: Impact on the Economy

Publisher Community Transportation Association of America, 2003, *Community Transportation 21(1)*

Excerpt: Transportation has long been a leading generator of jobs, both directly through the construction, operation, and maintenance of the nation's transportation system and indirectly through its support of the broader economy by making the movement of people and goods possible. Today, 11.3 million Americans are employed in transportation occupations. More than eight million of these workers are directly linked to surface transportation. All transportation occupations depend on a viable transportation system. They will continue to thrive only as long as strong investment in transportation infrastructure is sustained. The direct benefits of transportation investments have been thoroughly quantified. Each billion dollars of federal highway investment generates 47,500 jobs; 26,500 as roads and bridges are built and an additional 21,000 as those who earn their money directly from transportation activity buy goods and services. For every billion dollars in transit investment, job generation is virtually the same as that for highways.

The Socioeconomic Benefits of Transit in Wisconsin

HLB Decision Economics, Wisconsin Department of Transportation, Federal Highway Administration, and Federal Transit Administration, December 2003

From Abstract: The primary objective of this study was to identify and measure the benefits of transit to other economic sectors in Wisconsin. This study specifically focuses upon the benefits of public transit service to the healthcare, work, education, and retail, recreation and tourism sectors. A secondary objective was to measure the impact of public transportation on congestion

management in large urban areas of the state. The analysis relies upon a methodology previously developed by the author that identifies user preferences and actions as well as modeling the impact of such decisions on the appropriate sectors . . . [Sources include] a comprehensive literature search, an on-board rider survey, information from several transit agencies in Wisconsin, panel opinions from a group of experts, as well as reports and publications from earlier studies. The study confirmed the important role public transportation plays in maintaining the viability of the state's economy. The research found the existence of public transit service in Wisconsin saves various sectors within the state a total of \$730.17 million, while providing 98.96 million transit trips annually. Without transit services 15.10 million transit rides would convert to forgone trips that individuals would not make by means of other higher cost transportation modes. In evaluating future cost-benefit criterion for new or expanded services, it is estimated that the average sector benefit from each trip is \$7.38. For those areas that are fully served by transit, there are significant benefits to both riders and state programs. However, [in] areas that remain without service and those that are underserved, the potential remains for greater benefits to be cultivated through additional transit service programs.

Bus Service and Real Estate Values

William G. Barker, 1998, *68th Annual Meeting of the Institute of Transportation Engineers*, Toronto, Ontario, Canada

Dollars and Sense: the Economic Case for Public Transportation in America

D.H.W. Camph, June 1997, Aldaron, Incorporated, Culver City, CA

This report compares the benefits of transit versus highways. Some of the findings include (*Abstract excerpt*):

- 1) While transit is clearly a boon to those who use it, even larger benefits accrue to motorists, businesses, and society in general;
- 2) Given flexibility in how they develop their transportation investment strategies, more and more areas - central cities, suburbs, and smaller towns and villages - are choosing to make public transit an essential component of their strategic transportation investment portfolio;
- 3) In those areas where such strategic investments in transit have been made, ridership has grown, and the economic benefits to those communities have risen accordingly.

Other Transportation Sector Investments:

Economic Impact Analysis of Ferry Operations in Wisconsin

Adams et al, 2007, Transportation Research Board 86th Annual Meeting, *Report No. 07-0131*, Washington

From Abstract: This paper presents economic analyses of selected ferry operations in Wisconsin. The intent is to quantify the significance of the ferry operations to the economies and transportation of their respective communities in Wisconsin. A cost and time analysis compares travel by ferry versus highway from the traveler's perspective. An economic impact analysis quantifies the baseline estimates of direct, indirect, and induced output and total jobs supplied that can be attributed to the ferry operations.

Assessing the Economic Benefits of Boston's Central Artery/Tunnel Project

William P. Anderson, and T.R. Lakshmanan, 2006, *Report No. 9781843766100*, K. Kobayashi, T.R. Lakshmanan, and W.P. Anderson (eds.)

From Abstract: [This] chapter has three objectives: (1) to provide an overview of [Boston's Central Artery/Tunnel] project, including some historical background; (2) to review efforts to date to make quantitative estimates of the economic benefits of the project; and (3) to identify types of benefits that are missing from these estimates and to propose methods for estimating them.

Economic Development Impacts of Transportation Demand Management

Todd Litman, Victoria Transport Policy Institute, May 2002, Transportation Research Board
Conference on Transportation and Economic Development, Portland, OR

http://www.marshall.edu/ati/tech/PortlandConference/updatedPDFs/Portland_Litman.pdf

From Abstract. [This paper] investigates the optimal level of motor vehicle use, and the degree to which [Transportation Demand Management (TDM)] strategies that reduce automobile travel are justified based on economic principles. This paper identifies various market distortions that result in economically excessive automobile travel . . . It summarizes research on the economic development impacts of various transportation investments and management policies. This analysis suggests that TDM strategies can increase economic productivity and development, and are often better investments than capacity expansion projects. However, TDM policies and programs must be well planned to provide maximum economic development benefits.

Study of the Economic Benefit Potential of Intermodal Transports

J.M. Nelson, R.T. Kawai, and R.D. Grego, April 2001, *Report No.'s NAS 1.26:219847 and NASA/CR-2001/210847*, Boeing Commercial Airplane Company, Seattle, WA

Abstract. A conceptual study was conducted to determine the benefit potential of an intermodal transport in which quick change payload modules are used to reduce the cost of air travel by increasing daily utilization. Three basic concepts varying the degree of modularity were investigated for a 122,000 pounds payload 3,000 NM range regional wide body transport. The profit potential for operating as a passenger transport during the day and as a freighter at night was assessed. Assuming current levels of profitability, intermodal operations could offer an operating cost reduction potential up to 20%. Enabling technology needs are identified as very quiet aircraft for expanded night operations, distributed load carrying quick disconnect latching, and configuration dependent safety issues. Recommendations are made to explore if additional benefits are possible from alternative mission and usage modules.

An Analysis of the Economic Impacts of Florida High Speed Rail

T.A. Lynch, N. Sipe, S.E. Polzin, and S.E. Chu, 1997, Center for Urban Transportation Research, University of South Florida; Florida Department of Transportation; and Florida State University, Tallahassee, Center for Economic Forecasting and Analysis

Abstract. This report is one of three documents produced reporting on the impacts of Florida high speed rail. The three documents consist of two technical reports and an executive summary. This report addresses specific impacts of interest to planners, the public, and decision makers. These economic impacts are discussed and quantified in their respective units of measure: jobs (expressed as person years of employment), wages and salaries (expressed in 1997 dollars), and economic output (also expressed in 1997 dollars). This report is organized to briefly describe the transportation market in Florida and the Florida Overland eXpress (FOX) plan, followed by a more substantial discussion of the methodology and findings of the analysis.

Methodology Studies:

Transportation Infrastructure and Economic Activity: Evidence Using Vector Autoregression, Error Correction and Directed Acyclic Graphs

Steve K. Peterson and Eric L. Jessup, 2007, Transportation Research Forum, 48th Annual Forum, Boston University

This paper describes how prior analysis regarding transportation infrastructure has often focused on the aggregate effects of public investment on economic growth or activity, usually at a national or state level. Modeling efforts that attempt to treat all counties as equivalent units, while assuming a homogeneous modeling structure for all the units, may miss important information regarding the statistical and causal relationships between economic activity and transportation infrastructure. This paper examines the interrelationships between infrastructure and activity using two Washington State highway infrastructure datasets in combination with county-level

employment, wage and establishment numbers for several industrial sectors for a subset of counties from 1990 to 2004. Estimations using vector autoregressions, error correction models and directed acyclic graphs are made. The results show that the relationships between infrastructure investment and economic activity are often weak and are not uniform in effect.

Empirical Analysis of Transportation Investment and Economic Development at State, County and Municipality Level

Joseph Berechman, Dilruba Ozmen, and Kaan Ozbay, November 2006, *Transportation: Planning, Policy, Research, Practice* 33(6): 537-551

Abstract: Although positive elasticity between transportation investment and economic development has been documented in many studies, the magnitude of the measured effect seems to decline significantly as the econometric model is further refined, mainly with regard to space and time lags. That is, the use of national or state data produces elasticity results which are much larger than when using county or municipality data. Similarly, when a lag between the times when the transportation investments are made and when the economic benefits transpire is introduced into the econometric model, the measured elasticities decline with the size of the lag. This paper investigates these issues analytically and empirically and provides a plausible explanation. The authors do so by using alternative econometric models and applying them to a database which is composed of longitudinal state, county and municipality observations from 1990 to 2000. Results show that transportation investments produce strong spillover effects relative to space and time. Many reported empirical results are likely to be overly biased unless these factors are taken into account.

Analyzing the Economic Impact of Transportation Projects Using RIMS II, IMPLAN and REMI

T. Lynch, October 2000, Institute for Science and Public Affairs, Florida State University

From Abstract: The focus of this study is to provide public transit managers, operators and planners Information with a well researched and simply presented comparative economic impact assessment guidebook for using each of these tools. The analysis will use each of these tools on an identical set of transit examples with varying capital, operation and maintenance and other costs and explain the pros and cons of each.

Equity Impacts of Transportation Improvements on Core and Peripheral Cities

Eran Leck, Shlomo Bekhor, and Daniel Gat, 2007, *Report No. 07-2263, Conference Title: Transportation Research Board 86th Annual Meeting, Washington*

Abstract: Equity is concerned with the spatial distribution of income and resources and is inevitably linked to concepts of fairness and social justice. This paper investigates the hypothesis that transportation improvements can generate tangible welfare economic benefits, such as wage convergence between core and periphery. Specifically, this paper aims to assess the impact of travel-time reduction on the improvement of economic equity among core and peripheral cities. The methodology applied in the study was to estimate both aggregated regression models and discrete choice models in an attempt to identify key variables affecting workplace choice decisions. Data used in the analysis was extracted from the 1995 Israel Census. The study estimates the effect of the main explanatory variables used in the model (travel time, wage differentials and employment ratio) for the specific case of southern cities in Israel. A simple example is presented to illustrate the wage convergence between poor southern towns (Greater Beer-Sheva Region) and affluent core cities (Tel-Aviv Metropolitan Area) as a function of travel time reduction.

Modeling Transport in Interaction with the Economy

F.W.C.J. van de Vooren, September 2004, *Transportation Research, Part E: Logistics & Transport Review* 40(5): 417-437

From Abstract: This paper presents a dynamic, interregional model about the economy, transport, infrastructure and other regional features. Its main characteristic is the interaction between

transport and economy. In this respect, the model differs from other transport models, where mostly either the economy influences transport or transport influences the economy. The simulation of time paths, the use of statistical data and the estimation of the coefficients of the model are explained. The model has been applied to the 40 regions of the Netherlands, resulting in long-term simulations of transport and economy on the basis of some policy scenarios. The model developed here allows for calculating future developments of transport and economy as well as effects of transport policy in space and time.