

**TRANSPORTATION INVESTMENT AND ECONOMIC
EXPANSION**

SUMMARY REPORT

**Prepared for
National Cooperative Highway Research Program
Transportation Research Board
National Research Council**



**LOUIS BERGER INTERNATIONAL, INC.
Washington, D.C.**

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Preface

This report is a summary of a research project sponsored by the American Association of State Highway and Transportation Officials (AASHTO) Special Committee on Economic Expansion and Development, to prepare a report on what we know about the **fundamental ways in which transportation investment affects economic expansion** in today's global economic climate. The research project was conducted by Louis Berger International, Inc., based on a synthesis of previous studies and the results of selected case studies covering all modes and types of transportation investments. This work is intended to help focus on priority transportation investments that are most supportive of the nation's and the states' economic expansion objectives. The findings and results of the research are more fully presented in a two-volume report that includes references to the previous work reviewed. Readers interested in a more complete synthesis of the subject may particularly be interested in Section V of Volume I which more fully discusses what we know and what we don't know about the linkages between transportation and economic expansion. This summary report presents a brief overview of the findings and conclusions presented in the full two-volume report.

Acknowledgment

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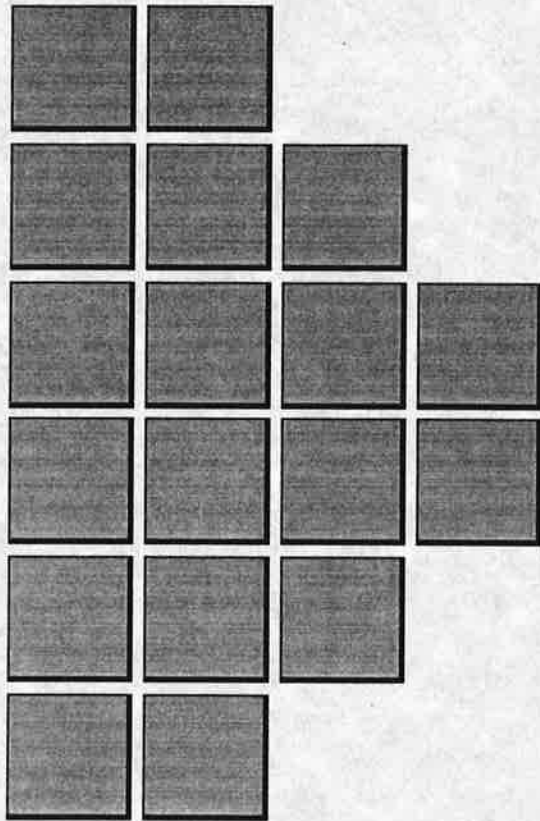
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Acronyms



**I. Transportation Investment, Economic
Expansion, Productivity and
Competitiveness**



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TRANSPORTATION INVESTMENT AND ECONOMIC EXPANSION: CASE STUDIES

I. Transportation investment, economic expansion, productivity and competitiveness

Transportation investment has played a key role in the development of the nation's economy. Throughout our history, the private and public sectors in the US have been leaders in transportation technology and service innovation.

Perhaps the most significant impact of recent major transportation investments, such as the Interstate Highway System and the National Airspace System, has been the improvement in connectivity and reduction in travel time between population, production and distribution centers across the nation. This improved connectivity, coupled with deregulation, has significantly improved the **productivity** of the transportation industry and other users of the system. The manner in which transportation investment can further increase productivity in what is increasingly a technology and service based economy is the most significant way in which transportation investments can influence economic expansion in the future.

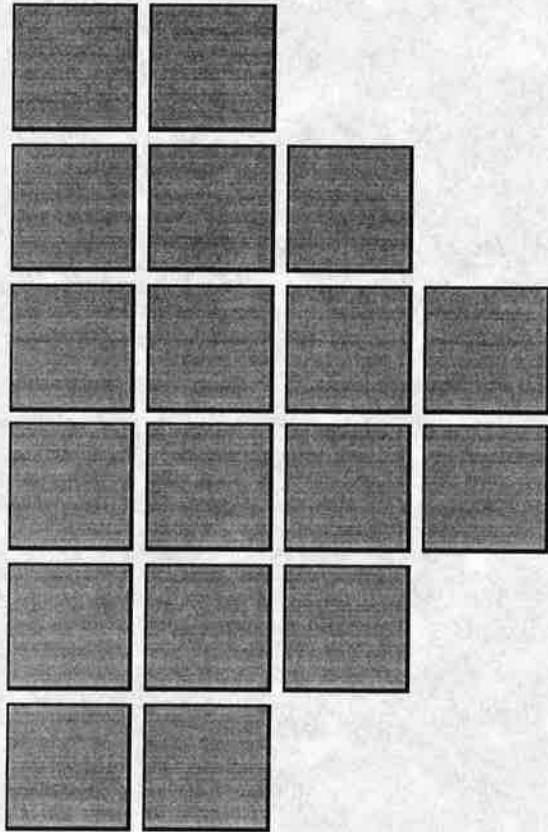
The US economy is continually being transformed as a result of many global demand and supply forces that affect the **competitiveness** of individual American businesses. To achieve or maintain competitive advantage, private firms must be able to produce and distribute their products and deliver their services faster at lower costs. To do so, businesses must continuously improve efficiency, raise product and service delivery quality, introduce new technology, etc. In response to the need to increase competitiveness, we are seeing trends in distribution and logistics, shipper requirements, and business location patterns that are revolutionizing the private transportation industry. Properly targeted transportation investments increase reliability, reduce congestion costs, and make possible inventory and related costs reductions. They are an important element to support industry restructuring initiatives and other efforts aimed at increasing national economic productivity.

The quality and cost of transportation services shapes the economic climate in which private firms compete. Improved transportation infrastructure and service delivery can promote or impede the achievement of competitive advantage. Although the US transportation system is unparalleled anywhere else in the world, other nations and economic blocks (e.g. the European Community, Japan and the Asean Economic Group, the four countries of the southern cone market of South America or Mercosur) recognize that transportation efficiency and productivity have played an important role in the success of American businesses in the global marketplace. These countries, either individually or as economic blocks, are therefore increasing their commitment to improving their transportation infrastructure. Many of these countries have made access to larger markets and growth through exports and trade one of their primary goals. With the US joining Mexico and Canada as part of NAFTA, the question we must face is how should our transportation system be further developed to meet the changing needs of the economy as American businesses increasingly face global

competition.

The quality of an area's transportation system also affects business location decisions. At the national, state or local levels, transportation investment remains an essential ingredient to retain the existing economic base, attract new target industries, and/or assure that the area's infrastructure can serve the needs of the growing sectors of the economy.

In addition to the direct impact of transportation on industry competitiveness, i.e. affecting the costs of moving people and goods, transportation infrastructure and services also affect the ability of industries to restructure their operations in order to achieve increased efficiency. Major additional increases in overall industry competitiveness are being achieved as a result of lower inventory costs, improved distribution systems, changes in production processes, and long-term industry restructuring, which are made possible by faster and more reliable transportation services. These additional impacts can be viewed as secondary effects of a transportation investment, and they are clearly becoming more important in increasing American industry access to global markets and national competitiveness.



**II. Fundamental Ways in Which
Transportation Investment is Linked to
Economic Expansion**



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II. Fundamental ways in which transportation investment is linked to economic expansion

Transportation investment is linked to the four major economic factors of production - **land, natural resources, labor and capital** - but its linkage to economic expansion is best understood by considering how investment influences the main component affecting growth in today's economic climate - **productivity**.

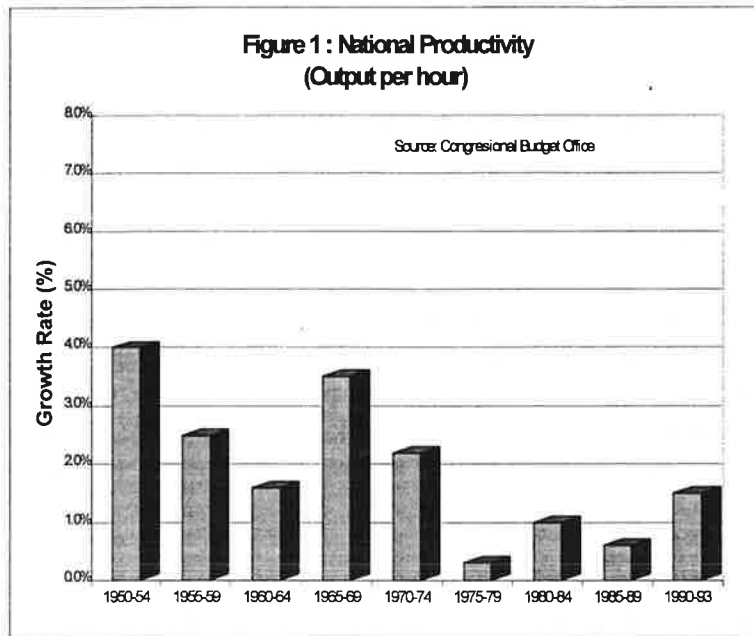
The most traditional view of looking at the economic impact of transportation investments lies in their importance in **opening up land and/or natural resources for development**, as was historically the result of the construction of ports, railroads, farm to market roads, mass transit systems, interstate highways and airports. All types of transportation facilities can increase **accessibility** to raw materials, markets, employees and consumers, thereby making land more attractive for agricultural, industrial, commercial or residential development. Without access, land usually remains unproductive.

An improved transportation system expands accessibility, **opening up job opportunities for individuals and increasing the labor pool from which employers can select employees**. Metropolitan area beltways and rapid transit development are examples of transportation investments that fundamentally change the accessibility of residential locations to jobs, the labor pool that employers can tap, as well as the long term pattern of residential and business locations in the area, making possible industry relocations. These types of transportation investments also can increase household and individual productivity, by reducing commuting times and costs, and thereby increasing time and disposable income for shopping, vacation/weekend travel and other leisure activities.

An improved transportation infrastructure is part of the capital investment that the nation or a state must make to increase the production capacity and efficiency of the economy. Since there is a total amount of capital to be invested for all purposes at any one time, public sector transportation investment can affect or "crowd out" the capital available for private sector investment needs. At the same time, transportation capital investment can add capacity and enhance productivity, raising the rate of return of businesses and encouraging more private sector investment. Therefore, **the key to stimulating long-term economic growth lies in properly targeted transportation investments that enhance productivity and result in a net increase in private sector investment**.

The most relevant way to look at the linkage between transportation and economic expansion is to consider how investment in transportation infrastructure can increase **national economic productivity**.

Nonfarm business productivity growth in the 1970s and 1980s was significantly slower than in the 1950s and 1960s. Yet, beginning in the late-1980s, it has been accelerating, reaching rates in the early 1990s comparable to the rates of the early 1960s. (see Figure 1) The long-term objective of transportation investment policy in the US should be to achieve economic expansion not through



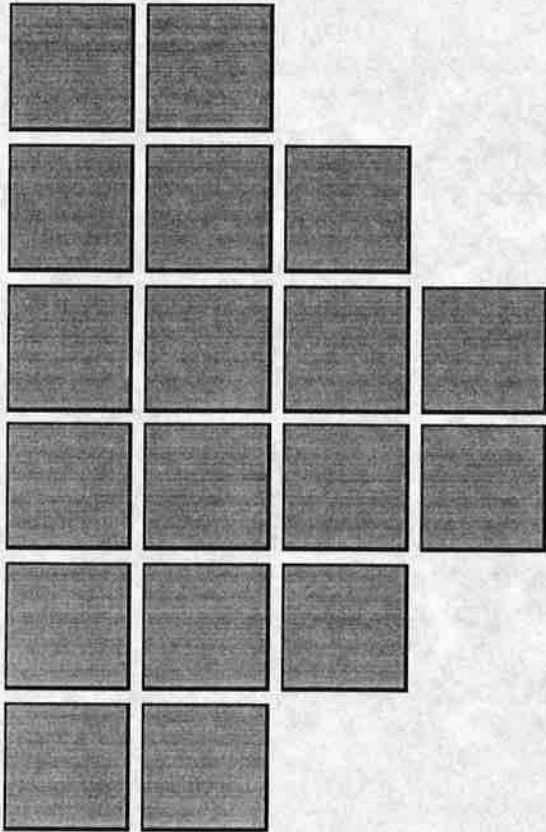
short term direct job creation but through increases in capacity, productivity and related production, distribution and service delivery efficiencies (increased output per worker-hour). Companies have been downsizing and modernizing their manufacturing, distribution, and financial systems, but to compete more effectively, American businesses need to also further reduce their transportation and inventory costs, and increase the speed and reliability of product delivery. Speed and reliability are also important to service industries, the fastest growing economic sector where most new

jobs are being created. Service industries have different transportation requirements, placing greater importance on access to customers, employee travel, and business travel. In the long-run, increased transportation productivity and reliability should result in a wider geographic reach and growing demand for a company's products or services and lead to increased competitiveness and economic development.

Transportation infrastructure investments to enhance the nation's economic productivity involve both public and private investments as follows:

- Public sector transportation investments, (e.g. introduction of new technology - such as Intelligent Transportation Systems (ITS) and other initiatives that lower costs, increase speeds, reduce congestion and travel times, and increase reliability).
- Private sector transportation industry investments, (e.g. introduction of higher capacity vehicles with lower unit costs and initiatives to increase fleet utilization).
- Private sector non-transportation industry investments (e.g., investments to introduce more efficient production and distribution processes based on reduced inventory levels, industry restructuring initiatives, etc.).

In the end, the impact of transportation investments on the nation's economic productivity is reflected in the competitiveness of the private sector businesses and the manner in which their transportation functions are integrated into their production, distribution and service delivery processes.



**III. Why is Transportation Investment
Important as a Public Policy Tool to
Facilitate Economic Expansion?**



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III. Why is transportation investment important as a public policy tool to facilitate economic expansion?

Transportation investment is an important tool to stimulate sustainable economic expansion long-term because it enables private companies to produce their products or provide services at a lower cost, thereby increasing their competitiveness. When an airport adds to its runway capacity, making it possible for more direct or faster airline service to new markets, businesses located in the airport's vicinity can compete more effectively. Similarly, when a new highway is built and the travel time is reduced for nearby businesses, companies can spend less on truck driver wages for deliveries, reduce truck wear and tear, and in general, the company can lower the cost to deliver its products to the ultimate consumer and/or increase the size of its market. Some of the most successful public investment programs in terms of long-term economic impact have involved the development of transportation infrastructure (e.g., the construction of the Interstate Highway System and an extensive air transportation network).

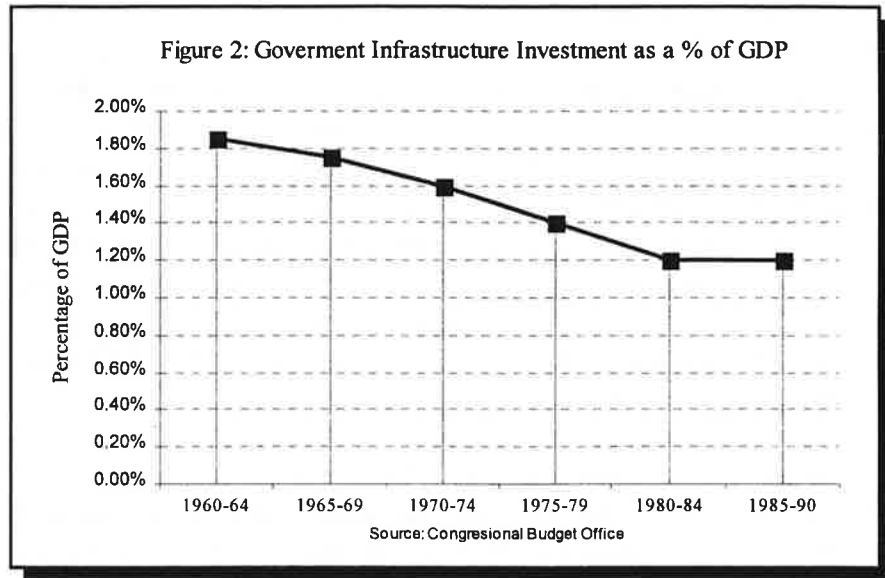
Transportation investment is similar to the spending on new factories, machines, computer systems, and warehouses that businesses make to increase their productive capacity and efficiency. Just as national or state policies are designed to stimulate or facilitate economic expansion by encouraging private investment in additional productive capacity, new technology and more efficient production and distribution systems, so should the federal government and the states and local jurisdictions consider how transportation investments can increase economic production capacity and efficiency.

The national debate about the budget deficit and the emphasis on reduced government expenditures at the state level has sometimes failed to recognize **the difference between operating expenditures and long-term investment**. A major portion of government transportation expenditure involves an investment in the future, and its impact should therefore not be measured solely in terms of short-term economic results. The impact of constructing new or expanded highways, airports, rapid transit systems, and other transportation facilities can take years to materialize, as has been the case in achieving the benefits of the Route 128 corridor in Boston or the I-70 corridor in Colorado. This time-lag in being able to achieve benefits from the investment should be expected, just as private corporations invest in major facilities and equipment knowing that it will take years to achieve their targeted financial return.

No business can survive without periodic investment to modernize its facilities and introduce new technology, nor can it afford not to conduct research to develop new products and services. However, there is no hard and fast rule as to what percentage of corporate resources should be spent on R&D or new product development. Long-term corporate growth generally requires a stable or growing level of commitment to capital investment and research. The same can be said about transportation investment and research and its importance to the nation's and the states' ability to successfully achieve a sustained economic expansion. The fact that infrastructure investment at all levels of government as a percentage of GDP has declined since the 1960s can therefore be viewed with concern. Similarly, federal government transportation expenditures have also declined as a

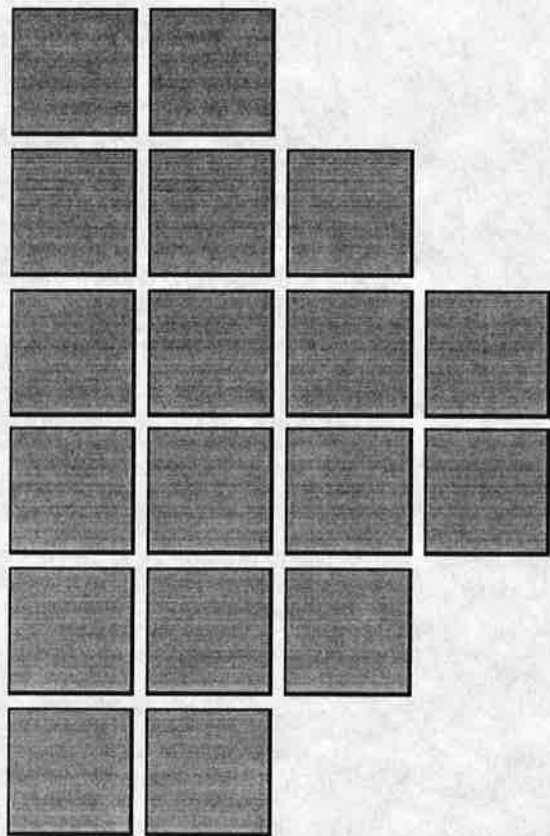
percentage of GDP.

In the early 1990s, two economists, David Aschauer and Alicia Munnell, brought attention to what they conclude is the nation's inadequate public investment in all types of infrastructure in the past two decades. (see Figure 2) They concluded that much of the decline in U.S. productivity growth rates that occurred in the 1970s was partly a result of declining rates of public capital investment in the nation's



infrastructure, including transportation. Both argued that public capital investments in infrastructure play an important role in enhancing both productivity and private economic activity. Other economists, e.g. Robert Eisner, contend that the evidence is still inconclusive, noting that the question "Does public capital investment contribute to more output?" is still unanswered.

In many respects, the cause and effect relationship does not matter as much as the recognition that **effective capital investment is necessary to sustain economic expansion**. One could argue that there can be no long-term economic expansion without transportation investment, because economic expansion implies serving larger, more distant and more varied markets. There is general agreement that transportation investment is an important ingredient to achieve or sustain economic expansion, i.e. whether to stimulate expansion or to support it once it is underway, the nation, the states and the private sector need to regularly undertake appropriate transportation investments.



**IV. How Does Transportation
Infrastructure Affect Private Sector
Productivity?**



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IV. How does transportation infrastructure affect private sector productivity?

To gain a clear understanding of how a firm or economic sector is affected by transportation infrastructure investments, it is necessary to understand the private sector motivation to maximize profits. Typically, when operating plans and production schedules are established a firm assumes the existing transportation infrastructure to be fixed. Similarly, in most cases, a firm will assume existing conditions in deciding where to locate.

Businesses will relocate and/or restructure their operating processes when they identify an opportunity to decrease costs or to profitably expand their operations. If transportation investments result in a less expensive or more reliable service, businesses and industries will respond in an attempt to reduce their operating costs or expand their markets. The cost reductions may result in increased profit and/or production. Such cost reductions can be achieved in numerous ways including decreases in business travel times, freight delivery time reductions, decreases in fuel and other operating costs, and opportunities for reducing inventory requirements as a result of improved reliability.

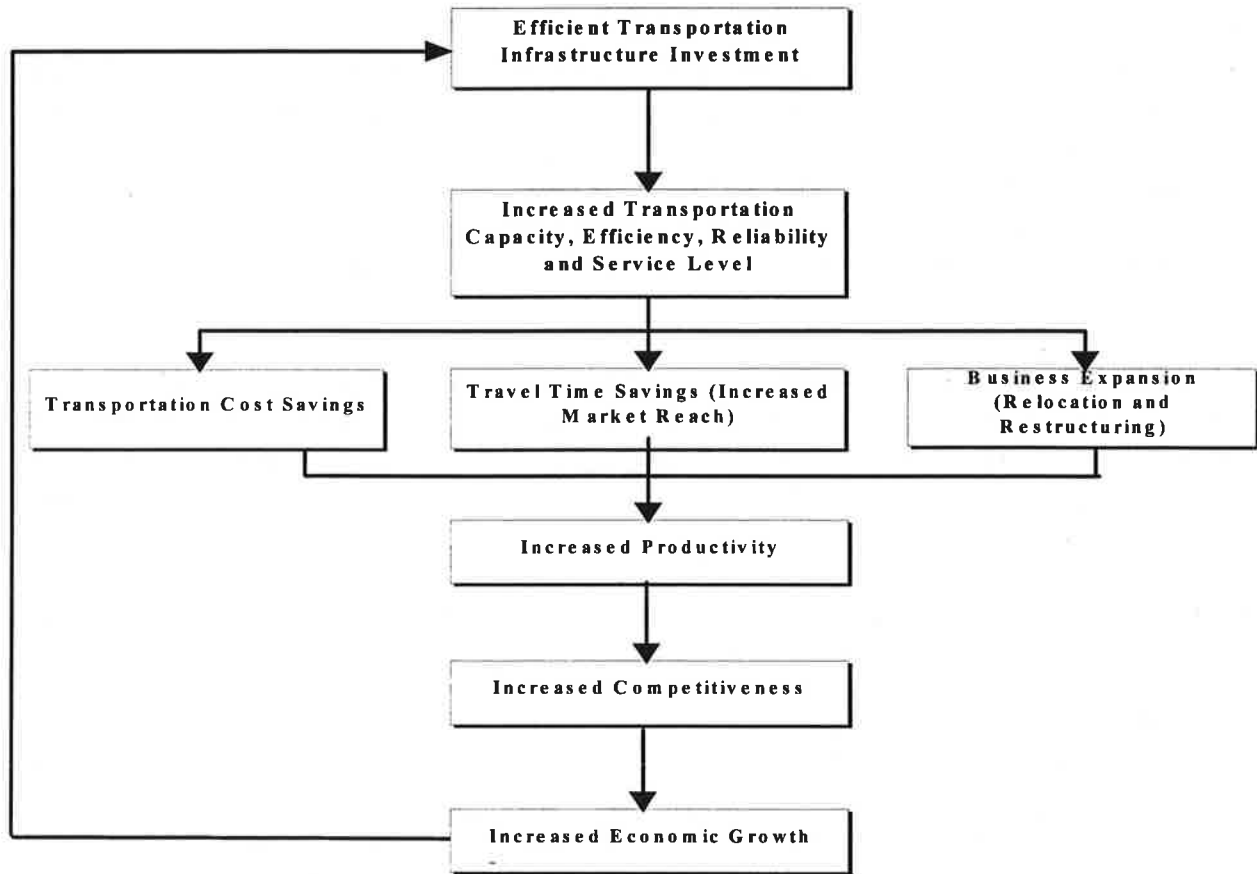
Expansion of operations as a result of a transportation investment may take place because of increased access to new and larger markets or restructured operations that reduce costs and increase competitiveness and profitability. Reducing costs and restructuring the production process of a firm or industry typically leads to productivity increases, creating an opportunity for expansion of production and economic growth.

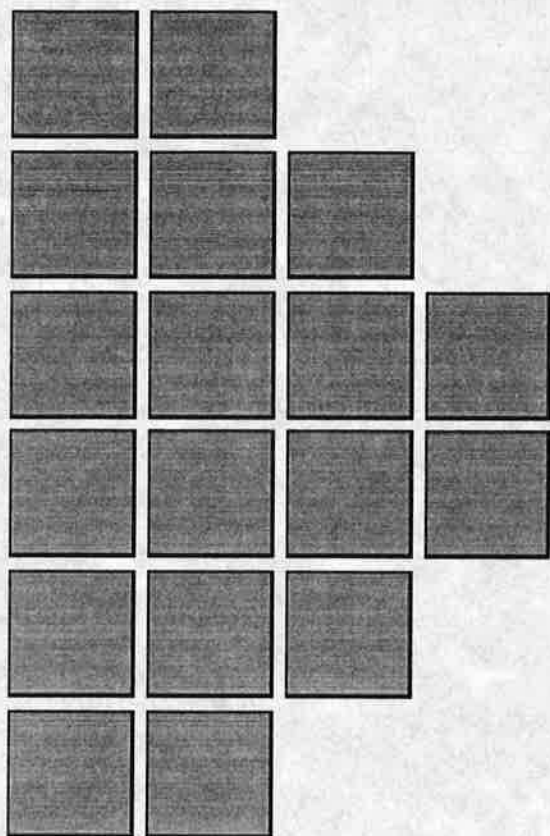
Transportation investment (capacity expansion, new technologies, use of larger and/or more efficient vehicles, etc.) can then lead to improved private sector productivity in several ways (see Figure 3):

- by reducing transportation costs for existing firms at their present locations;
- by making possible expansion of markets from existing locations, thereby resulting in increased output;
- by opening up opportunities for restructuring of manufacturing and distribution processes (reducing plant locations, production of certain parts at different locations with final assembly closer to consumers, reduction of warehouse locations and related inventory costs, etc.);
- creating opportunities for innovative, new, more productive businesses that are dependent on more reliable or faster transportation access.

In today's competitive global economy, a large company usually has multiple manufacturing and warehouse locations, requiring supplier-originated, intracompany and customer-bound shipments on a daily basis. The inventory requirements, transit times, equipment needs, transportation costs, and impacts on manufacturing production schedules are all factors that companies consider in reviewing opportunities for industry relocation and/or restructuring. Properly targeted transportation investments reduce logistics and distribution costs and lead to national productivity increases.

Figure 3: How does transportation infrastructure investment affect private sector productivity?





**V. Recent Economic Growth Trends and
Implications for Transportation
Investment**



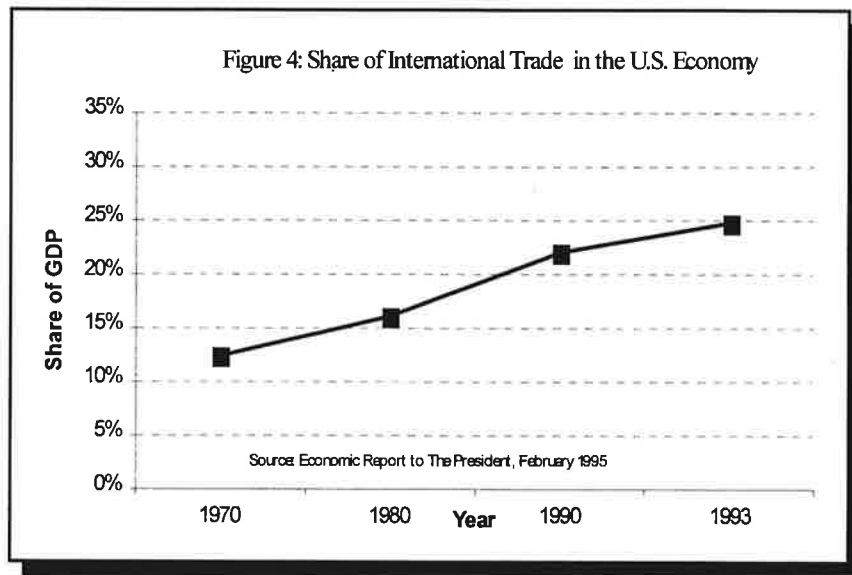
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V. Recent economic growth trends and implications for transportation investment.

The US economy has undergone dramatic changes in the recent past, many with significant implications for transportation investment. From an industrial base emphasizing mass production of standardized goods mainly for domestic consumption, the US economy has been transformed into a post-industrial economy. This post-industrial economy is increasingly service-oriented, with the faster growing service sector accounting for more than two thirds of GNP and four out of every five jobs. Most of the nation's jobs created since the 1970s have been in the service sector. The service sector is also evolving with rapid growth in the demand for travel, tourism, hospitality services and entertainment, as well as the emergence of new services based on new high-technology and telecommunications capabilities. Service industries place increasing importance on access to labor as well as consumers, and they rely more on the movement of people than goods.

At the same time that the US economy has become more service-oriented, another trend has been the increasing globalization of the economy and the importance of foreign trade and multinational production. The share of foreign trade as a percentage of GDP increased from 12% in 1970 to 25% in 1993. (See Figure 4)

The importance of international trade is highlighted by the recent creation and ongoing discussions regarding a few major multinational markets (North America, Europe, Asia, Mercosur). The economic forces and free trade policies that are generating increased worldwide trade tend to generate transportation demand, as products flow longer distances and regions specialize in



products which can be distributed competitively to a larger hinterland. This trend toward a global economy requires American businesses to compete with firms from around the world.

Partly due to foreign competition, basic manufacturing industries have declined in importance. To regain their competitiveness during the past decade, traditional American manufacturing companies have been downsizing and restructuring their operations. In addition, new smaller, knowledge-based manufacturing industries have emerged, producing a wider variety of specialized and high technology goods. Today, the manufacturing sector of the US economy is much more efficient than in the recent past. It produces fewer heavy, bulky products and lighter, higher-value goods, using

processes that are quickly adaptable to changing demand. Increasingly, final assembly of US manufactured products utilizes inputs partially assembled at decentralized locations, relying on a just-in-time (JIT) inventory system, and in many cases involving parts or partially assembled products originating in different countries around the world. A larger number of American manufacturers today require more frequent shipment of low-volume, higher-value goods, involving both domestic and international origins or destinations. Industry restructurings tend to generate increased transportation demand, since companies tend to disperse their manufacturing and/or concentrate distribution out of one or a few distribution centers serving the entire nation.

One other trend has been the increasing number of American firms that have evolved into large multinational corporations. The emergence of multinational corporations contributed to the growing integration of the US into the world economy. In such an integrated world economy, international trade will influence the structure and competitiveness of US industry, as well as future demand for domestic transportation services. The North American Free Trade Agreement, in particular, is also likely to significantly affect cross-border movements and domestic transportation patterns.

As the nation's economy evolves in a more competitive environment, transportation infrastructure and service requirements of American companies are also changing. Certain types of transportation investment are particularly important to support the expanding sectors of the economy. All businesses require local passenger transportation access to their plants, offices, warehouses, retail outlets, and service locations, for both employees and customers. In addition, many businesses increasingly rely on efficient, long distance passenger transportation services for their operations, e.g., the multinational companies, the tourism industry, and the professional services industry (computer, engineering, financial, management, etc.).

Some of the fastest growing industries and most competitive sectors of the US economy, the newer high-technology and knowledge-based industries (e.g. medical equipment, computer equipment and software, and telecommunications equipment) have short product cycles and increasingly rely on faster transportation service and improved reliability for their global shipments.

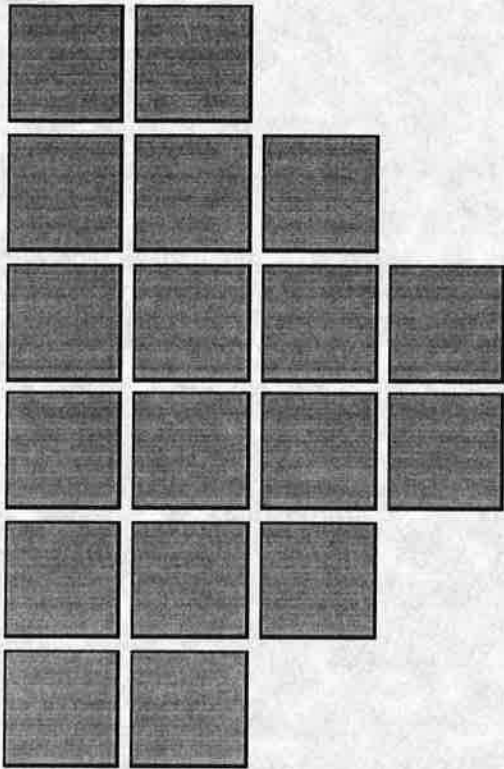
Globalization of the economy not only involves manufacturing industries, but all economic sectors, including services. While the overall US trade deficit has increased, the service sector has experienced an increasing trade surplus. Services generally tend to have a smaller hinterland. Although much smaller and dispersed, the expanding service industries also place importance in faster delivery and improved reliability for their freight transportation needs, such as distribution of ingredients for food service outlets, merchandise for retail outlets, and the overnight delivery of documents for the financial and information services industries. New technology, improved transportation and modern communications is increasing the hinterland of many service businesses, (e.g. the retail industry through mail order), and the market reach of the food service industry (e.g. making possible global chains of restaurants).

Some of the fastest growing economic sectors worldwide involve the industries encompassing travel,

tourism and hospitality services, which also generate increased demand for transportation, as people tend to travel more frequently or farther away on vacations.

Transportation is an even more important and significant factor for goods-producing industries than for service providers, representing a larger share of their total costs. Furthermore, companies are increasingly looking at freight transportation as part of their logistics needs. Thus American businesses are continually trying to reduce their total logistics costs, not solely freight transportation, but also inventory costs and customer requirements related to the production and distribution process.

The survival of domestic industries facing foreign competitive challenges is partly dependent on whether American products can be transported and delivered at a competitive price to a larger hinterland. In an increasingly competitive global economy, the availability of both efficient passenger and freight transportation services affects the competitiveness of American business. It is important then to continually invest to meet the changing and future passenger and freight transportation needs of the various sectors of the economy.



**VI. Types of Transportation Investments
and Their Impact on Economic
Expansion**



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VI. Types of transportation investments and their impact on economic expansion

All types of transportation investment (new systems, expansion of existing systems, and system preservation) influence economic expansion and competitiveness to the extent that they enhance accessibility, improve service quality and reliability, increase capacity, and/or reduce transportation costs.

The development of a **new** transportation system, whether at a national or regional level (e.g., adding a controlled access highway system, a high-speed intercity rail system or a metropolitan rail rapid transit system), is an infrequent and costly undertaking. A new transportation system is typically implemented to achieve a higher level of service, by introducing new technology or significant improvements in the use of previously deployed technology. Historically, the introduction of rail and aviation technologies are the best examples of how new technology can significantly improve transportation service and impact economic activity patterns and expansion. The National System of Interstate and Defense Highways is perhaps the best example of new system development using previously deployed technology. A magnetic levitation system, a high-speed intercity rail system, or a national ITS (Intelligent Transportation System) are examples of possible future systems using new technology presently under study. A national truck-only corridor system is an example of a possible new system using existing technology.

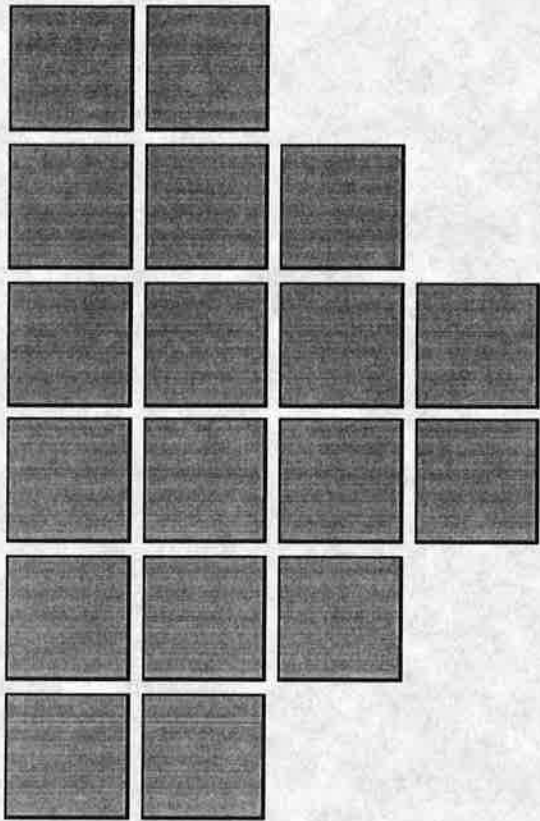
The history of transportation clearly demonstrates that a new transportation system, whether involving existing or new technology, has a large impact on economic expansion. Over time, such investments generally result in **fundamental changes in development patterns, increased productivity, and improved living standards**. However, it has always been difficult to fully foresee the impacts of the introduction of new technology and/or significant increases in service levels not previously experienced.

A more typical transportation investment is the expansion of an existing system by adding new facilities, e.g. a new highway, rapid transit line, a port terminal, airport, etc. System expansion improvements may also involve adding new technology, such as coordinated highway traffic signal systems, computerized traffic incident control systems, new microwave or GPS-based landing system and other air traffic control technology, semiautomatic container cranes, automatic vehicle identification equipment, and other cargo handling equipment. The proposed 155,000-mile National Highway System is an example of a significant system expansion. Most transportation system expansion investments have at least one of these fundamental objectives:

- increasing accessibility (for people and businesses) and market reach (for jobs, products and services)
- expanding capacity
- reducing congestion and delays and thereby, increasing reliability
- improving safety, and/or
- supporting land development and economic growth plans

To the extent that these transportation investments reduce costs, expand the size of the labor pool, and improve productivity, they will also influence private sector competitiveness.

The preservation and maintenance of existing transportation facilities are frequently not adequately considered nor given appropriate priority when identifying transportation investment requirements. Once a transportation facility is built, it becomes part of the infrastructure supporting the economy of an area. Businesses and individuals rely on it for their transportation needs. **The condition of a facility is then as important in supporting the nation's or the states' economic objectives as its existence.** The lack of regular maintenance and periodic rehabilitation of existing infrastructure (bridges, highways, railroads, airway systems, airports, port access channels, port terminals, etc.) can lead to route closings, increased user operating costs, delays, reduced speeds, and other similar negative impacts that affect area industries and businesses. Although efficient system operations and adequate maintenance do not typically generate the interest or excitement associated with building a new facility, it is fundamentally as important to support economic activity.



**VII. Roles of Different Modes of
Transportation in Influencing
Economic Expansion**



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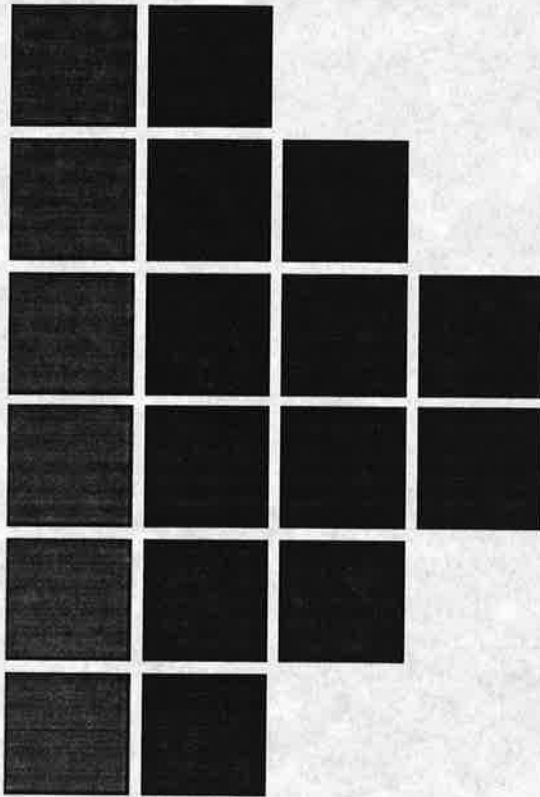
VII. Roles of different modes of transportation in influencing economic expansion.

All types of transportation investment support an area's economic activity and expansion. However, investments in different types of transportation projects, modes and locations can have very different purposes and result in different impacts in terms of stimulating economic expansion or productivity increases. Ten cases were selected to help identify how different modes and types of transportation investments influence economic growth. The cases are diverse enough to include projects involving:

- all modes of transportation;
- urban and rural settings;
- both freight and people movement; and
- both system preservation and facility expansion.

The following pages summarize what is known about how different transportation modes and types of transportation investments influence economic growth, based on the lessons learned from each of the following case studies:

1. National Highway Programs - Case Study: Interstate Highway System
2. National Aviation Programs - Case Study: National Airspace System
3. Railroad Investment - Case Study: Pennsylvania Railroad Clearance Projects
4. State Transportation Economic Development Programs - Case Study: Michigan, Minnesota, Wisconsin, Pennsylvania, and Georgia
5. Rapid Transit Development - Case Study: BART, MARTA, SEPTA and WMATA
6. Highway Investment and Tourism - Case Study: Impact of I-70 on Colorado Tourism
7. Port and Airport Economic Impacts - Case Study: Oakland, California.
8. Metropolitan Beltways - Case Study: Route 128 and I-495, Boston, Massachusetts
9. Border Crossings - Case Study: Laredo, Texas Port of Entry
10. Dredging of Port Access Channels - Case Study: Baltimore, Maryland



1. National Highway Programs
Case Study: Interstate Highway System

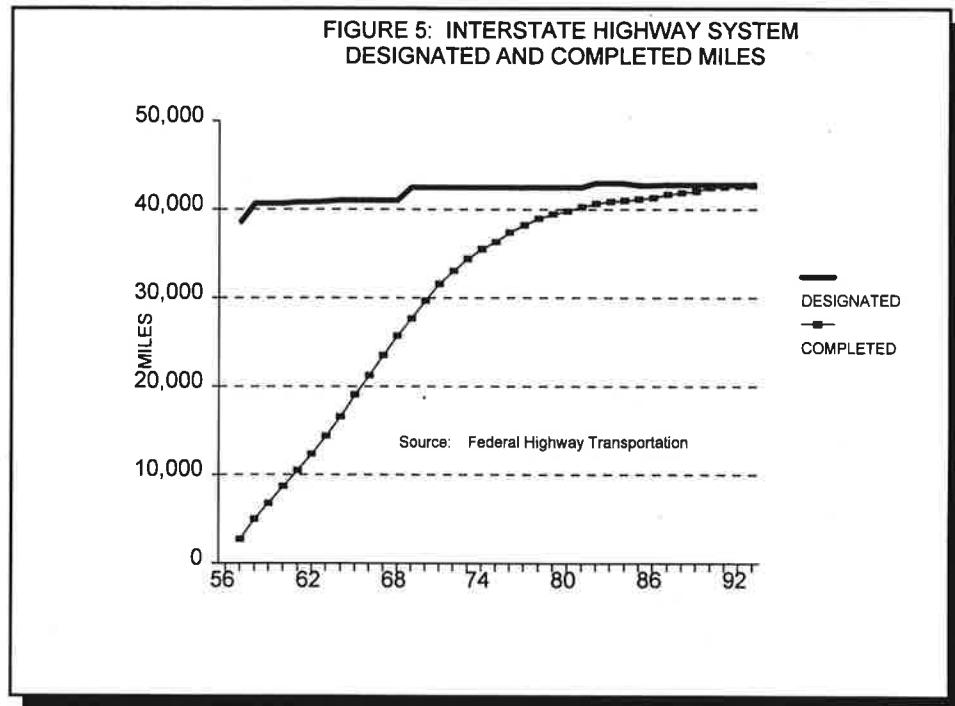


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1. National Highway Programs - Case Study: Interstate Highway System

Investment Description

The Interstate Highway System, approved in concept in 1944 and initially funded by the Federal Highway Act of 1956, has been called "the most ambitious public works program since the Roman Empire" and represents perhaps the largest single infrastructure investment program ever undertaken in the US. More than 37 years after the main funding source was approved, less than 100 miles remain to be completed on the 42,800 mile system. (Figure 5) In 1956, the initial 38,548 mile system was estimated to cost \$27 billion to complete. The latest estimate to complete the since expanded system is \$129 billion, of which \$116 billion has been spent.



The Interstate System case study demonstrates the significant effects of a transportation investment at the national level involving a new system using existing technology to achieve a higher level of service. This case study also highlights the implications of such a massive investment in terms of longer-term maintenance and rehabilitation requirements.

Investment Objectives

The basic rationale for the system was to connect all major cities in all states, most State capitals, tourist attractions and key industrial areas, defense establishments, and major economic centers by the construction of a limited access highway network to the highest engineering standards (70 mph design speed) that would be able to move long-distance interstate commerce traffic faster and more efficiently. The system was designed to carry a large portion of the long-distance travel nationally, based on estimated traffic volumes to meet the anticipated demand for a 20-year planning period.

Results Achieved

The Interstate System reshaped the economics of residential, commercial, and industrial locations

throughout the nation, providing a level of mobility and accessibility unequaled anywhere else in the world. Construction of the system has made it possible for individuals to commute to their work places from distant low-density rural and suburban areas. Similarly, coast-to-coast trucking services became competitive. The result is that firms have been able to reduce their warehouse locations and production facilities, so they can now efficiently serve the entire US from a few, and in some cases a single, plant(s) and/or warehouse location(s).

One of the most significant impacts of the improved highway infrastructure has been the improved connectivity between population, production and distribution centers, resulting from the higher service level, homogeneous highway network, serving all areas of the country. The system also made possible overnight delivery services to more locations, larger service areas for warehouses, plants and retailers, and a significant reduction in order cycle time - the time that elapses between the receipt and delivery of an order. The improvement in Interstate connectivity, coupled with deregulation, has resulted in significant reductions in transportation costs and travel time, which are reflected in **productivity increases** for the private transportation industry and other users of the system.

In addition to the direct impact of the investment on industry competitiveness, i.e., the actual costs of moving people and goods, the Interstate Highway System also affected business location decisions and the ability of industries to restructure their operations in order to achieve increased efficiency. Major additional increases in overall industry competitiveness have been achieved as a result of lower inventory costs, improved distribution systems, changes in production processes, and long-term industry restructuring, which were made possible by faster and more reliable trucking services. These additional impacts have been particularly important in increasing American industry access to global markets and national competitiveness.

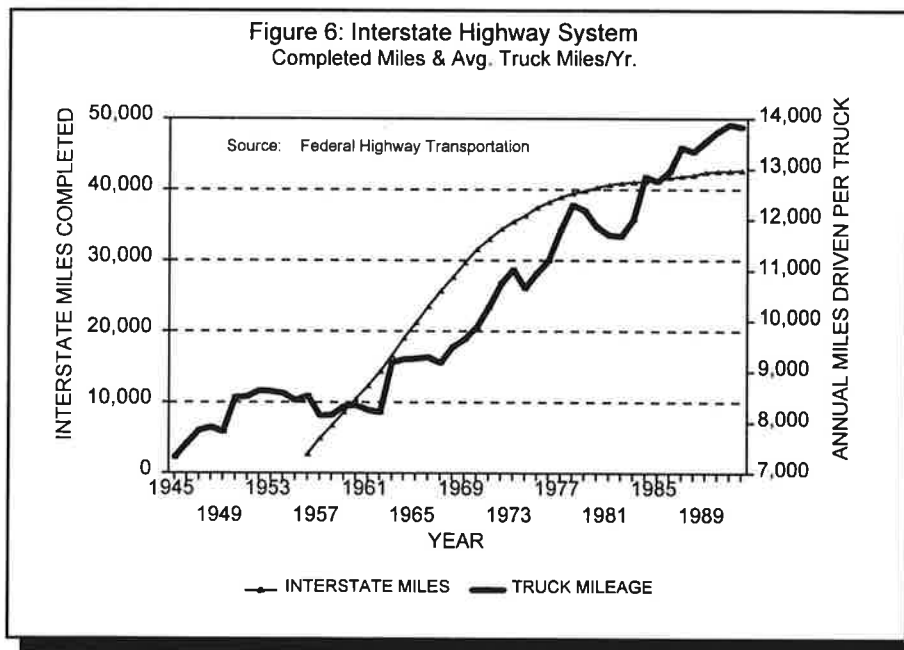
The Interstate Highway System then has had profound implications on land and economic development, as well as economic productivity. Although there is no known study that has quantitatively looked at the effects of the investment nor the life-cycle costs, and although there is no simple way to measure the linkage between the investment and economic well being, productivity and development, several conclusions can be reached:

- The most direct, readily measurable, and fundamental way in which the Interstate Highway System influenced economic development is by reducing the transportation costs to move people and goods between one location and another across the US. The system now carries more than 21% of all highway travel, an indicator of its importance to the national economy.
- The Interstate System made possible the development of reliable, coast to coast trucking services, thereby increasing options and service for freight movements. The system resulted in a reduction in the cost of consumer products and the ability of firms to serve consumer markets from fewer plants or warehouse locations. Since

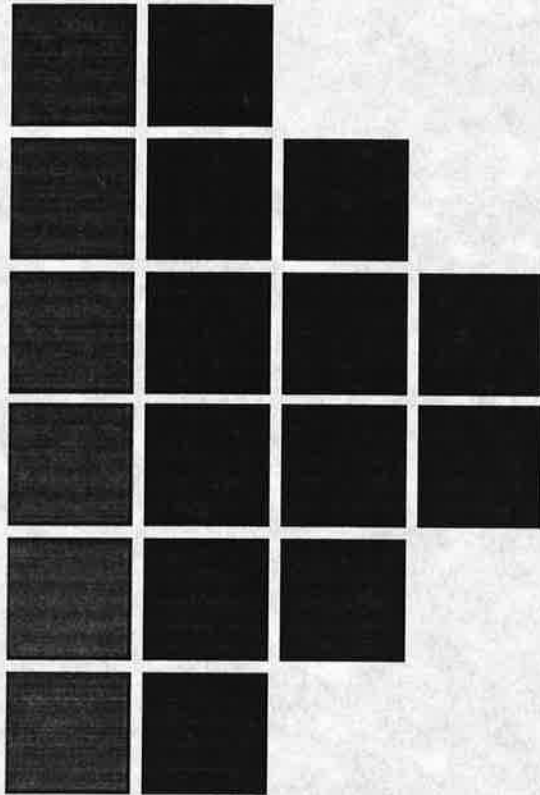
the 1960s when the miles of completed Interstate highways began to rise rapidly, the average miles per truck have also increased rapidly (see Figure 6).

- The local and regional impacts of the Interstate Highway System on land development have been profound, particularly in shaping urban development.
- The Interstate Highway System was probably one of the most important factors affecting personal mobility during the last 50 years, as indicated by the large increase in average distance driven for various trip purposes and the average annual miles driven per person.
- Access to an Interstate highway has become an important factor in business location decisions.
- Based solely on the economic savings from reduced accidents, injuries, and fatalities over a 30 year period, an argument can be made that the system has paid for itself.
- Traffic congestion costs on urban Interstate highways are huge and growing; Interstate highway improvements which alleviate congestion contribute to creating a more productive environment.

Continuing investment in the Interstate Highway System will be needed to assure that the system continues to serve the economic needs of the nation. Lack of proper maintenance or rehabilitation



(e.g., the lack of timely snow removal, deferred pavement resurfacing, etc.) results in increased transportation costs and delays, which negatively impact businesses and economic productivity. Continuing investments aimed at increased efficiency are essential to preserve service levels, introduce improved technology (such as ITS), as well as to add connections to other highway systems and transportation modes.



2. National Aviation Programs

Case Study: National Airspace System



LOUIS BERGER INTERNATIONAL, INC.

2. National Aviation Programs - Case Study: National Airspace System

Investment Description

The National Airspace System (NAS) is the largest and most technologically advanced aviation infrastructure in the world. It is probably the most complex, but one of the least visible elements of the nation's transportation infrastructure. Its purpose is to control air traffic, and provide information and communications links to pilots. It is also one of only two elements of the nation's transportation network that is solely a Federal government responsibility (the other is the waterway network).

In 1981, the Federal Aviation Administration (FAA) published the first National Airspace System Plan (NAS Plan). The plan involved a comprehensive strategy for improving the safety, capacity, and productivity of the air traffic control system. The Congressional Budget Office (CBO) estimated the total cost of the plan to be approximately \$10.7 billion, the investment would begin in 1982 and would continue over two decades. At the time, this investment represented roughly 36 times the previous capital expenditures for air traffic control, and one of the largest federal public investments works ever undertaken. By 1991, more than 40% of the original NAS plan projects were completed. Additional projects have been added over the years to reflect new opportunities for cost reductions and to introduce new technologies.

As is the case with any plan, the NAS Plan is an evolutionary document and many of the proposals in the original Plan have been updated and are reflected in newer versions of the Aviation System Capital Investment Plan. For example, originally, the FAA had planned to use a Microwave Landing System (MLS) as a replacement for the current Instrument Landing Systems (ILS) Category I/II/III precision approaches, providing a new curved approach capability. More recently, the FAA is emphasizing the Global Positioning System (GPS) instead of MLS. GPS is intended to be used for Category I approaches and possibly will also supplant MLS for Category II/III approaches. GPS will also provide on-route navigation.

Investment Objectives

The NAS involves the deployment of new technology, with the objective of achieving increased public sector productivity, while also requiring private investment to achieve the intended improved efficiency, since the new technologies are dependent on aircraft-based equipment. The FAA proposed the original National Airspace System Plan in 1981, partially in response to increases in demand for aviation services and forecasted increases in air traffic and facilities operation costs over the next 20 years. The plan has evolved into an annually revised planning process for facilities, equipment, and associated development required to operate and maintain the airspace system.

Although the airways system handles a relatively small percentage of the nation's total person travel and freight movement, its importance can be best understood when considering that:

- nearly all international travelers other than from Canada and Mexico arrive or depart the US by air, and
- in 1990, about 28% of the value of all exports departed the US by air.

The air transportation system is particularly important to the tourism industry and to companies competing internationally. The original 1981 FAA plan specifically identified four broad goals:

- Reduce the cost of operating the traffic control system,
- Accommodate anticipated growth in air traffic,
- Improve the safety of air travel, and
- Upgrade the quality of flight services.

The FAA's investment would reduce the cost of operations and accommodate future air traffic growth as efficiently and safely as possible. Greater automation within the system would facilitate further system efficiency gains. The resulting improvements in labor productivity from the new technologies would allow increased facilities consolidation, staff reductions, and provide for future air transportation needs. The NAS plan is based mostly on technology development and achieving higher productivity in the operation of the airspace system and in the use of the system. Although the FAA has modified its approach and proposed technology as the plan evolved, reflecting new opportunities for cost reductions, new technologies, and industry requirements, the objectives have remained the same. Recent versions of the plan have placed increased emphasis on increasing user preferred routes and altitudes that minimize operating costs

Results Achieved

The NAS improvements and the investment in new technology have resulted in increased productivity (flights per traffic controller) and savings for both users and nonusers of the system. It has also contributed to US technological leadership in an area with great potential for increasing exports.

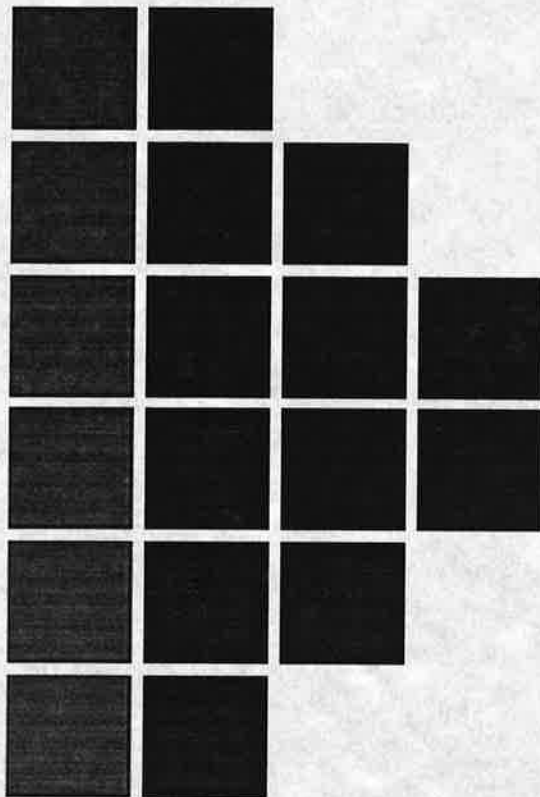
The plan was based from the outset on a rigorous analysis of economic benefits and costs. In general, the investment resulted in the following:

- increased capacity to meet increased demand for flights,
- decrease in air transportation travel time, reduced congestion, and increased reliability for passengers and time-sensitive freight,
- reduced airways operating costs, which should be reflected longer term in lower taxes or fees for passengers, air carriers, and other system users, and
- reduced aircraft and airline operating costs (through lower fuel use and less flying time), which should be reflected in lower airline fares or air cargo rates.

The NAS investment then has resulted in lower air transportation costs and increases in the service

levels air carriers can offer, thereby increasing the market reach of the nation's products and services. At the same time, it increases the competitiveness of the US in the global marketplace, both through the technology development and through the additional air service links that it makes possible.

The investment directly contributes to economic development through increased air traffic controller productivity and decreased air transportation costs. These benefits accrue not only to persons and businesses that use the airways. Lower air transportation costs may be passed on to consumers as lower prices for consumer goods that move by air, to workers as higher wages, or to owners of businesses and aircraft equipment as higher net income.



3. Railroad Investment

**Case Study: Pennsylvania Railroad
Clearance Projects**

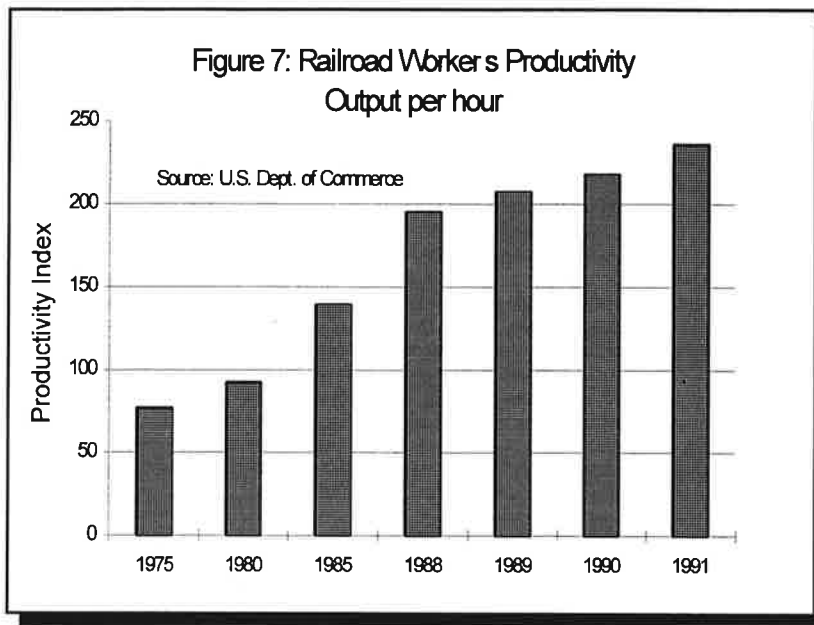


LOUIS BERGER INTERNATIONAL, INC.

3. Railroad Investment - Case Study: Pennsylvania Railroad Clearance Projects

Investment Description

Public sector transportation investment can result in economic expansion primarily through increased productivity achieved by private sector transportation carriers and/or users of their services. The US is probably the only country in the world where the railroad system was



developed and is mostly operated by private enterprise. More than 50% of cargos moving by railroads are bulk commodities that in most cases, cannot cost-effectively be moved any other way. In some cases, such as coal, railroad costs can significantly affect the competitiveness of US exports. Since deregulation in the early 1980's, the railroad industry has significantly improved its productivity (Figure 7). The primary increases in productivity occurred because

of reductions in the labor force, increases in equipment utilization, network downsizing, and use of new rail car technology.

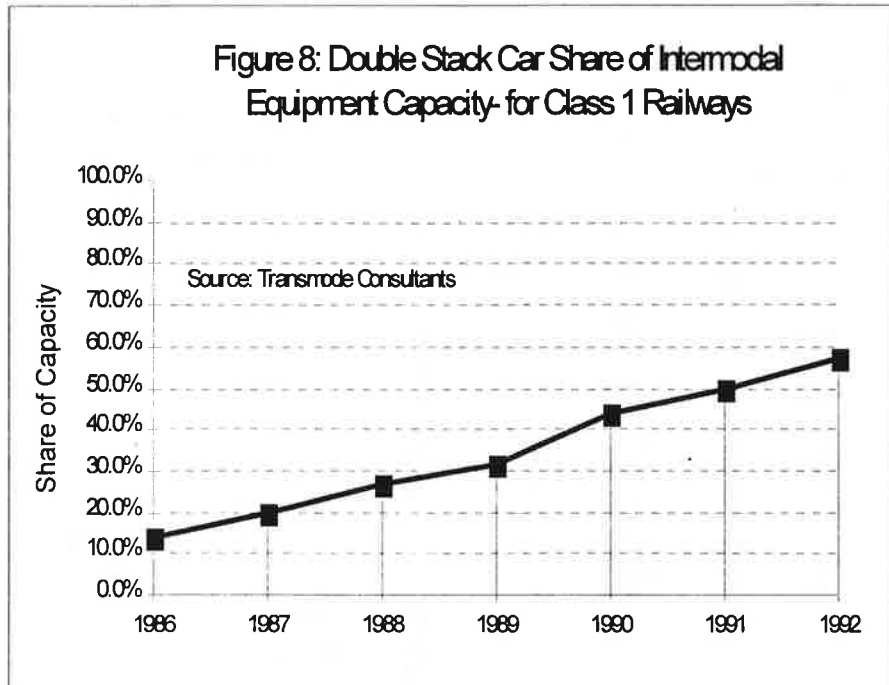
After many decades of losing volume and market share of general merchandise cargo to the trucking industry, railroads have recently started to attract back additional general merchandise cargo businesses. Governments and railroad carriers have recently been investing in double stack equipment, new modern intermodal terminals, and line-haul clearance improvements, so as to reduce costs and increase productivity to move intermodal cargo.

The major ways in which railroad investment can influence economic expansion in today's economic environment is by:

- the application of new technology to reduce costs and increase productivity;
- investing in clearance and terminal improvements that also reduce operating costs, streamline intermodal connections and increase productivity; and
- restoring lines, adding connections or preserving service to attract industrial development.

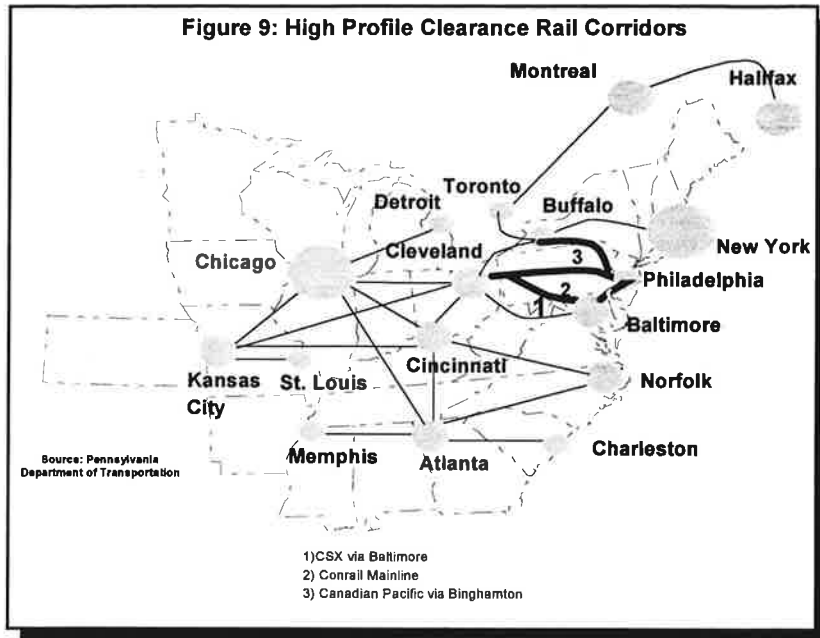
Freight rail service and costs can have a significant impact on a state's competitiveness. The State of Pennsylvania and other eastern states faced such a situation when the rail industry (following the initiative of American President Lines and other steamship lines) began to use double stack rail cars for intermodal services in the mid-1980's. Double stack railcars can result in significant line-haul cost savings (more than 40% compared to conventional intermodal cars). Double-stack

services first started operating from the West Coast ports mainly to move international cargo inland. The efficiencies made possible by the new railcar technology can be increased if the equipment is more fully utilized, so railroads and other operators of the service (steamship lines) quickly began to use available capacity to fill slots with domestic cargo. The double-stack network has expanded rapidly (Figure 8), and is one



of the main reasons why rail intermodal services have grown rapidly in recent years, even attracting truckload carriers.

In December 1992, Governor Casey signed legislation (Act 188) to provide funding for three Pennsylvania railroad clearance projects in cooperation with the three railroads involved, Conrail, CSX, and Canadian Pacific. These projects will increase clearances to allow use of higher capacity, more efficient rail cars, such as double-stack container rail cars and triple-level auto-rack rail cars, on three major rail corridors. (see Figure 9) Negotiations with the railroads occurred between January and April 1993, and construction began immediately thereafter on the Conrail and the Canadian Pacific railroad lines, representing an investment of \$35 million. Work on a third corridor is also being pursued, pending formal commitment by CSX and the state of Maryland, since this third corridor also involves connections through that state. The project is scheduled to be completed by December 1995.



Investment Objectives

The railroads were an important catalyst in bringing the need for this investment to the attention of policy makers. The project is being implemented as a public-private partnership (the state's share was estimated at 30% of the total for the three corridors). It is clear that the state and the railroads have very different investment objectives. For the State of Pennsylvania, the objectives include:

- 1) providing higher productivity, lower cost transportation service to manufacturers and distributors who operate from Pennsylvania;
- 2) attracting additional business, such as central distribution and warehousing services, wholesale distribution, and integrated retail firms operating throughout the North-East region; and
- 3) encouraging economic development.

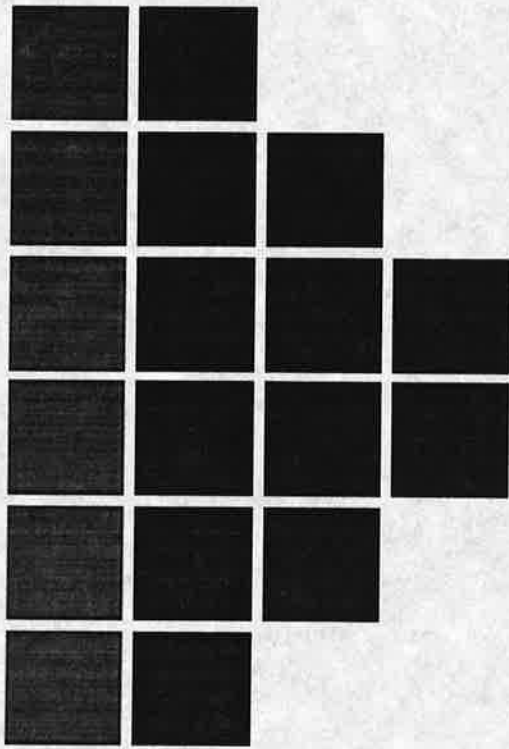
For the railroad, the objectives focused on developing new markets and increasing their intermodal competitiveness. Both the state and the railroads benefit if the investment attracts additional cargo as a result of the improved transportation service.

Results Achieved

A benefit-cost analysis of the clearance projects estimated that the net present value of the benefits would add up to \$373.2 million to the year 2000, compared to \$72.4 million in construction costs. Although the project is still in its implementation stage, the following conclusions regarding how transportation investment can impact economic expansion can be drawn:

- A public-private partnership may be an appropriate way to achieve needed transportation improvements when the private carriers are unwilling to make their own commitments and there are some broad public sector objectives to improve an area's competitiveness.

- Transportation service availability (such as double-stack container service or triple-level auto-rack service) can be a significant competitive factor for industry site selection and retention of existing businesses.
- The transportation investment commitment by the State, including spending public funds on privately owned assets, reflects the importance of maintaining a competitive transportation service to attract and retain industry.
- The investment was originally considered to improve the competitive position of the Port of Philadelphia for international cargo, but analysis concluded that the largest beneficiaries of such an investment are the domestic shippers making it possible for the State to participate in the rapidly growing long-haul domestic container markets with profound implications for Pennsylvania-based manufacturing and distribution industries.



**4. State Transportation Economic
Development Programs**

**Case Study: Michigan, Minnesota,
Wisconsin, Pennsylvania and Georgia**



LOUIS BERGER INTERNATIONAL, INC.

4. State Transportation Economic Development Programs - Case Study: Michigan, Minnesota, Wisconsin, Pennsylvania, and Georgia

Investment Description

State and local economic development officials have long recognized the importance of a transportation infrastructure among the factors considered by businesses in their site selection process. In recent years, nearly half of the states have established programs to address specific new or upgraded highways and/or rail and other transportation access needs, aimed at attracting or retaining businesses and industries. These state transportation programs are closely tied to broader state economic development programs. The programs include both near-term targeted projects benefiting specific private developments and/or longer-term regional projects which set the stage for economic development.

The case study explored several examples of state transportation investment programs with the specific goal of economic expansion in **Michigan, Minnesota, Wisconsin, Pennsylvania, and Georgia**. Typically, the program level for specific near-term investments targeted to attract specific private businesses is relatively small (about \$21.6 million in Wisconsin since the program's inception in 1987), while it generally involves a much larger investment level to complete long-term network improvements (e.g., \$627 million in additional investment was estimated to complete the Wisconsin Corridors 2020 program, a network of multi-lane divided highways connecting major activity centers).

Investment Objectives

Since most states continually face scarce fiscal resources for transportation investments, these programs provide a mechanism to specifically target funds for economic expansion. Through these transportation investments, the state seeks to enhance private economic activity and an improved statewide economy. In considering the allocation of scarce fiscal resources with the specific objective of economic expansion, these transportation programs typically balance competing claims for funds and consider:

- transportation needs,
- regional economic development benefits, and
- the implications on the beneficiary target industry.

Typically, states establish these programs to respond to **the competitive economic development efforts of nearby states and the need to reduce transportation costs and enhance productivity**, for example:

- In Michigan, the State found that it needed to offer incentives to firms such as foreign automobile manufacturers in order to successfully compete with other states, as well as to preserve its substantial job and manufacturing base in a period of rapid economic change. Michigan officials also were pursuing a diversification policy to reduce the state's dependency on the automobile sector.
- Pennsylvania defined a 12,000 mile Priority Commercial Network (PCN) comprised of the most important commercial routes for the movement of raw materials and manufacturing products, and has been working to further improve its highway system to support agribusiness and industrial park development
- Minnesota's Market Artery System objective was to eliminate spring weight restrictions on those highways most important to economic and shipping activities.
- In Georgia, the state has sought to improve its economic potential by funding transportation projects which improve accessibility and lower transportation costs for farmers, industry and tourism.

Some programs give priority to highway improvements which provide commercial and industrial access to rural or economically depressed areas.

Results Achieved

Direct linkages between state transportation economic development programs and measurable increments in productivity are difficult to identify as there are so many other individual and external factors affecting business location and expansion decisions, but the following conclusions can be drawn:

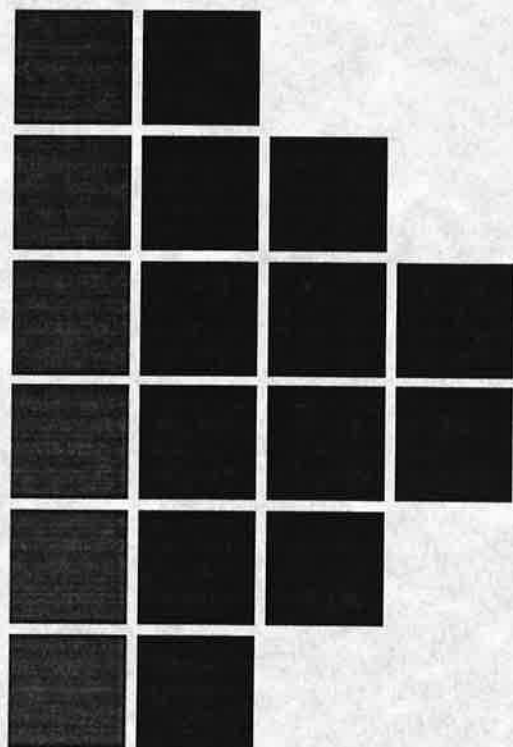
- Despite the best efforts of program officials, typically it is not possible to conclude whether a transportation investment in fact leads to a business location decision.
- A public/private partnership is generally required to ensure non-speculative economic development projects.
- State decisions for these investments are guided by overall state economic strategy; there are risks involved and the choice is similar to that which all private businesses make when deciding if it is worthwhile to reduce prices (or offer subsidies or other incentives) on an initial sale in order to ensure repeat business, increase volume, or enter a new market.

- Some state highway investment programs focus on **laggard economic centers** judged to have the strongest growth potential if access is improved. It is generally agreed that transportation investment does not ensure economic expansion unless other prerequisites also are there (natural resources, competitive labor, business climate, etc.).
- Some programs emphasize access to population and employment centers, seeking to ensure **connectivity** with regional, national and global markets. To the extent that such investments facilitate transportation industry productivity; improve access to raw materials, tourist destinations and other export industries; as well as increase the market reach of key industries in the State; such programs are likely to impact positively long-term economic growth objectives.
- Programs aimed at specific network deficiencies affecting productivity (such as bridge postings, seasonal truck restrictions, network-wide or specific locations with weight and/or size restrictions that affect truck routings and productivity, and intermodal connections) are most likely to result in transportation cost reductions to businesses.

In conclusion, **properly targeted** state highway investments to reduce transportation costs, increase the productivity of firms located in an area, or attract new business, **can** be a valuable tool to increase the competitiveness of a state or local area. As the individual states focus on how to attract jobs, attention is given to the factors that influence business location decisions, increase tourism and reduce business costs. As such, the states are competing in the context of global and national markets. By focusing on issues such as improved multi-state connectivity and lowering business transportation costs, the states are seeking improved access to distant markets, and eliminating congestion and obstacles that may influence industry competitiveness.

Other factors that will affect competition between states and local areas for jobs and priorities of state transportation investment in the future are the requirements of the 1990 Clean Air Amendments Act (CAAA). While some states will continue to follow a strategy of highway capacity expansion and targeted roadway investments for improving competitiveness, other states and regions, pressed by their non-attainment status, may determine that air quality conformity with the State Implementation Plan will have to be a priority. This latter objective will require more attention to such approaches as demand management (to reduce congestion) and land use controls.

Air quality attainment status is likely to affect business location decisions, transportation investments, the relative economic expansion potential of different regions, and the spatial patterns of national and metropolitan development. Similarly, the regulations may impact the efficiencies of moving people and goods, which may affect the relative competitiveness of industries within and between regions. As these implications continue to emerge within a context of global competition, states will want to continue to explore the economic development implications of their transportation investment decisions.



5. Rapid Transit Development

**Case Study: BART, MARTA, SEPTA, and
WMATA**



LOUIS BERGER INTERNATIONAL, INC.

5. Rapid Transit Development - Case Study: BART, MARTA, SEPTA and WMATA

Investment Description

Urban mass transit systems influenced the shape and size of large older cities, allowing high density development of urban areas such as New York and Chicago. However, the increased reliance on automobile travel and resultant decentralized development since World War II has reduced the significance of mass transit as a major factor in development and individual and business locational decisions.

Nevertheless, existing systems in older urban centers require maintenance and rehabilitation, while growing metropolitan areas use new rail transit systems as a tool to stimulate center city growth and channel development along the new transit corridors. In many cases, the historical development of urban rail transit systems was largely influenced by the profit-making potential of private land development at or near transit stations, rather than transit operations.

Four transit systems were reviewed to consider the role of rapid transit on development patterns and economic growth and change. Systems with heavy rail components were reviewed - three of them also operate other forms of mass transit (buses, trolleys, commuter rail) - as heavy rail requires the greatest public financial commitment and has the greatest potential for transit-related development opportunities. Three of the rail systems were constructed during the past twenty years and the fourth has operated subway lines since the early 1900's. The four rapid transit investments are:

- **BART (Bay Area Rapid Transit), San Francisco-Oakland CA**, a 71-mile, 34-station system built between 1972 and 1977 costing \$1.6 billion. Today, fare revenues cover 38 percent of operating costs, with the deficit financed through local sales and property taxes.
- **MARTA (Metropolitan Atlanta Rapid Transit Authority), Atlanta GA**, started in 1975 and by mid-1993 consisting of about 39 miles of rail, built at a cost of \$2.7 billion, as well as 1500 miles of bus routes. Passenger revenues cover about 36 percent of operating costs with local taxes making up almost the entire shortfall.
- **SEPTA (Southeastern Pennsylvania Transportation Authority), Philadelphia PA.**, consisting of 307 route miles of commuter rail and subways, out of a total of more than 1,800 route miles, including bus, light rail, and trackless trolleys. Rail operations have been extensive since 1894. Recently, SEPTA has undertaken a twelve-year \$4.5 billion rebuilding program. Operating revenues for the overall system provides approximately 53 percent from the farebox, with state, federal and local subsidies making up the balance.

- **WMATA (Washington Metropolitan Transit Authority), Washington, D.C.**, currently consisting of 89 operating miles and 74 stations of a planned 103-mile 83 station rail rapid transit system and the area's largest bus system. Construction of the rail system started in 1969 with the first segment opening in 1976. Total capital investment has been \$7.5 billion with an additional \$2 billion projected to complete the system. Passenger revenue accounts for 49 percent of operating costs for the combined rail/bus system.

New rapid rail construction is so expensive (about \$70 million per mile) that only the largest metropolitan areas containing densely populated cores and strong central cities can pursue so great an investment. Further, the investments require easy intermodal connections between bus and rail and parking facilities for the automobile users. Neither the new or old systems are able to achieve more than about half of their operating expenses from the farebox. Older mass transit systems such as SEPTA face issues of facility obsolescence, rising maintenance and declining ridership.

Investment Objectives

The main objectives of rapid transit systems is the movement of large numbers of people and reduction of congestion in high density urban areas. Rapid transit directly improves access to workers and service businesses, while also indirectly affecting freight transportation by reducing automobile traffic. Other objectives of new urban mass transit investments include:

- sustain and maintain dense development and growth in the downtown core;
- manage and shape land use development;
- create and stimulate economic growth and employment opportunities.

For the modern systems, construction of rail mass transit is also viewed as a city-building exercise with long-term implications for a region's economic health and status. The metropolitan areas that invested in mass transit perceived themselves as taking significant strides toward improving their place among a hierarchy of national and international cities. Clearly, economic expansion is an implied goal of rail mass transit investment; growth and development are anticipated to follow from becoming a "world class" city.

Transit system investments are equally important to revitalize the economies of older cities. Obsolete systems frequently contribute to the deterioration of the entire urban area, and a reversal of this process can recapture some of the center city advantages. Most large metropolitan regions are dependent on mass transit. SEPTA estimates that 70 percent of all work trips to downtown Philadelphia are made on mass transit. Without mass transit service, the region's businesses and individuals would face significant economic losses. The economic dislocation would be severe. Maintaining and modernizing an existing transit system is important to preserve jobs and support

an area's economic activity, just as it is important to preserve and maintain other infrastructure. Ultimately, new businesses, entertainment centers, and residential development in the central area are dependent on rapid transit access, which can raise center city land values and the attractiveness and image of the region.

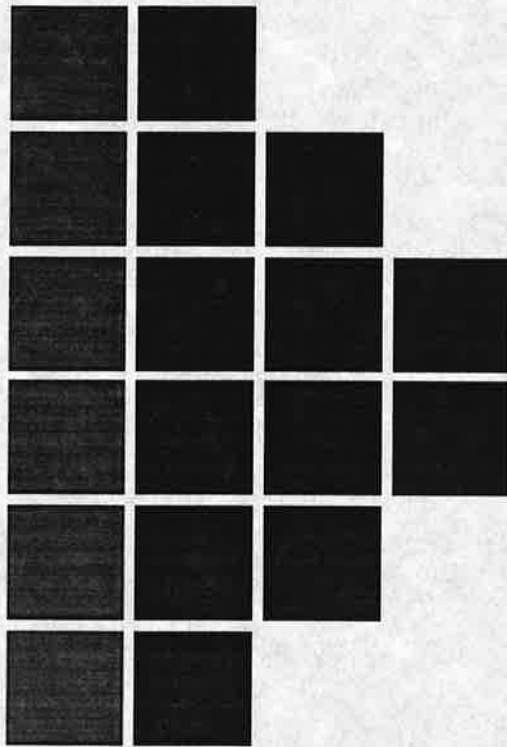
Recently, some areas have articulated an additional objective of mass transit investment, i.e. the improvement of air quality in non-attainment areas. With the passage of the Clean Air Act Amendments (CAAA) of 1990, the ability of mass transit to reduce automobile usage and assist in the management of congestion has become a key concern for many metropolitan areas that have to demonstrate conformity with clean air requirements. Some investments for new mass transit systems, especially the one in Los Angeles, are based heavily on achieving this objective.

Results Achieved

New mass transit systems in major US metropolitan areas have influenced the location of development. Each of the three metropolitan areas analyzed which built rail mass transit systems in the last 20 years, were growing rapidly when the systems were started, and have continued to grow. These metropolitan areas have strong, diverse economies which continue to expand and are viewed as desirable business and residential locations. However, the economic development process is so complex, that it is not easy to isolate the unique contribution of mass transit, so the specific consequences cannot be fully measured in terms of employment created and income generated. Several general observations can be made about the linkages between mass transit investment and economic change:

- Mass transit systems have resulted in high density development around stations and in the downtown core by making these areas more accessible to workers and more attractive as business, cultural and residential locations, rendering them a major factor in maintaining vibrant urban economies in large US cities.
- Land development impacts of rail transit are very much affected by planning and coordination between rail transit systems and private developers. In the Washington area, this type of planning occurred to a large degree across the entire Metro system, and the results were felt at suburban as well as downtown locations. MARTA and BART were less successful in stimulating development at suburban locations; in each case, the lack of coordinated land use and public investment planning was cited as a key reason. However, transit is only one of several factors affecting development; most or all of those factors must be present, or transit will not make a difference in development.
- Rapid transit systems reduce highway congestion and make possible job expansion, residential and business development, and improved truck productivity in areas that otherwise could not support further development.

- Rapid transit provides transportation access to inner city residents to suburban areas where many service jobs are available, increasing their employment opportunities.
- Rapid transit increases the locational advantage of suburban sites for clerical, labor intensive office operations, and other service businesses, the economic sector that accounts for most new jobs.
- Mass transit investment today is also necessary to rehabilitate and maintain the aging infrastructure in the older cities. Older mass transit systems are an essential component of the urban economy; without this service, the economies of the urban cores could not function, leading to the loss of businesses and jobs. In the Philadelphia area, a 1991 study found that a shutdown of the SEPTA urban transit system would, over time, result in a loss of about 10% of the total metropolitan area jobs.
- Although not measurable, it is recognized that rapid transit systems do add to an area's image as an important economic center.
- Mass transit investment improves the access to downtown areas, and makes these areas more attractive as business locations for regional headquarters, central offices, financial institutions, and major government agencies' regional or national headquarters.
- The tourism industry can be a beneficiary of mass transit investment if attractions are located close to transit stops, and there is convenient access from hotels, rail and airport facilities. This has been the experience in Washington and Atlanta.



6. Highway Investment and Tourism

**Case Study: Impact of I-70 on Colorado
Tourism**



LOUIS BERGER INTERNATIONAL, INC.

6. Highway Investment and Tourism - Case Study: I-70 in Colorado

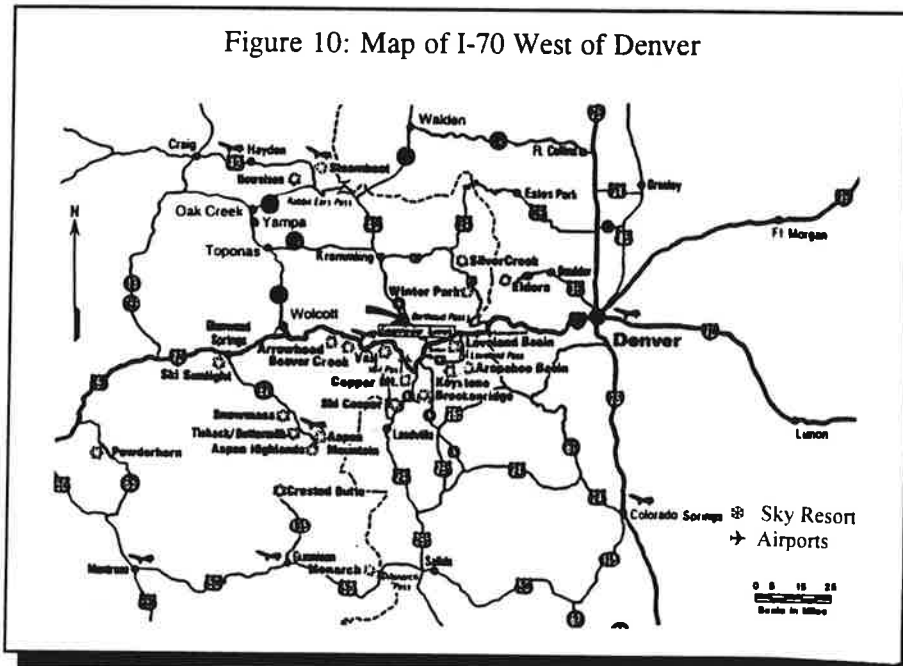
Investment Description

Tourism is one of the largest and fastest growth industries in the world (it represents about 12% of the world's GNP, and in the US ranks third among all export industries and second in terms of employment generation among all industries). Travel and tourism is the first, second or third largest employer in 37 States. The tourism and hospitality industries depend directly on transportation infrastructure for the movement of people to access their businesses, including airports, highways, intercity rail and urban transit. The growth of tourism nationally has been significantly facilitated by improved access resulting from investment in transportation facilities. The construction of I-70 west of Denver is an example of a transportation investment which had profound implications on economic development in western Colorado.

Interstate I-70, one of the major national east-west corridors, was constructed over a thirty-year period as the primary artery through large areas of the U.S. National Forest and the Colorado Rockies, linking the Denver Metropolitan Area and its international airport to ski resorts and other tourist destinations. (See Figure 10)

Highly significant for its impact on tourism development, the westbound bore of the Eisenhower Tunnel was opened in March of 1973 costing \$117 million, and the eastbound bore, the Edwin C.

Johnson tunnel was completed in December of 1979 costing \$145 million. In 1978, the 21-mile Vail Pass area was completed at a cost of \$91 million. The last section of I-70 to be constructed in Colorado and the last unfinished section of I-70 was through the Glenwood Canyon area. This segment took 12 years to construct and was completed in 1992 at a cost of \$480 million.



Construction of I-70 in the Colorado resort area demonstrates the effects of constructing a highway through an area having the potential for tourism development but requiring improved access. I-70 played an important role in expanding and diversifying the state's economic base. Often an "export" industry serving the residents of other states and nations, tourism has steadily increased in Colorado since the construction of I-70.

Investment Objectives

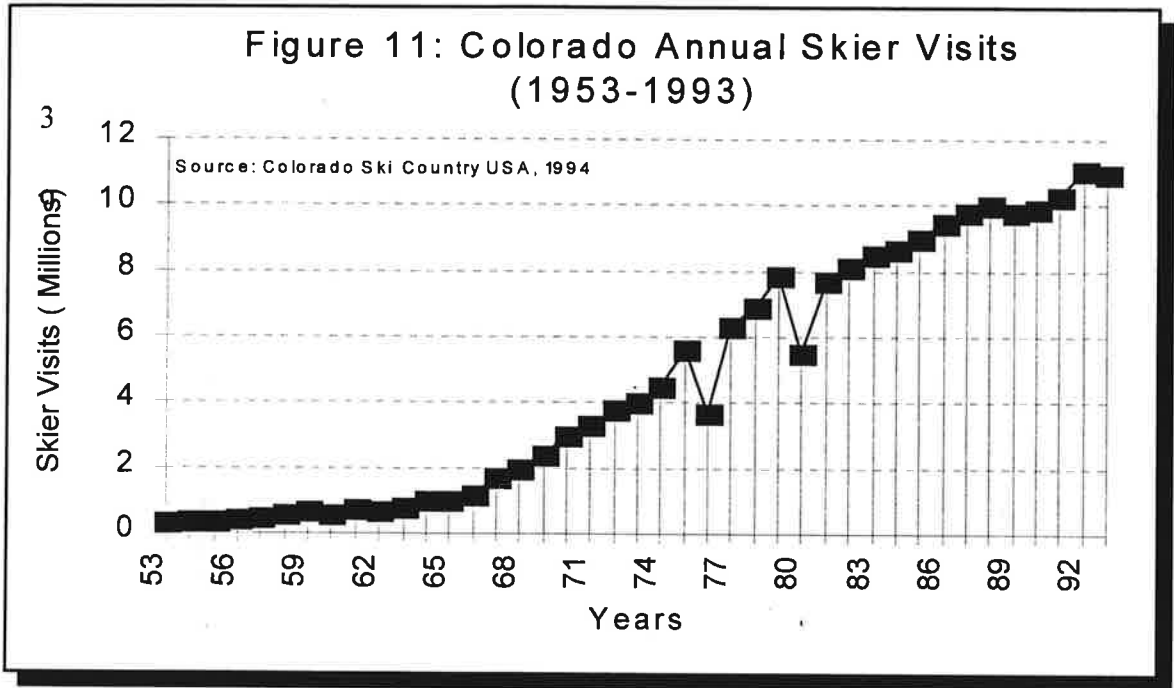
As with the rest of the Interstate System, the major objective of constructing I-70 through Colorado was to provide a limited access highway to improve connectivity, reduce congestion, enhance safety and improve the movement of people and goods to meet the nation's economic and defense needs. While the potential to alter spatial patterns of development and attract increased tourism development were generally understood by highway planners at project inception in the 1940s and 1950s, economic development and land use consequences were not specifically mentioned as principal construction objectives.

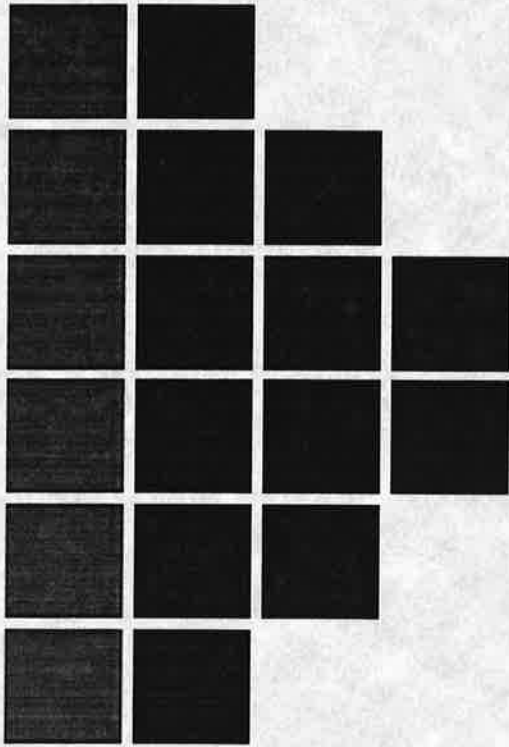
Results Achieved

The transportation investment in the I-70 Corridor has clearly had a major impact on economic development in the Corridor. The population and economic growth would not have been possible without an increase in accessibility for both metropolitan area residents and out-of-state visitors, including those of other nationalities using the international airport. The reduction in travel time between Denver and the resort areas near the highway (including Breckenridge, Copper Mountain, Loveland Basin, Vail/Beaver Creek), particularly following the completion of the Eisenhower Tunnel, has resulted in significant land development, job creation and economic activity associated with the tourism industry. Among the linkages between the investment and economic growth are:

- I-70's provision of dependable, safe, faster, cost efficient access from Denver and its airport to the rural mountainous hinterland has been marketed by land and resort developers as well as by the retail and commercial businesses which benefit from the disposable incomes of the leisure time population now attracted to the area.
- I-70's access to the tourism areas encourages active outdoor lifestyles which in turn have contributed to Denver's competitiveness nationwide as a high quality and attractive business and residential location.
- The transportation investment in the I-70 Corridor, including the construction of the Eisenhower tunnel, has clearly had a major impact on the corridor, the state's economic diversification, and employment and population growth. In 1950, only a few hundred people depended on skiing for their livelihood in Colorado. By contrast, today it is estimated that the state's ski and recreational resort industries (both summer and winter months) account for 66,000 jobs, more than \$2.5 billion in annual retail sales, and \$1.3

billion in personal income. The ski resort industry includes more than 27 ski areas and provides an estimated \$113 million in tax receipts. The U.S. Forest Service received approximately \$6.6 million in fees as well. Recreational tourism represents the single largest industry for the state's western slope. This economic activity is generated by around 10 million skier resort visits annually (see Figure 11), including 6.8 million destination visitors (persons staying overnight) and 2.9 million "day tripper" visits. Colorado draws an average of 10,000 out-of-state visitors a day to the state's resorts. Out-of-state visitors





7. Port and Aiport Economic Impacts

Case Study: Oakland, California



LOUIS BERGER INTERNATIONAL, INC.

7. Ports and Airports Economic Impacts - Case Study: Oakland, California

Investment Description

Ports and airports are major elements of the nation's transportation infrastructure. State and local jurisdictions, through government agencies or independent public authorities invest in these transportation facilities mainly for the purpose of attracting jobs and economic development to their areas. Typically, these transportation facilities - particularly ports - compete with other ports in the region for cargo in their local hinterland, and with ports around the nation for cargo enroute to farther inland destinations. Recently, with the establishment of more hubs and international gateways, larger airports also increasingly compete for international and long distance travel not originating in, or destined to, the local area.

Port and airport facilities are viewed by local governments as catalysts for development. Having an airport or port locally with extensive direct and fast domestic and international connections can serve as an important incentive to attract new business to the area. Depending on the competitive situation in the region, ports and airports can be profit-making enterprises. Because of their ability to generate their own revenues, they usually are structured to function with some autonomy and with independent financial authority.

The Port of Oakland, a public enterprise established in 1927 by the City, operates both the Oakland International Airport and the Oakland marine terminal facilities. It is an example of a transportation investment by a local jurisdiction, with the explicit objective of generating economic activity and serving the needs of local businesses. The focus is on the economic impact of the aviation and maritime investments on the communities they serve.

The Oakland port and airport investments shed some light on the role of transportation investment by a major port and airport organization to generate economic development. The investment criteria usually considered by port officials include (1) the financial viability (measured typically by the pay back period, internal rate of return and debt coverage ratios), and (2) the regional economic impact of the project(s), as measured by the number of jobs and the amount of income generated.

Investment Objectives

The overall objectives behind the investments are to improve connections to international and domestic markets from the local area, thereby facilitating foreign trade and business and personal long-distance travel. Specifically, the port and airport investments have the following objectives:

- for the aviation-related investments, upgrade and maintain aviation facilities to keep pace with increased passenger demand and to make airfield improvements that result in increasing overall airport capacity; and

- for the maritime-related investments, help the port maintain its current competitive position and volumes, and to achieve a "moderate" growth rate in the future.

Generally, these types of port and airport investments are viewed as supporting economic development efforts of the local areas and are considered to be:

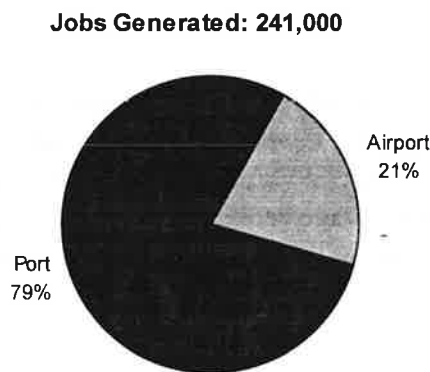
- important direct generators of economic activity and revenue production, through their operations,
- significant catalysts in nearby land development,
- incentives to business location decisions, since businesses and individuals seek access to more efficient port and/or airport operations, with adequate capacity, fewer delays, easy passenger and cargo intermodal transfers and access to highways, and increased services connecting to foreign and domestic markets.

Results Achieved

As of 1991, airport operations in Oakland supported some 51,000 jobs, \$3.6 billion in business revenue, and \$1.6 billion in personal income. In addition, in 1992, maritime operations generated

some 190,000 jobs, \$729 million in business revenue, and \$430 million in personal income. (Figure 12) These economic impacts are not the direct result of any specific investment, but since 1927, investments on port and airport land totals approximately \$1 billion as of June 1993.

Figure 12: Jobs Generated by the Port of Oakland and the Oakland International Airport



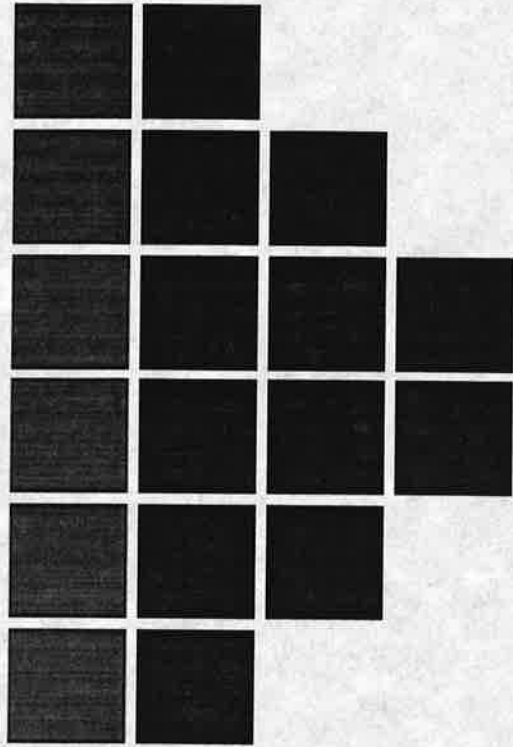
Source: Port of Oakland

Of crucial importance to the continuing strength of port and airport operations is their ability to continue upgrading and modernizing their facilities to maintain their competitive position. Oakland's predominant position as a port derives from the fact that it was the first west coast port to build specialized container-handling facilities as early as 1962. In the late sixties and early seventies when the

competing ports of Los Angeles and Seattle made improvements to their facilities, they were able to regain parity. In the last two decades, however, Oakland was not able to provide the same level of deep channel access, due to regulatory delays, nor on-dock double-stack rail service, due to

inadequate tunnel clearances out of Oakland on all railroads, as other west coast ports. As a result, Oakland has lost a significant share of the west coast market.

As the Oakland case shows, port investments add capacity to meet growing trade needs. Also, through new technology, ports can improve their terminals to increase their own productivity and reduce cargo handling costs, thereby increasing the competitiveness of US products. In the case of airport investments, air transportation facilities provide the fastest national and international access to businesses increasingly competing in a global economy. Airports are the main mode of transportation for the movement of high-value, low weight products. They also are the preferred modal choice for most industries using just-in-time inventory and production systems. The service sector of the economy also sees airports as providing critical access to its costumers, specially those companies in knowledge intensive industries, financial services and tourism.



8. Metropolitan Beltways

**Case Study: Route 128 and
I-495, Boston, Massachusetts**



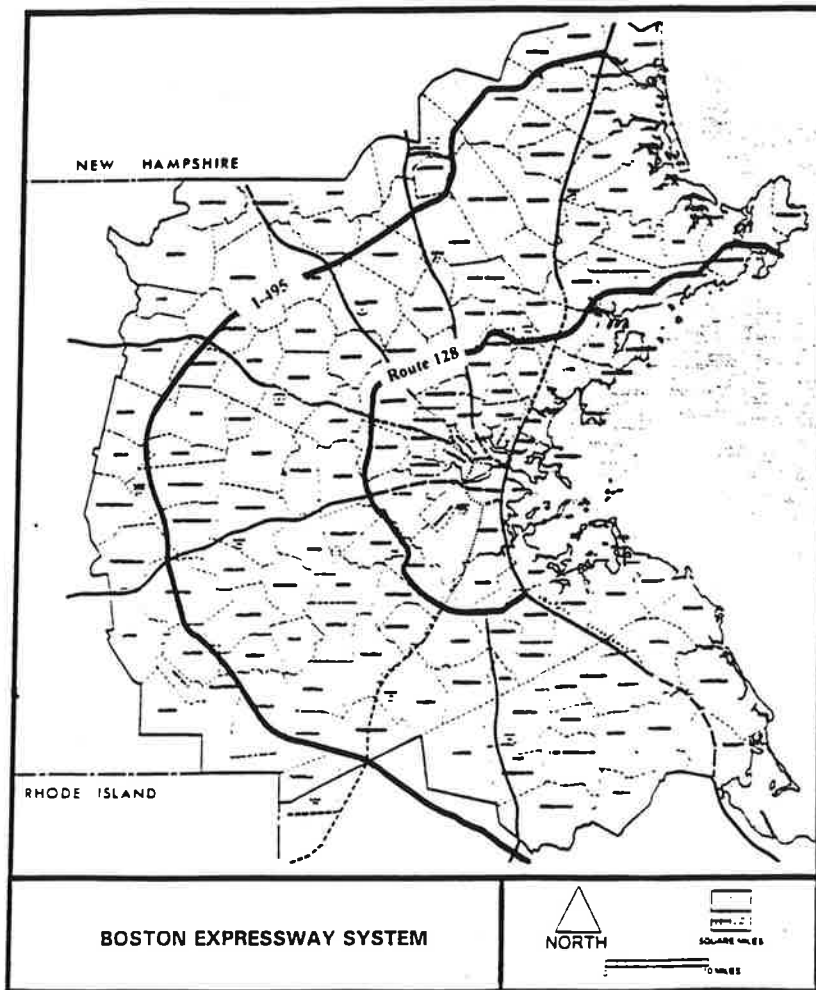
LOUIS BERGER INTERNATIONAL, INC.

8. Metropolitan Beltways - Case Study: Route 128 and I-495, Boston, Massachusetts

Investment Description

Route 128, now also designated as Interstate 95, is a limited access, circumferential beltway located approximately ten miles from the Boston, Massachusetts, Central Business District. It passes by or through 27 communities on about 66 miles of roadways extending from Braintree to Gloucester. Interstate Route 495 (I-495) is Boston's outermost circumferential highway, lying some 20-25 miles beyond Route 128. (Figure 13) It was conceived and built as part of the National System of Interstate and Defense Highways.

Figure 13: Route 128 and I-495



Route 128 varies from two to four lanes in each direction. Its busiest sections carry between 80,000 and 150,000 vehicles daily. The concept for this highway emerged as early as 1925 as an element of a regional plan. The first improvements were made in 1932 and 1933. The bulk of the highway was constructed in the 1940s and 1950s; it was completed in the late 1950s, but addition of lanes has continued. A fourth lane will be added between Routes 9 and 24 by 1996, the only heavily traveled segment which is not four lanes in both directions. I-495 is a six lane limited

access highway which runs for a length of approximately 125 miles. Its busiest sections carry approximately 90-105,000 vehicles per day.

Route 128 is of interest in considering the linkages between transportation investment and economic expansion because:

- It is the first major circumferential highway built around a U.S. city.
- It was built in segments over thirty years and periodically expanded.
- It has proved to be the key infrastructure element which has shaped economic growth in the Boston region since the late 1940's.

As a circumferential highway planned and built along an undeveloped area, I-495 resembles and was conceived after Route 128 achieved renown as Boston's Golden Semi-Circle success. The I-495 investment created another opportunity to follow the Route 128 example and therefore, it could be viewed as built to deliberately shape development along the corridor.

Route 128 investment costs including widening projects between 1958 and 1963 were estimated to total \$119 million. Perhaps the simplest way to estimate investment in Route 128 is that replacement cost of all facilities, excluding land acquisition, would be approximately \$2.4 billion in 1993 dollars. The replacement cost of I-495 is about \$2.8-\$3 billion.

Investment Objectives

Until the late 1950's, Route 128 was primarily justified on the basis of transportation need, such as reducing congestion on radial roadways. Even though its role as regional economic catalyst is now apparent, the need for the investment was focused on its transportation benefits rather than economic performance. Emphasis was placed on solving the problems of the day and the role Route 128 could play in economic growth and development was not understood until it had already assumed that role.

Route 128 was regarded as a bypass to improve accessibility between the spokes of a radial highway/rail system centered in downtown Boston. The generally assumed benefits of connectivity and reduced travel time seemed sufficient justification without recourse to economic impacts.

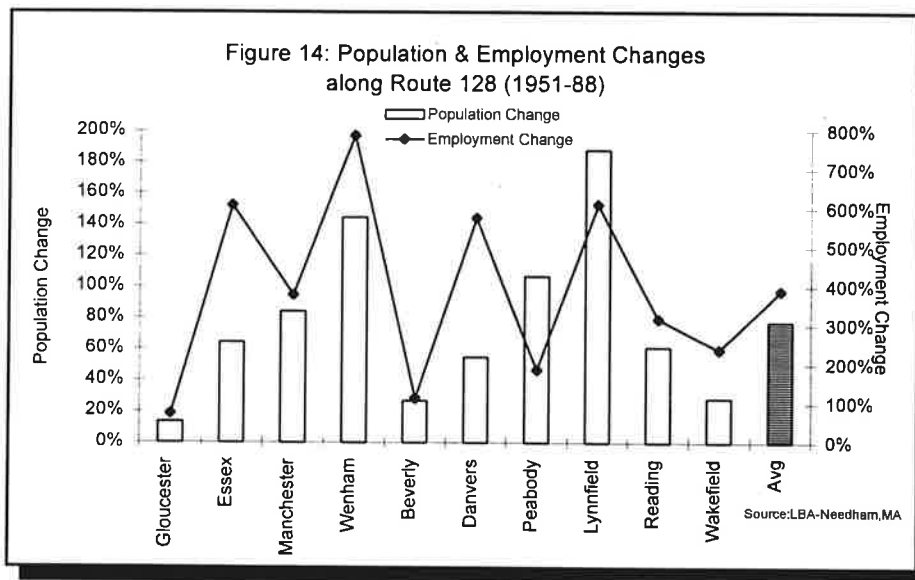
Evidence indicates that I-495 received priority not because there was a demonstrated need, as in Boston's congested neighborhoods, nor because of development objectives, but because it could be built with little or no opposition and property-taking costs were low. In Boston, vehicular congestion was an undeniable problem, but the property takings involved in building circumferential "inner belt" highways would clearly lead to major political controversies that would delay or stop the project.

Results Achieved

As a highway investment, Route 128 has achieved many of its transportation goals. It functions as a vital artery connecting parts of Massachusetts to each other and to the Massachusetts Turnpike, and linking residential areas to recreational destinations such as the North and South Shores and Cape Cod. It is a major collector link for Logan Airport, New England's major air travel and air cargo gateway.

What was unexpected about Route 128 when planned was how, by making cheaper land accessible within a reasonable length trip to regional resources such as downtown, universities and Logan Airport, it proved such a catalyst for economic development of the entire Boston region and became an economic growth generator in its own right.

Early analyses (1957-58) indicate that there was little understanding of the potential effects of changing Boston's until then radial roadway system to a hub, spoke and wheel system. The change in distances that could be reliably traveled within reasonable times appears in retrospect to have been extremely important to the region's economic development. Whereas about 25,000 people were employed in the Route 128 communities in the late 1950's, there were more than 1,200 firms employing over 85,000 people by 1974. Initially, the highway enabled people to move out of Boston to less costly and less populated areas west of the city; within a decade it had begun to generate new residential and commercial development in the communities west of Route 128. The Route 128 area saw employment increases from 0.51 employees/sq.mile in 1951 to 2.29 employees/sq.mile in 1988 in the 370 square mile surface area of abutting communities. In the same period, population per square mile went from 1,509 to 2,161, respectively. (Figure 14)



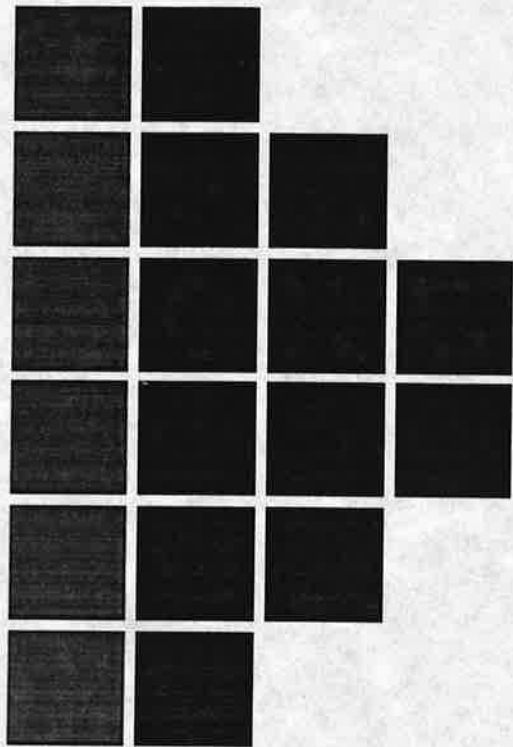
Both the transportation and economic analyses which have been conducted on Route 128 confirm the assumption that highways, in general, and metropolitan limited access highways, in particular, facilitate and redirect economic growth. At the same time, it is not possible to

isolate the specific impact of the highway investment, since economic growth is generated and is

affected by so many forces independent of transportation decisions. The studies also confirm that ease of regional access is a major locational factor for commercial and industrial enterprises. In other words, although not easily quantifiable, **travel time for both people and goods has significant economic value.**

One major lesson from the 128 history seems to be a fairly consistent underestimation of traffic demand and the resulting congestion, requiring widening and periodic improvements, although today its roadway capacity is only attained in a few locations. Another lesson from the history of Route 128 is that it takes some time to understand the nature of ongoing change, particularly when a new type of transportation investment is introduced. People only began to grasp how Route 128 was affecting the regional economy in the late 1950s when it had already been in use for some time.

The impacts of I-495 on population growth and development along its path has not been as dramatic as for those towns surrounding Route 128. It is still possible that Route I-495 will develop in a way similar to Route 128. Presumably this will happen as both population and the economy grow and as congestion near Route 128 causes an exodus to cheaper, accessible land. This would repeat the patterns by which congestion and property value pressures in the area within Route 128 caused people and businesses to move out from Boston and its inner suburbs. It is not clear whether there is a boundary beyond which the existing modes of transportation can no longer support the extension of the low-density development pattern characteristic of the Boston Metropolitan region.



9. Border Crossings

Case Study: Laredo, Texas Port of Entry



LOUIS BERGER INTERNATIONAL, INC.

9. Border Crossings Port of Entry - Case Study: Laredo, Texas

Investment Description

The nation's foreign trade has been increasing in importance over the last two decades, growing from 15% of GDP in 1970 to 25% in 1993. The growth of international trade is highlighted by the recent agreements and ongoing discussions regarding the creation of a few major multinational markets (NAFTA, Europe, Asia-Pacific, the Southern Cone countries of South America or Mercosur).

Mexico is the United States' third largest trading partner. In the five-year period from 1987 to 1991, US exports to Mexico increased by 145 percent and they doubled from 1989 to 1994, even before the NAFTA agreement became effective. Imports have also grown rapidly, and the devaluation of the peso in late 1994 has resulted in significant growth in northbound trade. The border between the US and Mexico extends over 2,000 miles. The Texas-Mexico border defined by the Rio Grande accounts for over half of that distance. The Laredo, Texas port of entry is the largest of the 40 ports of entry along the US-Mexico border. Laredo is also the largest gateway for US exports to Mexico.

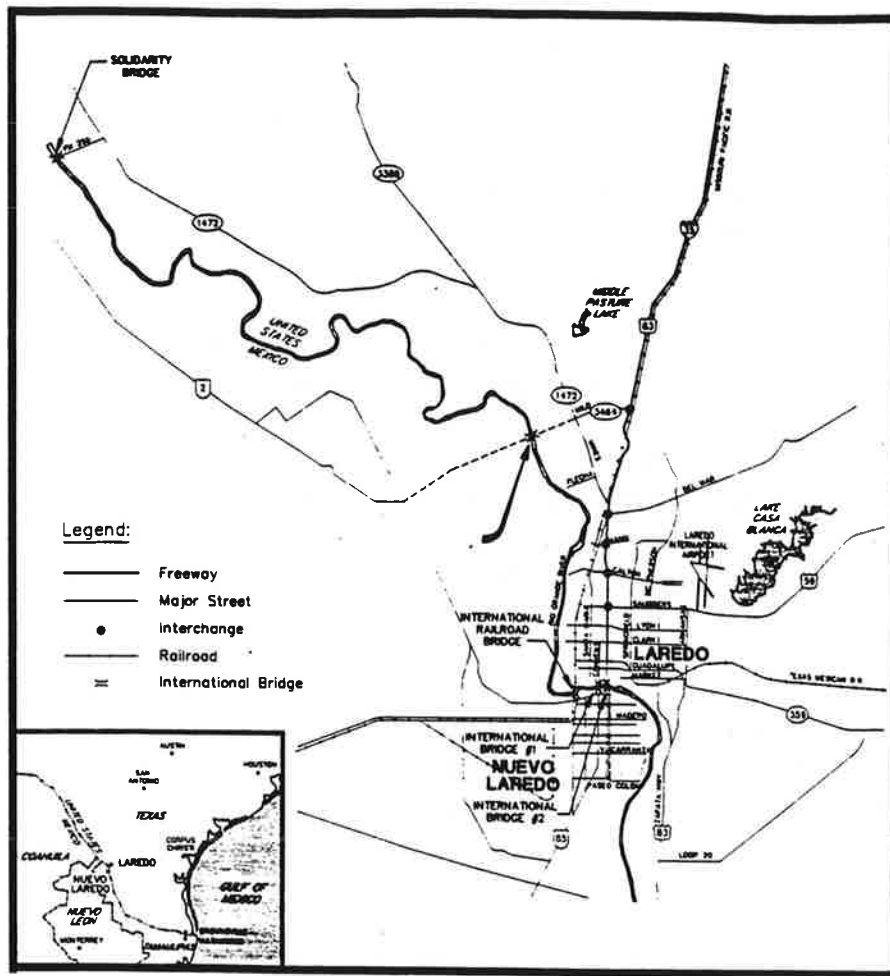
The infrastructure of a border crossing port of entry consists of three major components: the highway or railroad border crossing itself, the highway and/or railroad facilities connecting the border crossing to the major transportation facilities in both sides of the border, and the international inspection facilities.

Laredo handles about 38% of all trade between the US and Mexico. In 1994, Laredo handled 59.4 percent of all loaded trucks crossing the Mexico-Texas border and 67.6% of all loaded rail car crossings. Imports to the US through the Laredo District of US Customs increased to \$49.5 billion in 1994, while exports have reached \$50.8 billion.

There are presently three international highway bridges and one railroad bridge in the Laredo area. The Convent Street Bridge (also known as Bridge I) and the Juarez-Lincoln Bridge (dubbed Bridge II) are located within the Laredo core area, while the third international highway bridge, known as the Solidarity Bridge or Colombia Bridge is about 25 miles to the northwest of the city. The three highway bridges are jointly owned and operated by the City of Laredo through the Laredo Bridge System (LBS) and by the Mexican government through the Camino y Puentes Federales de Ingresos y Servicios Conexos (CAPUFE). All the bridges are toll facilities, with the toll scheme differing for northbound and southbound traffic. The existing railroad bridge, owned by the Texas & Mexican Railroad, is also located in the core area. Figure 15 shows the location of the existing bridges.

The original Convent Street Bridge (Bridge I) was destroyed in a flood in 1954, and the current bridge I was built in 1956. Its inspection facilities are probably the oldest in use on the Texas-Mexico border and were completely renovated in 1991. Bridge I has two northbound and two southbound lanes for vehicles crossings and two sidewalks for pedestrian crossings. In light of its proximity to downtown shopping areas, Bridge I is the most popular pedestrian crossing in Laredo. The Juarez-Lincoln Bridge, or Bridge II, was opened to traffic in 1976 and is accessed directly from the major highway into the Laredo area on the US side, Interstate I-35. The bridge has six-lanes. Pedestrians are not allowed on this bridge.

Figure 15: Laredo Bridge System



Completed in less than one year, Laredo's third international bridge began operations in August 1991. Solidarity Bridge is located in Laredo's western extraterritorial limits and is accessed from FM 1472 (Mines Road). The bridge has eight lanes for vehicle traffic and two for pedestrians. Unlike Bridges I and II, which cross into Nuevo Laredo in the state of Tamaulipas, the Solidarity Bridge links Dolores, Texas with the town of Colombia, in the State of Nuevo Leon. The proposal for construction of the third highway bridge was made to the US by the State of Nuevo Leon, representing the first time that Mexico has initiated plans and sought US participation for a border crossing. The cost for the US portion of Bridge I was about \$3 million in 1956, Bridge II cost about \$9 million in 1976, and the Solidarity Bridge about \$12 million in 1991 (including other facilities financed by the city).

The cost of each bridge itself is a relatively small portion of the total infrastructure cost of a border crossing. As noted above, besides the bridge, connecting roads and inspection facilities are also required. In the case of the Solidarity Bridge, the US Government and the State of Texas covered

the additional \$22 million cost for highway connections, customs, INS, and other inspection facilities.

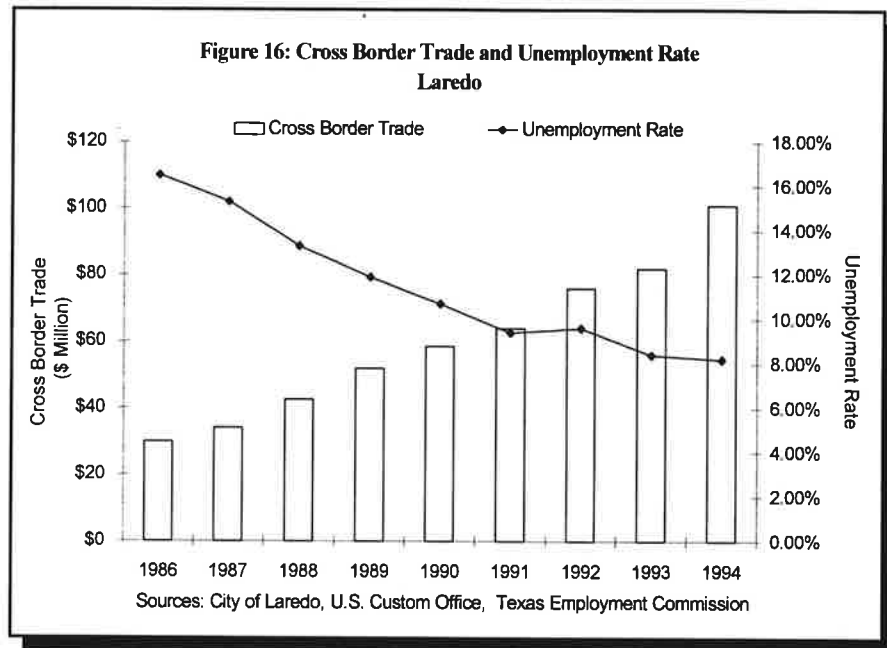
In general, although any border community can put in a request for construction of a new bridge, it is not a simple matter to have a project approved and funded by the governments of both countries. On the US side, a Presidential Permit is required, and clearance must be obtained from many agencies. Funding on the US side is usually provided by the local community itself. State and local governments generally provide the connecting highway infrastructure, while federal agencies provide the inspecting facilities. In recent years, Mexican states have been given more autonomy by the Mexican federal government regarding bridge projects. In addition, private investment sources have been allowed to participate in the funding and operation of these projects.

Investment Objectives

The efficiencies of ports of entry at the border crossings impact the competitiveness of the local economy and the region they serve. The main objective of transportation infrastructure investment at the Laredo port of entry has been the need to accommodate growing US-Mexico trade (see Figure 16) and the

development of maquiladora plants, trucking terminals, warehouses, etc. associated with that increased trade. Maquiladora plants established by US and foreign firms use high quality Mexican labor at a lower competitive cost to assemble export products, ranging from automobile parts to integrated circuit boards, television components, hospital supplies, garments and food

items. In 1987, there were 79 maquiladora plants in the border area using the Laredo port of entry. By 1992, there were 78 maquiladora industries in Nuevo Laredo alone, and there were about 200 maquiladoras in the border area using the Laredo port of entry, including most of those located in Nuevo Laredo, Tamaulipas, and Nuevo Leon. In addition, Laredo handles much of Mexico's trade with Canada, Europe, and the Far East, reflecting shippers' preferences for the lower cost and higher efficiency of US ports and land transportation services.



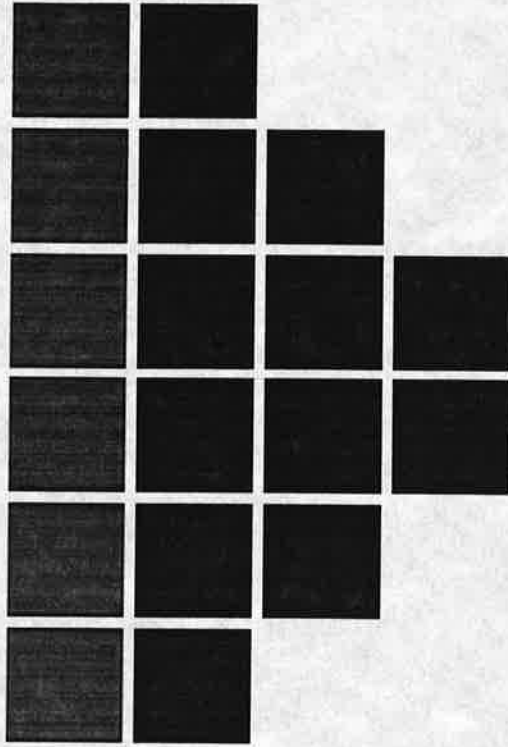
Results Achieved

In the 1990s, increased US-Mexico trade and cross-border production sharing have contributed to spur Laredo's growth, so that Laredo became the fastest growing city in Texas and the second fastest growing city in the US. It appears that the investments in the border crossing facilities at Laredo, have responded to the requirements of economic growth in the area.

The Solidarity Bridge has not attracted significant volumes and is not operating at or near its full potential. The additional travel distance (19.5 miles from the intersection of FM 1472 and IH35 to the bridge, and similarly from the bridge to Mex 85) is a principal explanation for the above situation. Another drawback is inadequate connecting highway infrastructure on both sides of the border, particularly on the Mexican side. Finally, the scarcity of customs brokers at or near the bridge has deterred freight crossings. On the US side, the connecting infrastructure has improved significantly since the bridge opened, with the completion of FM 255 and the near completion of FM1472. Eventually, once the planned development strategies that were the basis for the construction of the bridge are implemented, and once the highway connections are completed, the bridge is likely to attract additional traffic. The delays in the implementation of access connections to the Colombia bridge point out the importance of a better coordinated binational transportation planning process. Such a binational has been proposed to be carried out along the entire US-Mexico border.

Although historically a major reason for the transportation infrastructure construction at the border crossings was a result of demand for increased international trade, as the Laredo area has grown, local development objectives have become increasingly important. The city's objective for the proposed Bridge IV and the Union Pacific railroad proposal to build a new railroad bridge are aimed primarily at rerouting commercial vehicle and rail traffic away from the tourist and pedestrian areas and the related traffic that will continue to dominate the border crossings at Bridges I and II.

In conclusion, although some portion of border crossing demand is based locally, it is significantly affected by binational trade trends that can result in rapid growth or some significant unanticipated changes in the flow patterns, due to currency exchanges and other factors that affect global production and supply routes. For a border area community, an investment in transportation and related infrastructure is a key ingredient to attracting employment and economic growth to the region.



10. Dredging of Port Access Channels

Case Study: Baltimore, Maryland



LOUIS BERGER INTERNATIONAL, INC.

10. Dredging of Access Channels to Ports - Case Study: Port of Baltimore

Investment Description

Uncluttered channel access and water transport routes linking ports to the ocean are vital to maintaining and increasing US competitiveness, because an estimated 95 percent of U.S. overseas trade moves in and out of U.S. seaports. Adequate access channels are particularly important as the nation's economy becomes more closely integrated into the global economy.

The dredging process involves excavation of soils and rocks in the access channels, as well as transportation and disposal or use of the material removed. The environmental impacts of dredging are of paramount concern to local residents, which can be affected by pollution from the dredged material as well as by degradation of the areas in the vicinity of the deepened waterways. A complex process, dredging is not typically considered by some as a transportation investment and is little understood outside of the group of experts and specialists who work on such projects, both in terms of its importance to the nation's or an area's economic well being and its environmental impacts.

The US Corps of Engineers (COE) is the lead agency responsible for the dredging of the nation's main navigable waterways. The maximum depth for channel dredging is authorized by Congress based on studies carried out by the COE. Actual channel depth is not always the same as authorized depth, as channels shoal due to sediment transport.

About 100 million cubic yards of material need to be dredged annually to maintain navigation channels in the US. In addition, a recent survey identified plans to dredge between 9 and 28 million cubic yards annually to deepen channels over the next few years.

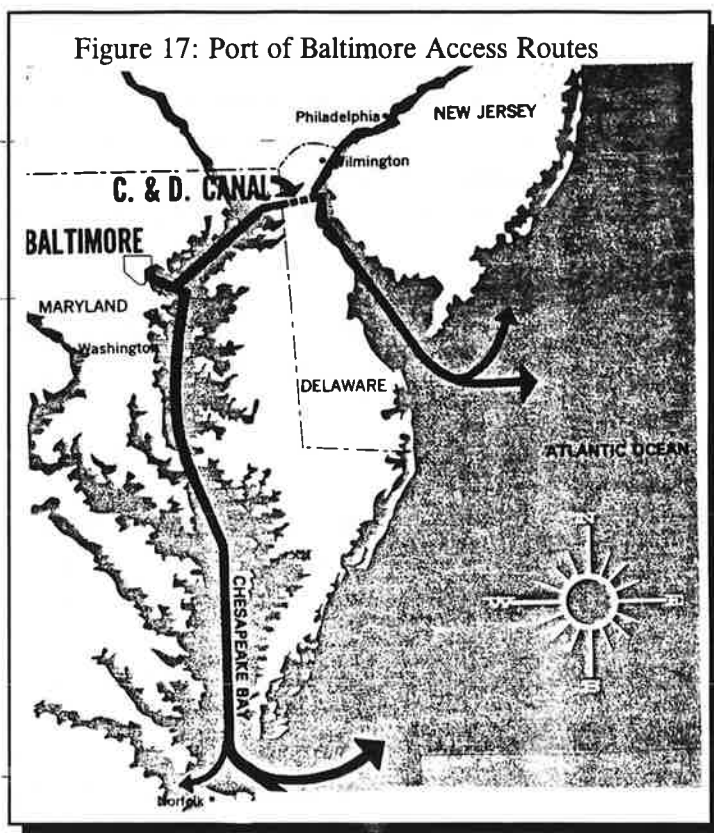
In the late 1980s the Port of Baltimore's (POB) deepened its main or southern approach channels from 42 to 50 feet while at the same time dredging was carried out to maintain the authorized 35-foot depth of the northern approach channels. The deepening project was the culmination of over 30 years of studies and controversies about the merits of the project. The project to deepen the southern or main approach channels to the Port of Baltimore, from the entrance to the Chesapeake Bay in Virginia to the Baltimore harbor maritime terminals was first proposed in the 1950s. It was implemented between 1987 and 1990. Projected costs were \$388 million, but actual costs ended up being *lower*, about \$227 million, primarily due to favorable bidding conditions, but also due in large part to the fact that while the affected channels were deepened to 50 feet, they were not widened as much as called for in the initial project design.

After the initial studies for the deepening project were completed in the 1970s, environmental concerns delayed construction. During this period, numerous additional studies were undertaken, focusing on issues such as an appropriate dredge disposal site for the contaminated materials from Baltimore harbor. By 1984, Hart-Miller Island had been selected as the dredge disposal site for Baltimore harbor material. The original justification for the project was based on a benefit/cost

analysis conducted by the Corps of Engineers from a national perspective. In 1984, the project was evaluated from the State's perspective with regard to benefits and costs. It was determined that the project could be justified in terms of increased bulk tonnage for the port and increases in employment and income if the state costs could be kept within certain limits. A substantial cost reduction was achieved, due in large part to a design solution which permitted the desired 50-foot channel depth, but reduced its width. Construction was initiated in 1987 and completed in 1990.

The POB's second access route to the ocean from the northeast through the Chesapeake and Delaware (C&D) Canal, saves about 150 miles on a trip between Baltimore and New York and about 100 miles on a trip to Europe.

(See Figure 17) There are a number of areas in the Upper Chesapeake Bay where rapid shoaling requires almost constant dredging to maintain the authorized channel depth. Due to environmental restrictions that prevent dredging during certain months of the year, maintenance dredging is generally carried out only once a year. Shoaling in this area can then decrease depths by as much as 3 to 5 feet prior to commencement of the next round of maintenance dredging. This annual maintenance of the northern approach access channels to the Port of Baltimore in the mid-1980s did not prevent the continuing shoaling of channels over the years, so that by the late 1980s, only vessels with a maximum draft of 30 to 31 feet could use this route at certain times of the year, compared to the authorized 35 feet depth. A one-time project at a cost of about \$26 million became necessary to bring the channel to the authorized depth and to assure that regular annual maintenance dredging could maintain the authorized depth year-round.



Investment Objectives

POB cargo trade can be divided into three types: dry bulk, liquid bulk, and general cargo. Historically, cargo traffic in and out of the POB has been dominated by bulk commodities such as coal, iron ore, grain, sugar, and residual oil. In terms of tonnage, dry bulk commodities accounted for 70 to 80 percent of Baltimore's foreign trade from 1980 to 1985, with liquid bulk

and general cargo (steel, lumber, autos, merchandise in containers, etc.) accounting for the rest.

Ports are always seeking ways to expand their service area, thereby attracting greater volumes which can be served profitably by larger vessels. These larger vessels can help achieve greater economies of scale, which benefit shippers, producers and consumers. An efficient and modern port system capable of handling all sizes and categories of vessels and commodities affords the greatest potential for increasing business. Dredging of ports and their access channels is essential to assure competitiveness and to maintain the flow of international commerce. Maintenance dredging assures adequate depths for vessels presently engaged in domestic and overseas trade, whereas channel deepening is undertaken to allow larger ships to call on a port.

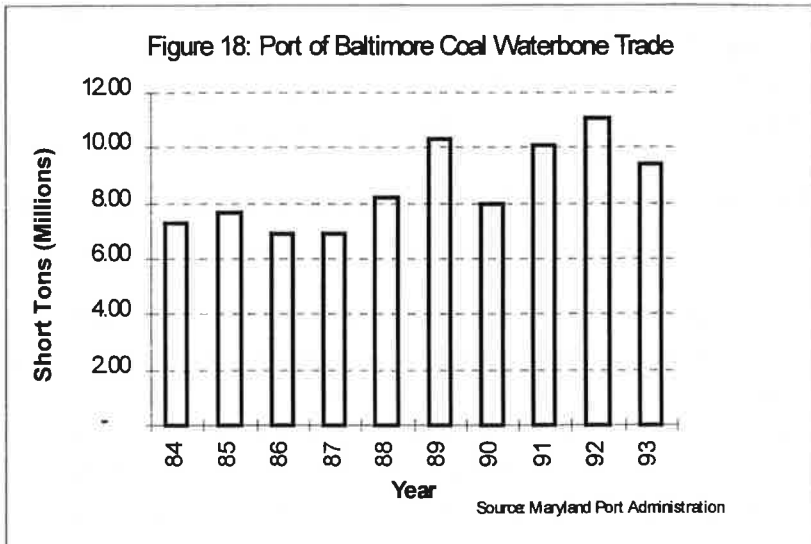
The underlying investment objective for **deepening the POB's main channels** was to increase the POB competitiveness, especially in the dry bulk trade, by lowering transport costs and permitting larger vessels access to the Port. The largest potential users of the 50-foot channel were the coal export facilities. The Port of Baltimore has 3 export coal piers with a combined capacity of over 30 million tons annually. The piers at two of the facilities (Consolidation Coal and Bayside Coal) were built in the early 1980s during the coal export boom that followed increases in oil prices, in anticipation of the 50-foot channel deepening project. In dollar terms, total U.S. exports of coal, the leading export commodity through the POB, amounted to \$3.196 billion in 1993. The impacts of the lack of dredging to deepen or improve the POB channels, therefore, are not only important to the local area, but extend well beyond the boundaries of the port to include the regions and states where the coal is produced, as well as the nation's overall export competitiveness.

In contrast to the objective of the deepening project of the main or southern approach channels, the **maintenance** project to assure that the authorized depth on the northern approaches were maintained on a year round basis was aimed not at the dry bulk cargo trade, but at preserving and increasing the competitiveness of the port in the container trade.

Results Achieved

At their own expense, the two largest coal export facilities, Consolidation Coal and Bayside, deepened their private channels connecting to the federal channel within one month of the channel deepening project's completion in anticipation of larger coal shipments. Consolidation Coal also expanded its ground storage facilities so that it can now handle 18 million tons annually on its 100 acre terminal. Since they are able to load 300 tons of coal per inch of draft, larger vessels can now be more fully loaded and dramatic reductions in overall shipping costs can be achieved. The Consolidation Coal terminal handled the largest export shipment in its history in mid April, 1995, a record 145,511 net tons of coal destined for the Electricity Supply Board at Moneypoint, Ireland. Partly as a result of the 50 ft. depth available in Baltimore, as well as its own high operating costs, Conrail closed its older coal pier in Philadelphia in 1992, resulting in increased volumes through Baltimore. (See Figure 18)

The major user of iron ore imports in the port, Bethlehem Steel, has not yet increased its private access channel depth to accommodate larger shipments of iron ore. The only one remaining grain elevator in Baltimore, the Indiana Grain Cooperative (now known as Countrymark) elevator in the Locust Point terminal indicated before construction that they supported increasing the channel depth to encourage larger grain shipments. However, Baltimore is not a major grain export port, and is used mainly to fill orders during peak load periods in other ports. As a result, grain export and other dry bulk facilities have not taken



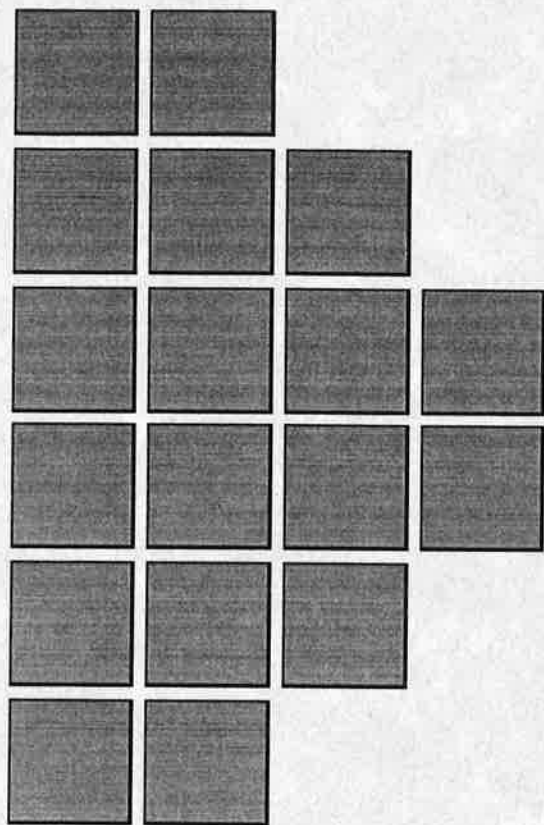
advantage of the potential benefits as a result of the deepening. All in all, a limited number of coal ships have benefitted from the port's greater depths and actual benefits to other commodity shippers have been rather limited to date.

Since project completion in 1990, coal shipments through the POB increased 26 percent in 1991, while 1992 levels were up 10 percent over 1991 figures. In 1993, grain and iron ore movements showed slight increases over 1992 levels. Some of the coal increase is due to deeper channels, but it is still too early to say how much is directly attributable to larger shipments. Most bulk traffic has fluctuated widely since the mid-1980s indicating that it is more dependent on global demand and supply market forces.

While it is still too early to say whether channel deepening will boost dry bulk commodity flows through the POB, many port officials believe that the real benefits of increased traffic have yet to be realized. The project was viewed as having a 50 year life, so that benefits cannot be judged after only a few years in operation. Furthermore, even though the channel deepening project was aimed primarily at increasing dry bulk cargoes moving through the port, in a rapidly changing industry, deeper channels are soon expected to become important for container vessels. There are now more than 60 large post-Panamax vessels (vessels too large to transit the Panama Canal) in operation or under construction. Many of these new vessels will eventually require 45 foot channels, compared to the typical present maximum requirement of 40 to 42 feet for container vessels. The deepening of the POB access channels to 50 feet has also enhanced the competitiveness of the POB in the container market.

This investment points out the importance of seeking a balance between the economic and environmental impacts of dredging port channels. The Port of Baltimore deepening project was delayed for many years, and was therefore not completed when it would have produced significant positive impacts during the coal export boom of the early 1980s. Other ports throughout the nation have also experienced long delays in their channel deepening or maintenance dredging projects, primarily due to environmental concerns related to the disposal of dredged materials, including Port Newark/Port Elizabeth, Oakland, Boston, etc. Presently, there is no time-limits for reaching decisions on acceptable disposal methods, nor is there a decision-making framework to balance the economic costs associated with dredging delays versus the required environmental safeguards to assure safe dredged material disposal and their costs. The end result is continuing delays and/or uneconomic alternatives for disposal.

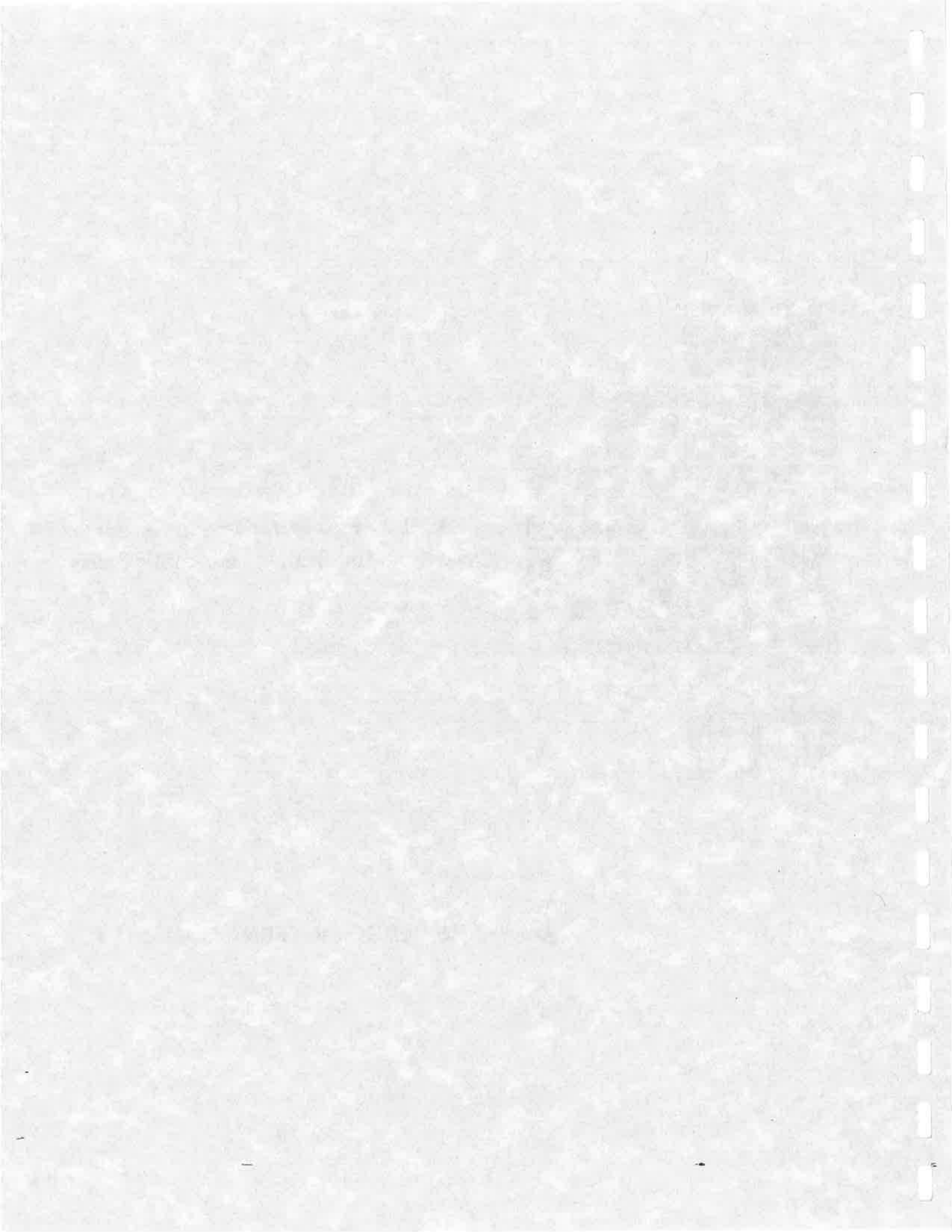
In conclusion, the importance of dredging investments to the nation's competitiveness in an increasingly global economy have not generally been well articulated in the public policy and decision-making process. Delays in project implementation affect the nation's industries and export competitiveness.



**VIII. Transportation and Economic
Expansion - Implications for Public Policy**



LOUIS BERGER INTERNATIONAL, INC.



VIII. Transportation and Economic Expansion - Implications for Public Policy

Transportation investments result in economic productivity increases to the extent that they lower transportation costs and travel times. These time and cost reductions may be realized in numerous ways, including increases in safety, decreases in fuel and other operating costs, lowering of business inventory requirements and costs, lowering of travel times, increases in travel time reliability, etc. These productivity increases not only accrue to persons and businesses whose vehicles use the transportation facility, but to others as well. The key to stimulating long-term economic growth lies in **properly targeted transportation investments that enhance productivity and result in a net increase in private sector investment.**

In a competitive, free market economy, lower transportation costs are passed on to consumers as lower prices for consumer goods or services, to workers as higher wages, or to owners of businesses as higher income. These are then the three main groups of users whose response will determine the eventual productivity impact of transportation investments. It can be argued that without investments to expand and improve the transportation system, there can be no long-term economic expansion, since economic expansion implies serving larger, more varied and more distant markets and destinations for:

- employees,
- customers of service businesses, and
- manufacturers and distributors of products.

Public policy initiatives should be explored to **explicitly consider the potential economic impact of alternative transportation investments** at the national, state and regional/local levels. Strategic investments that affect the global competitiveness of the nation's economy (such as congestion points, intermodal and international connections, new technology, and system gaps) need to be given **national priority**, as is the case in many other countries. Streamlining of decision-making to expedite targeted investments is necessary to assure that an **appropriate balance is maintained between environmental, social, and economic goals.**

The decision to proceed with an investment should carefully consider the degree to which it can increase transportation access and reliability or reduce costs to workers, service establishments, and product manufacturers and distributors. Such decisions should not rely solely on demand estimates and the environmental and social impacts, as is the case today. Only a comprehensive analysis of economic benefits and impacts on competitiveness and a consistent analysis for alternative investments can assure implementation of the most cost-effective and economically sound projects.

The case studies reviewed in this study describe the range of economic development impacts associated with different types of transportation investments and the importance of transportation investment to long-term and sustainable economic expansion. The major lesson learned is that **all major transportation investments influence economic growth.** The challenge to improve investment decisions is to establish a process that formally considers economic expansion impacts

of alternative investments so as to assure the selection of properly targeted strategic projects. The following other conclusions can be reached:

1. The most direct, most readily measurable and the most fundamental way in which transportation investment influences economic development is by reducing transportation costs to move people and goods, which in turns increases economic productivity.
2. Congestion is a major factor that affects economic expansion and productivity in today's competitive environment. It particularly affects the service and high value product manufacturing industries that count on fast and reliable product distribution and service delivery to remain competitive. Congestion reduction is a major objective of transportation investment, whose achievement is critical to future economic expansion.
3. Properly targeted investments so as to measurably reduce transportation costs and increase service quality and reliability, without negatively affecting the tax burden of residents and other industries, can improve productivity and stimulate economic expansion.
4. The economic development benefits of transportation investments can take long periods to materialize. While it may not be possible to isolate or quantitatively measure the specific impact, the potential economic impact of various alternative investments should be considered explicitly to improve transportation decisions.
5. Even though the linkages between transportation investment and economic expansion are very complex and difficult to fully foresee, much remains to be done to provide better information for decision-making regarding prioritization and needed levels of investment. Consistent methodologies for analysis need to be available to quantify as fully as possible the economic, social, and environmental consequences of alternative investments.

Based on recent economic trends, certain strategic investments are particularly important to support the expanding sectors of the economy, such as those aimed at:

- increased reliability and faster freight delivery, including better control of highway traffic incidents, reduced congestion and bottlenecks;
- meeting air transportation requirements of management/professional staffs of businesses with decentralized operations;
- commuting needs for service sector labor to suburban and rural areas;
- increased efficiency of the nation's border ports of entry, seaports and airport systems to handle foreign trade needs, including improved inland access connections by rail and highway;

- new technology applications to improve transportation industry productivity and reduce costs;
- improved intermodal connections and rail clearances for railroads to be able to operate newer technology and more efficient railcars (e.g. double-stack and tri-level railcars);
- meeting the transportation needs of the tourism and hospitality industries (including long-distance travel to tourism destinations as well as travel within metropolitan areas); and
- increasing accessibility and market reach, by improving connectivity and eliminating system gaps, since transportation access remains an important factor in business and residential location decisions and industry competitiveness.

ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
BART	Bay Area Rapid Transit
CAAA	Clean Air Act Amendments
CAPUFE	Caminos y Puentes Federales de Ingresos y Servicios Conexos
CBO	Congressional Budget Office
C&D	Chesapeake and Delaware
COE	Corps of Engineers
CTPS	Central Transportation Planning Staff
FAA	Federal Aviation Administration
GDP	Gross Domestic Product
GNP	Gross National Product
GSP	Gross State Product
GPS	Global Positioning System
ILS	Instrument Landing System
INS	Immigration and Naturalization System
ITS	Intelligent Transportation System
JIT	Just-In-Time
LBS	Laredo Bridge System
MARTA	Metropolitan Atlanta Rapid Transit Authority
MLS	Microwave Landing System
NAFTA	North America Free Trade Agreement
NAS	National Airspace System
NASPlan	National Airspace System Plan
NCHRP	National Cooperative Highway Research Program
PCN	Priority Commercial Network
POB	Port of Baltimore
R&D	Research and Development
SEPTA	Southeastern Pennsylvania Transportation Authority
VMT	Vehicle Miles of Travel
WMATA	Washington Metropolitan Area Transit Authority

