NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP Report 421

Economic Trends and Multimodal Transportation Requirements

Transportation Research Board
National Research Council

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Report 421

Economic Trends and Multimodal Transportation Requirements

LOUIS BERGER INTERNATIONAL, INC.
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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communications and cooperation with federal, state and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration, U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

To save time and money in disseminating the research findings, the report is essentially the original text as submitted by the research agency. This report has not been edited by TRB.

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FOREWORD

By Staff
Transportation Research Board

This report contains the results of research into the economic trends affecting multimodal transportation demand; the requirements of American business in responding to those trends; and reference materials for planning practitioners on the changing transportation needs of business for use in the transportation planning process. The report should be of interest to state departments of transportation, metropolitan planning organizations, and other transportation project sponsors. It should also provide a valuable resource for transportation planners, transportation economists, and others responsible for long-range transportation planning and strategic management.

Over the past decade, the U.S. economy has sustained tremendous change in response to a changing global economy. Economic sectors have undergone significant change as have individual businesses. In supporting economic expansion goals, it is important to consider how multimodal transportation investments can sustain development in the future. This is particularly true in light of the opportunities for increasing the market reach of U.S. economic production and the competitiveness of American business in the worldwide economy. As federal transportation policy has evolved in the 1990s, under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21), there has been a growing expectation that transportation system improvements and investments should contribute to national, regional, and local economic growth and productivity in addition to fulfilling the many other functions traditionally associated with such investments. This can be accomplished through a greater understanding and recognition of the nature of our changing economic structures and needs.

Transportation planning practitioners and decision makers at all governmental levels need information regarding the types of multimodal transportation investments that can best contribute to increased competitiveness of American business. The results of this research provide information that can be used as a basis for considering strategic investment priorities at the national, state, and local levels that can support improved American business competitiveness while also sustaining economic development.

Under Project 2-20, "Economic Trends and Multimodal Transportation Requirements," Louis Berger International, Inc. of Washington, D.C., conducted research that developed guidance for use by planning practitioners and other transportation decision makers based on the relationship between current and future regional, national, and global economic trends and the freight and passenger transportation requirements of American business. The three-phased study focused on economic trends and the requirements of American business for transportation service and systems; perspectives for incorporating business transportation needs into the statewide and metropolitan planning processes; and reference material for use by planning practitioners.

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Summary

Introduction and Research Approach

The U.S. economy is being transformed as a result of many global demand and supply forces that affect the competitiveness of U.S. industry. Recent trends in distribution and logistics, shipper requirements, and business location patterns are also revolutionizing the private transportation industry. These trends also have significant implications for the types of infrastructure and government supported transportation programs that will be required in the future. Project 2-20 of the National Cooperative Highway Research Program (NCHRP) was conducted to consider how these economic trends are affecting multimodal transportation requirements and how they should be reflected in the transportation planning process.

The project's research approach involved a three phased effort. The objective of the first phase was to identify and consider the economic trends affecting multimodal transportation, particularly to identify the most relevant trends that significantly influence changing transportation demand and service requirements. The main objective of the second phase was to summarize multimodal transportation requirements of American business, in view of the previously identified economic trends. Finally, the objective of the third phase was to provide planning practitioners with reference and guidance material on the changing transportation needs of business for use in the transportation planning process.

To meet the objectives of NCHRP Project 2-20, information was gathered to gain a better understanding on how multimodal transportation investments can help increase the productivity and thereby, the competitiveness of American business. Changes in the structure of the U.S. economy over the past several decades and recent economic trends were summarized based on a review of the literature. Transportation needs from the perspective of businesses and industries were defined. In addition, the BEA interindustry tables were analyzed to determine the significance of transportation to various economic sectors and industries. This information was supplemented by interviews with representatives of selected industries and businesses. The project then also considered ways to more formally consider the changing transportation needs of American business in the transportation planning processes at the State and Metropolitan Area levels.

Report Objective

This report presents the results of the NCHRP 2-20 research effort including reference and guidance material to improve the ability of transportation professionals and decision-makers to respond to the changing requirements of American business in their planning efforts at the national, state, metropolitan and local levels.

Summary of Findings

A. Economic Trends

1. The major economic trends resulting in an increase and changes in the nature of transportation requirements of American business can be summarized as follows:

   - globalization of the economy
   - growth of service industries
   - restructuring of traditional manufacturing to increase competitiveness and emergence of high technology and knowledge based industries
   - industrial location and demographics trends, including
     - increased flexibility of businesses in their location decisions, as most businesses can choose to locate anywhere in the country
     - aging population and increased leisure time and demand for travel
   - reduced government role and privatization

2. Economic forces and free trade policies that are generating increased worldwide trade tend to generate transportation demand, as products move longer distances and regions specialize in products which can be distributed competitively to a large hinterland.

3. Globalization of the economy not only involves manufacturing industries, but all economic sectors, including services. While the U.S. trade deficit has increased, the service sector has experienced an increasing trade surplus. Many service businesses tend to have a small hinterland, sometimes only at a local or metropolitan level. Yet, new technology, improved transportation, and modern communications are increasing the hinterland of many service businesses, including, for example, the retail industry (through mail order) and the food service industry (making possible global chains of restaurants).

4. Economic trends and globalization of the economy are also forcing industries to restructure operations and become more competitive. Industry restructuring also tends to generate increased transportation demand, because, for example, businesses tend to disperse their manufacturing around the world to reduce labor costs, and/or increase transportation requirements by concentrating distribution out of one or a few distribution centers serving the entire nation. Traditional large-scale manufacturers have become more competitive over the past decade, partly by instituting just-in-time inventory control systems that reduce their manufacturing, distribution and inventory costs, and increase demand for higher levels of transportation service. These companies then are not only searching for ways to reduce transportation costs, but also are pursuing integrated logistics systems that reduce transit times and improve reliability.

5. Just-in-time systems are increasingly being used not only by manufacturing, but also by retailing and service industries. In general, JIT systems consume more transportation assets than conventional shipping arrangements. They require more trucks on the road, not to move more freight, but to move it quicker. The flexibility of U.S. transportation capacity may be

constrained, as highway volumes may increase faster than the cargo tonnage that is being carried.

6. Some of the most competitive sectors of the U.S. economy include the newer high technology and knowledge based industries that are generating changes in the nature of transportation demand, since they rely on shorter product cycles that can quickly become obsolete, as well as more frequent shipments of smaller, lighter products. Similar requirements have been introduced by the most successful firms in other industries, e.g. apparel, retailing and food products.

7. The competitiveness of American companies is dependent on whether their products can be transported and delivered reliably at a competitive price from a manufacturing plant or distribution center to a larger hinterland, including both domestic and foreign destinations.

8. Improved reliability of transportation service and the ability of a company to reduce its product inventory increases the firm's competitive advantage, both because of their ability to respond to changing customer demand faster and to reduce their costs. Of greater national policy importance, if enough U.S. manufacturers improve on their supply chain logistics efficiency, the whole economy is affected positively. This can be seen most clearly during an economic slowdown where a less severe downturn is expected than in the past due to more efficient manufacturers, as Allen Wastler explains in a 1996 article in *The Journal of Commerce.* In the past, inefficiencies in the supply chain "worsen recessions" according to analyst Steve Lewins. However, if the supply chain is efficient, there are not many goods in the pipeline, and as demand falls, production will decrease accordingly, thereby saving business losses from over production and over inventory. As such, the benefits of increased transportation reliability include contributing to U.S. competitiveness, business profitability, and overall economic stability.

9. An aging population is generating increases in demand for health care and hospitality services, which in turn increases the need for specialized transportation services for customers of those services.

10. One of the fastest growing economic sectors worldwide involves the industries encompassing travel, tourism and hospitality services, which also generate demand for transportation, as people tend to travel more frequently or farther away on vacations.

11. Based on data from the BEA interindustry tables, manufacturing industries are the largest single source of demand (measured in terms of revenue) for transportation service (passenger and freight) among industry sectors, representing about 22 percent of all sales made by transportation companies. In order of relative importance, services (5 percent of all transportation sales) and construction (4 percent of all transportation sales) are the two other economic sectors that represent the largest sources of demand for transportation services.

B. Transportation Service and Management Requirements of American Business

1. Although each sector (and industry group or individual firm) has its own unique transportation requirements, these requirements can be generalized into three broad categories:

   I. Sectors which produce raw materials, or bulky, low-market-value products with less emphasis on time delivery or reliability requirements;
   II. Sectors which rely on just-in-time inventory systems and/or produce higher-market-value products with time-critical delivery and reliability requirements; and
   III. Service industries - other than wholesale and retail trade, which have few freight transportation requirements (apart from overnight package delivery), and are more concerned with access for their service fleets and the transportation of their customers and employees.

   The major requirements of each economic sector are summarized in Tables 2.3–2.7 in Chapter 2.

2. Reliability and fast transit time are becoming more important freight transportation requirements of American businesses. For an increasing number of industries that rely on just-in-time delivery, including many of the fastest growing industry groups, and most of the technology and knowledge intensive industries, reliability and speed of delivery is the most important freight transportation requirement. These industries select their transportation carrier without regard to which mode is used, based mainly on lowest cost among those that meet their time, reliability, quality and other service requirements. The importance of transit speed and reliability to control inventory costs (particularly for high value merchandise) means that companies increasingly rely on truck travel and air cargo. When necessary, companies are sending materials needed for the production line by air rather than shutting down assembly lines. Similarly, retailers move products by air when necessary to avoid shortages during advertised sales.

3. The most inportant transportation requirement for industries in the service sector (other than wholesale and retail trade) is reliable, low cost transportation access for business travel and for their service fleets, as well as for their customers and employees. This includes good highway/freeway or primary road access, as well as reliable and low-cost access to public transport. Many of the service sector industries rely increasingly on overnight package delivery within the U.S. and North America, as well as 2-day package delivery to far away destinations in other continents. Service industries use such considerations in the choice of business location.

4. The growth of electronic commerce is also affecting the transportation requirements of businesses and the demand for transportation. As consumers increasingly find that they have less time for shopping, new businesses are developing to sell products by phone, mail, TV, electronic mail, or internet, with fast, reliable delivery expected within an urban area, across

the country, and even internationally. The growth of sales by catalog or through the Internet are examples of this trend that will increase the demand for overnight package deliveries and courier delivery services within residential urban areas. This trend also has potentially significant implications for transportation demand, eventually possibly reducing shopping trips in urban areas.

5. For some industries, business travel represents a significant share of total costs (as high as 10 percent). For these companies, business travel costs and service level affect their competitiveness and their area of operation.

6. Employee and customer accessibility by road, public transportation, and, in some areas, by rail is an important factor in locating businesses. Most service sector companies consider access to be an employee or customer concern once the business has been located, except when congestion affects their business. Some larger companies in downtown or urban/suburban fringe locations now have to participate in transportation management measures to reduce air pollution. Congestion causes inconvenience and minor inefficiencies and does not typically affect competitiveness, but when it does, companies consider relocation.

C. Changing Transportation Industry

1. The transportation industry, broadly defined to include travel management and freight logistics, has been rapidly evolving to meet the changing requirements of American business. Business travelers have an increasing number of options for their domestic and international travel needs, with expanded geographic coverage involving seamless connections between carriers that have established alliances or marketing agreements (e.g. United Airlines' Star Alliance and the proposed American Airlines-British Air alliance). Similarly, companies have an increasing number of alternatives for moving their freight to more destinations with improved reliability, with various alliances and mergers approved or being pursued (such as the APL-NOL merger, the Grand Alliance, the Global Alliance, the CSX-Conrail-NS mergers, etc.). At the same time, logistics and more sophisticated computer systems are evolving to manage both passenger and cargo needs, mostly through outsourcing to companies that specialize in these services. The ability of the industry to further meet the increasing requirement for reliability is dependent on assuring adequate long-term capacity, improving intermodal connections, and reducing congestion, particularly in heavily used urban corridors, ports and airports.

2. Seeking to satisfy the increasing demand for less expensive, faster and more reliable services, transportation carriers have been reducing their operating costs by consolidating their operations; creating larger, more efficient operating units through mergers, alliances, and partnerships; and introducing new technologies, more efficient vehicles, and information-exchange services aimed at meeting the changing needs of businesses. Although truck-rail intermodal services have grown rapidly in the past decade, many shippers are still not confident as to their reliability.

3. An increasing number of firms have contracted the management of transportation services, including arrangements with travel agencies for business travel needs, as well as contracting out freight transportation and logistics services. The major trends and emphasis areas in the management of the transportation requirements of American businesses in the U.S. include the following:

1. Emphasis on Quality Management.
2. Limited or Single Sourcing.
3. Outsourcing Integrated and Innovative Logistics Management Services.
4. Global Coverage and Management Capability.
5. Importance of Equipment Condition and Availability.
6. Increased Information Exchange Capability.

D. Framework for Considering Business Transportation Needs in the Planning Process

1. Business transportation requirements should be explicitly considered in State and Metropolitan Area transportation plans, taking into consideration the needs of the main economic sectors and industries that make up the local or State economy and their changing transportation needs to remain competitive. Approaches to reduce congestion in business travel corridors and international gateways and ports of entry should be explicitly considered in developing transportation plans and programs. Business transportation requirements can be broken down into two broad categories: (1) passenger movement requirements, and (2) freight movement requirements.

2. For passenger movements, because the main purpose of urban travel demand surveys has been to forecast demand at the household or individual passenger level, typically urban travel surveys classify demand by purpose, as follows:
   - Work
   - Shopping
   - Personal business
   - Social/recreational
   - Other

   It is proposed that to consider business needs, these travel categories can be reclassified from the perspective of the industries or economic sectors affected. The proposed market segments from the perspective of businesses are as follows:
   - Employee access
   - Customer access
   - Business travel

3. For freight transportation, business requirements can be examined with respect to three major market segments, i.e., the need for:
   - Movement of raw materials and inbound products that are input to the production process,
   - National or regional distribution of products to wholesalers and distribution centers, and

- Local distribution.

These market segments can then be further segmented or analyzed based on geographic scope or market reach of the materials, products, and distribution, i.e., the need for:

- Foreign trade (exports and imports),
- Long-haul intercity domestic movement, and.
- Local movements.

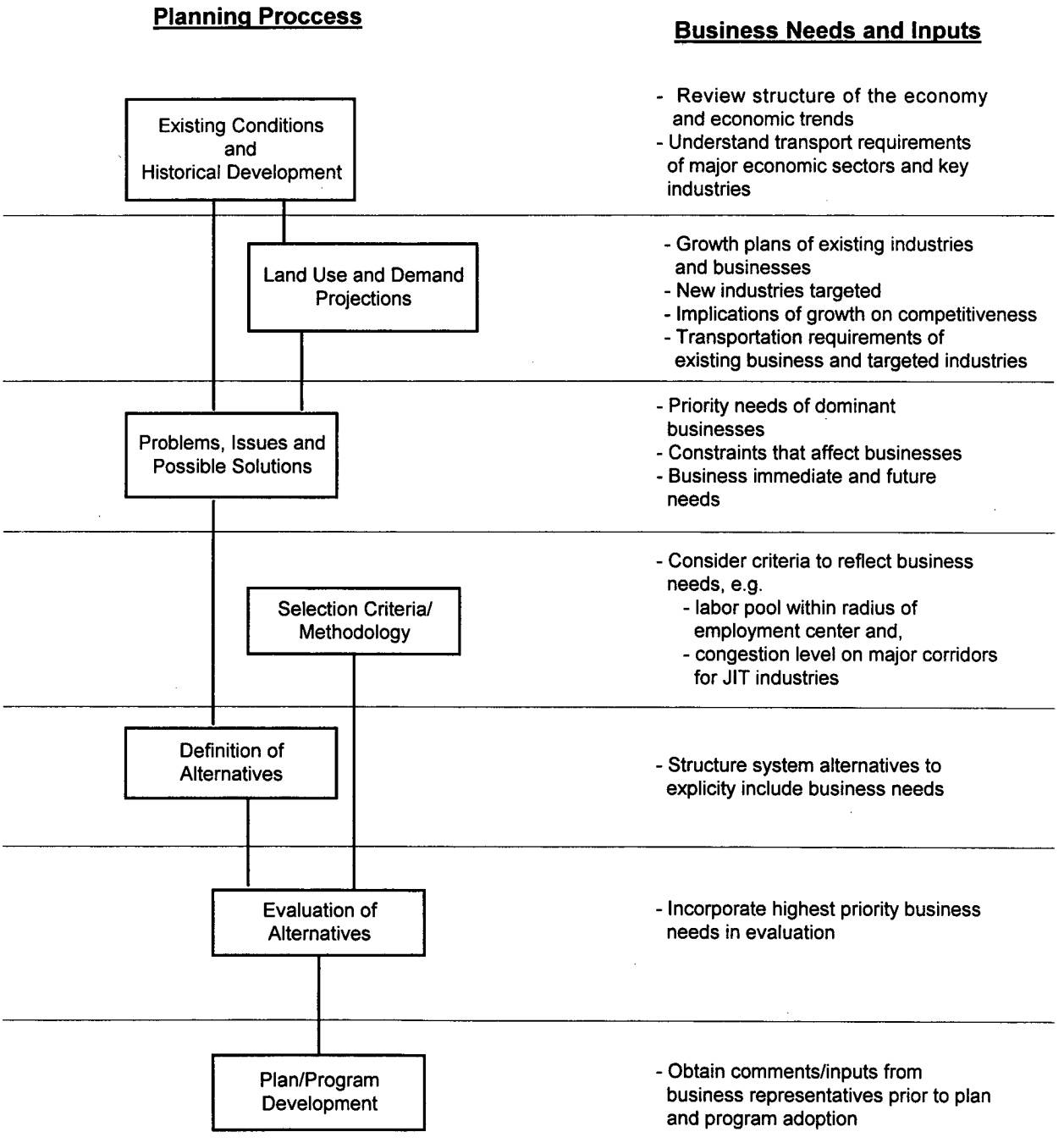
It should be recognized that specific freight transportation analysis are typically conducted by the transportation planning process to address:

- The access problems of industries threatening to move,
- Needed improvements to attract a new industry and to address airport, port, and border port of entry access problems,
- Policy positions on carrier merger proceedings, and/or
- Area-specific congestion problems associated with trucks.

4. As shown in Figure 1, each of the typical steps of the transportation planning process should incorporate analysis of business requirements and/or input from the business community, e.g. the following types of analysis should be regularly carried out:
   - Review structure of area economy and economic trends,
   - Analyze transport requirements of key area industries,
   - Review growth plans of area businesses,
   - Consider new industries targeted in economic development plans,
   - Analyze implications of business growth on transportation demand and competitiveness of area businesses,
   - Identify priority transportation needs of dominant businesses,
   - Consider transportation constraints that affect businesses,
   - Summarize immediate and anticipated priority transportation needs of businesses,
   - Develop evaluation methodology that formally incorporates criteria reflecting business transportation needs,
   - Structure transportation alternatives to include highest priority business transportation needs, and
   - Obtain comments/input from business representatives prior to plan and program adoption.

5. Possible strategies that can contribute to increased industry competitiveness should be considered in the planning process, categorized as follows, strategies to:
   - Reduce congestion and bottlenecks,
   - Encourage border-crossing/gateway development,
   - Improve capacity and efficiency,
   - Introduce new technologies,
   - Address institutional roadblocks, and
   - Standardize equipment and processes.

Figure 1: Incorporating Business Needs into the Transportation Planning Process



6. Strategies that appear to have the greatest potential to increase the competitiveness of American business should be selected if they:
   - Benefit a large number or at least several economic sectors (e.g., those investments that can increase reliability and reduce congestion, such as incident management, congestion management, ITS, etc.),
   - Appear to result in more significant reductions in transportation costs or increases in service level (e.g. improved highway access to rail yards, ports and airports so as to reduce time and cost of intermodal connections),
   - Address specific issues or obstacles that presently hinder industry competitiveness or address unique economic development opportunities (e.g. new highway corridors or intermodal connections that significantly reduce costs or increase service level along newly emerging corridors connecting Canada to Mexico as result of the NAFTA agreement), and/or
   - Provide opportunities for industries to improve competitiveness by helping them lower inventories, increase product delivery reliability, and improve speed of business travel.

Conclusions and Suggested Additional Research

1. Nearly all transportation demand is derived from economic activity, since freight transportation demand and most individual passenger travel is related to some economic activity. Therefore, the transportation requirements of the businesses and enterprises that make up an area add up to the transportation demand that the transportation planning process for a State or Metropolitan Area needs to address.

2. While the planning methodologies for people movement in general is relatively well developed and understood, a framework has been proposed for considering these passenger travel requirements from a business and industry perspective. It is proposed that transportation planners should analyze person transportation needs not only from an individual or household travel perspective but also from the perspective of an area's major economic sectors, industries and/or businesses.

3. Regarding freight transportation requirements, many states and metropolitan regions have little or no freight demand modeling capability and have just recently began to consider freight transportation issues. A framework has been proposed that can be used by transportation planners in further defining the process, emphasizing relevancy to the needs of businesses and targeted industries. Transportation planners should also formally consider freight transportation needs from the perspective of the major sectors and industries that make up an area's economy and taking into consideration the factors that increasingly affect those industries.

4. Travel management and logistics management providers are becoming potential sources of data (as long as the information is treated confidentially) and can provide an invaluable understanding of the transportation requirements of the industries they serve. Planners need

to consider how these management firms can best contribute to and/or participate in the transportation planning process.

5. The type of analysis on economic trends and their implications on changing transportation demand and the needs of American businesses that was carried it out as part of this study should be updated periodically. This study was based on 1987 data (the last BEA interindustry tables available at the time the research was conducted). BEA has now released 1992 comparable interindustry data, similar to the 1987 data the study team used. It is also suggested that similar analysis be carried out with older BEA data to determine changes in transportation use over time. In the future, the increased use of electronic commerce may have significant implications for transportation demand and business transportation requirements. This research should then be updated periodically to analyze changes in business transportation needs and use over time using the latest available data.

Chapter 1
Introduction

1.1 Background

The U.S. economy is being transformed as a result of many global demand and supply forces that affect the competitiveness of U.S. industry. Recent trends in distribution and logistics, shipper requirements, and business location patterns are also revolutionizing the private transportation industry. These trends also have significant implications for the types of infrastructure and government supported transportation programs that will be required in the future. Project 2-20 of the National Cooperative Highway Research Program (NCHRP) was conducted to consider how these economic trends are affecting multimodal transportation requirements. To meet the objectives of NCHRP Project 2-20, information was gathered to gain a better understanding on how multimodal transportation investments can help increase the productivity and thereby, the competitiveness of American business. This report presents the results of the NCHRP 2-20 research effort.

1.2 Study Objective

The objective of this project was to develop reference and guidance material to improve the ability of transportation professionals and decision-makers to respond to the changing requirements of American business in their planning efforts at the national, state, metropolitan and local levels. To achieve this objective, information is presented in this report on:

- How current and anticipated regional, national, and global economic trends are influencing the passenger and freight transportation requirements of the American economy;
- The importance of transportation to the competitiveness of each economic sector or industry, the key transportation service factors, and the multimodal transportation requirements that affect competitiveness;
- Examples of potential investment strategies to improve competitiveness, and how to more explicitly incorporate the needs of American business in the transportation planning process, such as when considering alternative transportation investment strategies.

1.3 Overview of Approach

The project's research approach involved a three phased effort. The objective of the first phase was to identify and consider the economic trends affecting multimodal transportation, particularly to identify the most relevant trends that significantly influence changing transportation demand and service requirements. The main objective of the second phase was to summarize multimodal transportation requirements of American business, in view of the previously identified economic trends. Finally, the objective of the third phase was to provide planning practitioners with reference and guidance material on the changing transportation needs of business for use in the transportation planning process.

1.4 Report Organization

After this introduction, this report is organized into three other chapters. Chapter 2 presents an overview of the economic trends and multimodal transportation requirements of American business. A more complete description of these research areas is presented in Appendix A.

Chapter 3 presents an overview of the statewide and metropolitan planning process in the context of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) requirements. It summarizes the major elements of the transportation planning process and the statewide and metropolitan planning factors required by ISTEA. It then presents suggested steps and examples of approaches on how to incorporate the needs of business in the transportation planning process when carrying out each of the planning elements and/or taking into consideration the planning factors required by ISTEA. Chapter 3 also categorizes the economies and other characteristics of states and metropolitan areas which affect business transportation requirements to assist planners in considering strategies to address business transportation needs. Appendix B includes some examples of transportation strategies that might be applicable to incorporate the changing needs of businesses in the transportation planning process. Appendix C provides samples of the interview forms that can be used to carry out a detailed evaluation of the changing requirements of American business for key industries in an area.

Finally, Chapter 4 presents the conclusions and the implications of these business transportation requirements as well as suggested approaches to develop strategies that address these needs as part of the transportation planning and policy development process.

Chapter 2
Economic Trends and Multimodal Transportation Requirements of American Business

This chapter presents an overview of the economic trends and multimodal transportation requirements of American business, including:

- The structure of the U.S. economy and the rapidly growing economic sectors and industries that play an increasingly important role in the American economy;
- The major economic trends affecting transportation demand and service requirements;
- The transportation requirements of American business, in view of the previously identified economic trends;
- An overview of how the transportation industry is responding to these changing requirements of American businesses; and
- Conclusions and implications for transportation planning.

A more complete description of each of these research areas is presented in Appendix A.

2.1 The Structure of the Economy

In 1993, the Gross Domestic Product (GDP) of the U.S. was estimated at $6,343 billion. Following the Government's Standard Industrial Classification (SIC) system, output is divided into the following major economic sectors:

- Agriculture, Forestry and Fishing;
- Mining;
- Construction;
- Manufacturing; and
- Services, broadly defined to include all other sectors, i.e.:
  - Transportation and Public Utilities;
  - Wholesale Trade;
  - Retail Trade;
  - Finance, Insurance and Real Estate;
  - Private Sector Services; and
  - Government Services.

Economic trends and industry changes due to increasing use of technology are blurring the lines between some of the sectors and industry groups. The printing and publishing industry, for example,

falls under the manufacturing sector. The industry, however, performs many service related activities (i.e., journalism functions, copy writing, editing, etc.). Furthermore, the increasing use of electronic media for the dissemination of "products" raises questions as to whether these industries are part of the manufacturing (e.g. producers of computer software or entertainment compact disks) or services sectors (distributors of these products over the Internet) . These trends and changes on how industries produce their output requires reconsideration of the definition of some industry groups and may result in changes in the share that each sector contributes to the economy.

Some important and fast growing "industries" cannot be aggregated within the government classification of industries and sectors. Tourism, for example, is one of the most consistent growth industries in the world, representing about 12% of the world's GNP. Tourism ranks third among all export industries, and second in terms of employment generation among all industries in the U.S. Travel and tourism is the first, second, or third largest employer in 37 states. However, this industry is not included in the SIC codes generally used to analyze the U.S. economy. Tourism includes several service industries, or segments of these industries. Based on expenditures, travel and tourism is the nation's third largest retail industry (as defined by the Tourism Works for America Council), after automotive dealers and food stores. Some of the services provided by the transportation industry also can be considered part of the tourism industry (e.g. air travel, car rental, tour providers, etc.). There have been some efforts by the World Trade Organization to better define the various segments of the tourism industry. Through such analysis, the relative importance of tourism to a national or state economy can be better understood.

The definition of industries, to better reflect the impact of technology, better categorize sectors and parts of industries that are inter-related (such as tourism), and consider the implications of changes in the production processes, is presently also being discussed by U.S. government agencies.

The contribution to GDP of the major economic sectors (as historically defined) is presented in Figure 2.1. As has been widely reported, service activities contribute the largest share of GDP. Furthermore, private sector services and the finance, insurance and real estate industries are now the largest economic sectors nationally.

2.2 Rapidly Growing Sectors of the Economy

During the 15 year period from 1977 to 1992, the U.S. economy grew 2.5% annually. The main economic sectors that grew at a higher than average rate during this period were: Agriculture, Forestry and Fisheries; and several sub-sectors within the broadly defined Services sector, i.e. Transportation and Public Utilities; Wholesale Trade; Retail Trade; Finance, Insurance and Real Estate; and Private Sector Services.

Viewed from a longer historical perspective, the U.S. economy has undergone dramatic changes since the 1950s. From an industrial base, built around mass production of standardized goods, the U.S. economy has been transformed into a post-industrial economy (Stanback et al., 1981; U.S. Department of Commerce, 1987). The post-industrial economy produces a wider variety of specialized goods and is more service-oriented.

Figure 2.1

Contribution of Major Industries to U.S. GDP

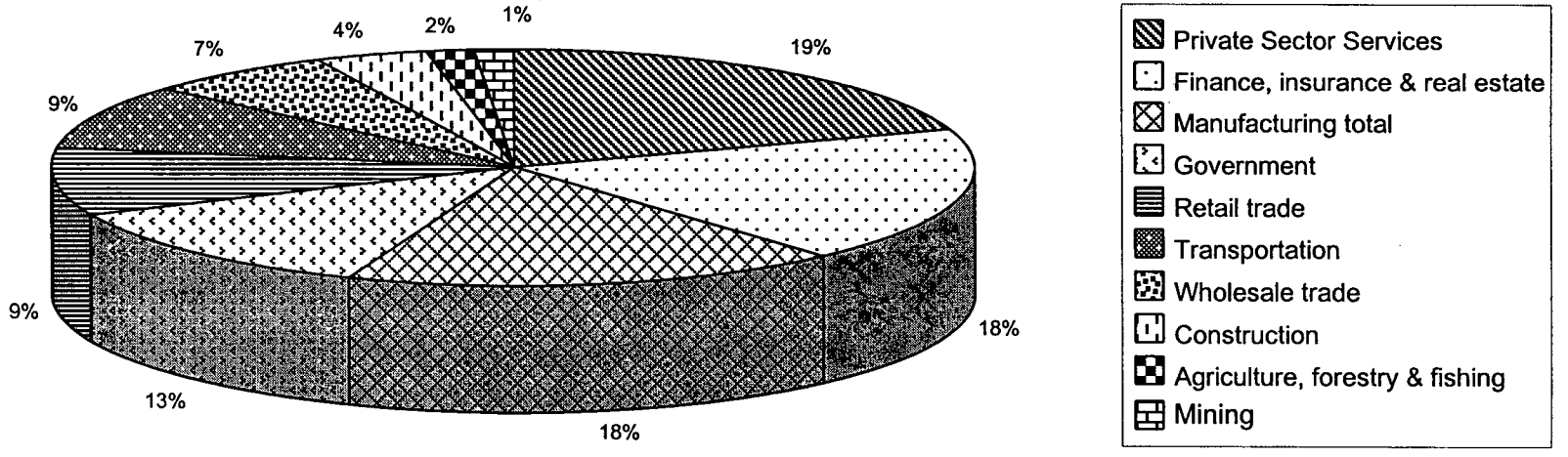


Figure 2.2 shows the changes in the contribution of the five major economic sectors to GDP from 1950 to 1993. All of the economic sectors, except the broadly defined "services," have experienced significant declines in terms of their contribution to national GDP, or their share of the national economy. The agricultural, forestry and fisheries sector, that accounted for more than 7% of GDP in 1950, now accounts for less than 2% of GDP. Similarly, mining declined from 3.2% to 1.4% of GDP and construction declined from 4.6% to 3.7% of GDP. The largest economic sector, other than the broadly defined "services" in 1950 was manufacturing, representing 29.3% of GDP. By 1993, manufacturing contributed only 17.6% of GDP, partly as a result of growing foreign competition. Most of the increase in contribution to GDP by the services sector has then been a result of a decline in the GDP contribution by the manufacturing sector.

While the GDP contribution of the manufacturing sector has declined, particularly as traditional heavy manufacturing industries have faced increased competitive pressures from abroad, technology-based and knowledge-intensive industries have grown rapidly and are forecasted to continue growing faster in the future. Table 2.1 shows some of the fastest growing industries and their forecasted growth rate for the period from 1992 to 2005. All of these 15 industries forecasted to grow rapidly are in the services and/or high-tech and knowledge intensive manufacturing sectors.

The growing importance of the service sector and the high-tech and knowledge-intensive manufacturing industries is not only affecting the structure of the U.S. economy, but similar trends can be observed in other developed economies. These and other economic trends affecting transportation demand will be discussed in the next section.

2.3 Economic Trends

Along with the expansion in information, technology and entertainment-based services in the U.S., there has been a rapid growth in the sales of services abroad by U.S. firms. Underpinning the continuing metamorphosis of the U.S. economy from an industrial to a post-industrial economy, are several concurrent developments, including the following five major recent trends:

- Importance of International Trade and Globalization of the Economy
- Growth of Services Industries and the Role of Service Functions within Corporations
- Changes in the Manufacturing Sector and its Competitiveness and Growing Importance of High-Tech and Knowledge-Intensive Manufacturing
- Changes in Industrial Location, Development and Demographics
- Reduced Government Role and Privatization

Each of these major economic trends affecting transportation demand are discussed in the following paragraphs.

1. *Importance of International Trade and Globalization of the Economy.* The U.S. has led in the growth in international trade over the last 20 years, and the impact of foreign trade on the American economy has increased significantly. The share of trade (imports and exports) as a percentage of GDP (in constant 1987 dollars) increased from 12.4% in 1970 to 24.8% in 1993. Although there has been a persistent trade deficit in the U.S. trade balance since the

Figure 2.2

Share of Gross Domestic Product by Sector

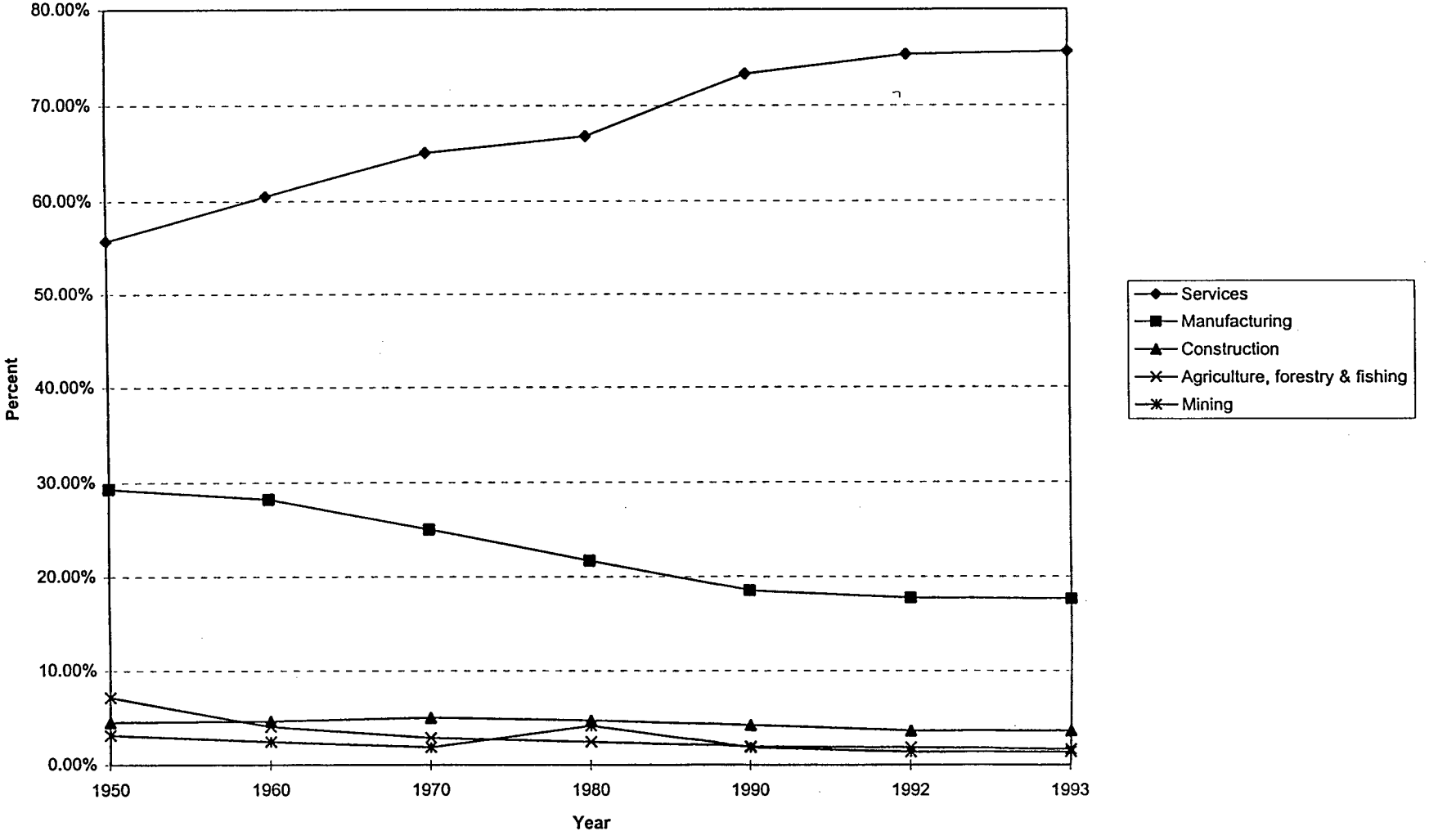


TABLE 2.1 Selected Fastest Growing U.S. Industries- Growth Rate 1992-2005

Rank	BLS Categories	Percent Growth
1	Computer Equipment	330.5%
2	Residential Care	175.2%
3	Semiconductors and Related Devices	169.4%
4	Medical Instruments and Supplies	116.8%
5	Child day care services	107.4%
6	Computer and Data Processing Services	97.7%
7	Security and Commodity Brokers	92.6%
8	Individual and Miscellaneous Social Services	91.5%
9	Business Services, not elsewhere classified	88.8%
10	X-Rays and Other Electromedical Apparatus	84.3%
11	Museums and Noncommercial Organizations	71.0%
12	Management and Public Relations	69.9%
13	Broadcasting and Communications Equipment	69.1%
14	Amusement and Recreation Services	68.4%
15	Health Services, not elsewhere classified	67.2%

Source : U.S. Department of Labor, "American Work Force : 1992-2005", 1994.

1970s, the international service trade balance has been consistently positive and growing.

2. *Growth of Services Industries*. As a whole, the service sector has been the fastest growing. However, not all services have exhibited the same rate of rapid growth. Some of the traditional service sectors of the economy, that to a large extent serve the goods-producing sectors (such as transportation and retail trade), experienced slight declines in their shares of national GDP. The three major economic subsectors experiencing significant growth during the last 40 years have been finance, insurance and real estate; private sector services; and government. Underpinning the continuing growth of the services sector are several other trends that are changing the nature of services required by businesses, for example

   - Rise of producer services, such as marketing, research and development, finance, and personnel management, and the trend towards outsourcing some of these functions due to corporate downsizing;
   - Increased technology and specialized telecommunications services;
   - Growth in multi-location production and increasing size of markets requiring more complex services, such as global market analysis, communications and distribution; and
   - Growth of international services.

With the services sector growing faster than other sectors of the economy, most of the nation's jobs created in recent years have been in the services sector. This growth in employment has been chiefly accounted by some sub-sectors. The employment share of the private sector services sub-sector in particular, grew from 18.4% to 29% of all service employment between 1970 and 1993. Part of the reason for the fast growth in business services employment has been the increasing importance of functions other than direct production, such as finance, marketing, advertising, product research and development, personnel management, and employment related to regulatory requirements. Even though corporate downsizing in recent years has reduced employment in some of the service functions not directly related to production, there are several other reasons for the fast growth in business services, such as:

- Rise of computers, expanded communications and related technologies, enabling efficient organization of more complex multi-location and multinational production and distribution, and creating demand for additional specialized services, such as consulting, engineering, logistics, etc.;
- Increasing size of markets, including the removal of trade barriers and the trend toward multinational, free trade, economic blocks;
- The rise in international services and the services associated with large multinational corporations.

3. *Changes in the Manufacturing Sector and its Competitiveness*. The changes in the manufacturing sector of the economy have been the result of several, related trends, led by increased foreign competition, that affected the competitiveness of U.S. produced goods. Due in part to this foreign competition, basic manufacturing industries have declined in importance. To regain their competitiveness, during the past decade American companies have been modernizing their manufacturing, distribution, and financial systems, and have been downsizing and restructuring their operations. In addition, new, smaller manufacturing industries have also emerged, producing a wider variety of specialized and high-tech goods.

Trends that have affected U.S. manufacturing production include:

- Emergence of Multinationals
- Rise of New "Knowledge-Intensive" and "Technology-Based" Industries
- Lower Volume–Higher Value Products
- Increasing Productivity and Competitiveness
- Changes in Nature of Manufacturing Processes, including:
  - Smaller, Technology-Based Production Processes
  - Just-in-time (JIT) Inventory Systems
  - Specialized and Differentiated Products
  - Reduction in Product Cycle Time
  - Lean or Just in Time Manufacturing
  - Decentralization of Manufacturing

Appendix A presents some discussion on each of these trends. The three most important trends affecting transportation demand, the rise of knowledge intensive and high-tech industries, the related increase in lower volume, high-value products, and the rise in JIT inventory systems will be briefly discussed below.

Perhaps the most significant trend affecting transportation demand is the growth and increasing importance of *technology-based and knowledge-intensive industries*. The composition of the U.S. manufacturing sector has been changing during the past decades. Basic industries have declined, as new industries have emerged. These new industries are the ones characterized by the "knowledge-intensity" and "technological innovation" of their products. In many instances, the physical inputs and outputs of these new industries are small, light, but highly valuable.

Table 2.2 underlines the increasing importance of some U.S. industries in the manufacturing sector considered as incorporating a high degree of technology in their production process. Table 2.2 has included the following industries as those involving a high degree of technology and/or knowledge and innovation:

- Industrial Machinery and Computer Equipment;
- Electronic and Electrical Equipment;
- Scientific/Laboratory Instruments;
- Other Transportation Equipment (aircraft); and
- Chemicals and Allied Products.

Some of these "high-technology" industries, which include drugs, medical equipment and supplies, electronic products, and office and computer equipment, have been growing and are anticipated to continue growing at a faster rate than other manufacturing industries. From 1977 to 1992, the share of these technology-based industries has increased from 35% to 42% of total manufacturing. This development is particularly interesting, considering that the contribution to GDP of the manufacturing sector has been decreasing over the years.

One characteristic of the newer manufacturing industries is that they are typically composed of a large number of smaller firms, with less concentration in the larger firms than is the case in the older industries. As new, smaller firms, they also typically depend on other firms for supplies and basic services and are not as integrated in their manufacturing and distribution processes. They also typically require higher-skilled labor.

Another important trend in the U.S. and world economies, with significant implications for transportation demand, is the shift from heavier, lower value, manufacturing products towards *higher value, less bulky, lighter products* typically associated with the new high technology based industries. One of the differences in the outputs or products of high-technology industries, compared to traditional basic industries, is their production of low volume, high value goods, and increasing demand for fast transportation of small quantities. As evidenced in a 1987 U.S. Department of Commerce report, the physical inputs of these goods tend to be also small, but highly valuable. Even the older, traditional manufacturing

TABLE 2.2 Share of "High Tech" Industries in Manufacturing Output

	1977	1980	1990	1992
Manufacturing	$741,552	$725,428	$928,483	$924,616
(in constant 1987 U.S.$ billion)	100.0%	100.0%	100.0%	100.0%
of which:				
Industrial machinery and equipment	11.0%	11.2%	11.0%	11.6%
Electronic and other electric equipment	7.3%	9.6%	9.8%	10.1%
Other transportation equipment	4.8%	5.3%	6.9%	5.8%
Instruments and related products	3.0%	3.3%	5.4%	5.4%
Chemicals and allied products	8.8%	7.9%	9.4%	9.5%
Total	34.8%	37.4%	42.6%	42.4%

of durable goods now produces smaller and less bulky products through greater use of plastic and other less bulky and lighter materials.

The U.S. Department of Commerce Study (1987) concluded that businesses in the future will require less transportation of industrial, raw materials per unit of output. Instead, expanding industries will produce lighter, less bulky goods, with an increasing value-per-ton, and the physical inputs of these products will also tend to be smaller, but highly valuable. These developments may have important implications for the relative use of competing transportation modes in the future. For example, demand for air freight and truck services may increase relative to water and rail services.

Another of the most important trends in manufacturing over the past two decades has been the emphasis of many businesses in "Just in Time" delivery and the shift of their operations to run on the basis of JIT inventory control systems. The JIT system was developed in response to the high interest rates of the 1970s and the high inventory carrying costs it generated. However, it continues to be increasingly used as a means of reducing inventory requirements and costs. The use of JIT is especially important to the electronics and automobile industries.

More and more manufacturers are carefully scheduling deliveries so that parts arrive when needed, not a day before or a day after. Through careful management of the transportation pipeline to the assembly plant, the inventory costs in storage and transit are kept to a minimum, thereby reducing warehouse and carrying costs. JIT requires more frequent, smaller shipments, emphasizing reliability.

4. *Industrial Location, Development, and Demographics Trends.* The trends that have affected the structure and growth of the U.S. economy have also affected the location of economic activity. Some of the resource-based sectors of the economy, such as agriculture and mining,

are restricted to those regions of the country where productive land and mines are located. Historically, basic manufacturing industries selected locations close to raw materials. As has already been mentioned, most of the recent growth has taken place in the high-tech, information and knowledge-based manufacturing sector, and in the service sector. In both of these cases, businesses have more flexibility and can choose to locate anywhere in the country. For states and metropolitan areas competing to attract additional jobs, it means that there is increased competition to keep existing businesses and attract new ones. Consequently such factors as climate, amenities, and ease of travel, become more important to an area's competitiveness.

The recent trends affecting location of economic activity involve several factors that can be summarized as follows:

- Continuing relative growth of Sunbelt areas that attracted significant shares of the growth associated with the new "knowledge-based" industries;
- Continuing growth in large metropolitan regions, because of their large cultural amenities, consumer services and markets, and availability of banking, international trade, and other specialized services, that attract national and regional headquarters;
- Faster growth in suburban-exurban areas, with many service activities, not requiring face-to-face interaction, moving away from the core urban centers;
- Greater dispersion of economic activity and greater flexibility or "foot-looseness" in terms of the factors that influence industry location, resulting from:
    - Multi-location manufacturing, in search of lower cost production, involving even multinational locations;
    - Dispersion of certain functions and/or services to different locations, such as locating manufacturing facilities in rural or suburban, low-cost labor locations, corporate headquarters close to certain cultural or climate amenities, and research and development near leading universities or research institutions; and
    - Agglomeration of certain activities in a few locations to make use of specialized skills required in the labor force, specialized suppliers and other services, or large consumer markets.

5. *Reduced Government Role and Privatization.* The role of government services in the U.S. economy grew significantly during the post-WWII period, from about 8.4% of GDP in 1950 to more than 13% in 1970. From the emergence of "Reaganomics" in the early 1980s to the "Contract with America" in the early 1990s and the continuing bipartisan effort to balance the Federal budget by the year 2002, the role of government in the economy has been on a decreasing trend. This development was further accentuated by the end of the Cold War that has resulted in cuts in defense spending. Military expenditures grew at an annual 0.3% growth rate during the period from 1977 to 1992, while GDP grew by an average of 2.5%.

At the same time that defense expenditures have been constrained, federal civilian expenditures have also grown at a lower-than-average rate compared to the overall U.S.

economy. The budget deficits have resulted in continuing efforts to reduce discretionary and non-discretionary expenditures. In many cases, these efforts have resulted in a transfer of responsibility to state and local governments.

During the last 15 years, state and local governments have also experienced budget crises and voter concerns about tax increases. Although efforts have been underway in many states and local areas to reduce the role of government, the rate of growth in their share of GDP (1.8%) was higher than that for federal expenditures, although still representing a lower rate than the 2.5% average annual growth for GDP.

The decrease in government and defense expenditures, and the emphasis on privatization of government services, ranging from health services to prison operations, welfare and education, has significant implications for future economic growth. This trend is likely to result in the growth of additional private service businesses aimed at meeting the needs of consumers, governments and businesses, that were, until recently, considered a government function.

2.4 Transportation Requirements of American Business

As some of the nation's economic sectors producing higher value products and services grow in importance and as businesses restructure their operations to be more competitive, their transportation requirements have been changing. An increasing number of businesses now place increasing emphasis on faster, more efficient services and reliability, and are not only looking for the lowest transportation cost.

This section summarizes the transportation requirements of the various economic sectors and selected industries. An overview of the transportation requirements, trends, and implications for modal selection for each of the major economic sectors is presented in five tables (Tables 2.3–2.7). Table 2.3 presents the major freight transportation requirements for the agriculture, mining, and construction sectors. Tables 2.4 and 2.5 present an overview of the freight transportation requirements for the manufacturing sector, separated into traditional industries (Table 2.4) and knowledge-intensive and technology-based industries (Table 2.5). Table 2.6 presents the freight transportation requirements for the service sector, categorized by the various sub-sectors. Finally, Table 2. presents the passenger transportation requirements across all sectors and industries.

Although each sector (and industry group or individual firm) has its own unique transportation requirements, these requirements can be generalized into three broad categories:

1. Sectors which produce raw materials, or bulky, low-market-value products with less emphasis on time delivery or reliability requirements;
2. Sectors which rely on just-in-time inventory systems and/or produce higher-market-value products with time-critical delivery and reliability requirements; and
3. Service industries, other than wholesale and retail trade, which have few freight transportation requirements (apart from overnight package delivery), and are more concerned with access for their service fleets and the transportation of their customers and employees.

TABLE 2.3 Freight Transportation Requirements of the Agriculture, Mining and Construction Sectors

Sector/Industry	Transportation Requirements	Modal Selection	Observed Trend
Agriculture	Normally low-value, bulky products: • transportation is a significant component of total cost • refrigeration/temp control • reliability, speed for perishables • damage/loss control	• emphasis on low-cost • initial movement by truck • consolidated onto rail/water for long-distances • perishables by air and/or truck	• dedicated transport contracts with service clauses
Mining	Generally dry/liquid bulk products and not time-sensitive: • cost • access to more transport providers • access to ports	Bulk products requiring low-costs: • rail • inland waterways • ships (for export) • pipelines	• shorter contracts between utilities and railroads • deregulation/changes in sales and purchases may change transport requirements
Construction	Transport accounts for a significant portion of costs/also characterized by freight movement over various and changing origins and destinations: • cost • speed • reliability/JIT	Emphasis on low-cost, bulk nature over distances: • rail • water • truck (to specific sites) • some air charters for international transport	• increasing use of service contracts • inventory and tracking system increasing level of sophistication

In general, many of the industries in the agriculture, mining, and to some extent construction and traditional manufacturing fall within the first category and emphasize low cost freight transportation service. There are exceptions, such as high-value perishable agricultural products and construction materials that affect project schedules with penalties for delay and/or incentives for early completion. For relatively low-market value products, the transportation cost component as a percent of the product's total selling price can be very high, having important competitive implications. In general, these industries, therefore, tend to use the least expensive modes of freight transport such as rail and ships.

Transportation cost remains important for industries within the second category (such as the high-tech and knowledge intensive manufacturing industries, wholesale and retail trade, and those that rely on JIT). However, it is frequently a secondary requirement to service reliability, speed, and damage/loss control. The transportation cost component of higher market value products tend to be smaller, while trends such as JIT inventory control systems are requiring more reliable and faster service. In addition, because of the higher value nature of the products, damage and loss control are important transportation requirements as well.

TABLE 2.4 Freight Transportation Requirements of the Manufacturing Sector (Traditional and Heavy Manufacturing Industries)

Sector/Industry	Transportation Requirements	Modal Selection	Observed Trend
Lumber & Woods Products	Transport costs are a significant portion of total costs: • cost • damage/loss control	• truck • small amount by intermodal rail • specialized equipment/port terminals	• development of new rail and truck equipment to increase payloads
Industrial & Commercial Machinery	Large, heavy, high-value equipment with time-sensitive delivery requirements: • cost • speed • specialized equipment (cranes)	Large size requires: • truck • rail • ship for exports/imports	• bulkier equipment shipments due to increased assembly at plant • long-term carrier contracts
Motor Vehicles & Equipment	Requires large number of items shipped to assembly plants with simultaneous control of inventory: • JIT/reliability • damage/loss control • speed • cost • long-term contracts with carriers	• truck • rail • some auto parts by air	• consolidation of carriers • long-term carrier contracts • use of express package services • outsourcing logistics
Fabric Mills	Industry faces competition from low-cost imports: • cost	Fragmented nature of industry requires: • truck • intermodal for longer distances	• operating fully integrated facilities to reduce transport costs
Food & Kindred Products	Industry requires reliability and consistency of delivery: • cost • reliability/JIT	• bulk products by barge • finished foods by rail and truck	• information exchange between suppliers and customers
Paper & Allied Products	• cost • damage/loss control for higher-value products • reliability	• rail • truck • break-bulk vessels for foreign shipments	• new equipment to handle greater loads • long-term contracts
Chemicals & Allied Products			
Fertilizers	Low value commodity requires low cost shipping	• rail • water • truck	• consolidation of fragmented shipping
Pesticides	High value often hazardous materials require reliability and speed	• truck (specialized for hazmat)	• expanding warehousing on short-term contracts

TABLE 2.5 Freight Transportation Requirements of the Manufacturing Sector (Technology-Based & Knowledge-Intensive Industries)

Sector/Industry	Transportation Requirements	Modal Selection	Observed Trend
Computer Equipment	High-tech, high-value products require: • speed • reliability • door-to-door service • damage/loss control • high level of service	• 80% of computer equipment moves by truck • air	• growth in home-based PC market • growth in mail order
Telecommunications Equipment	High-value, low-volume product/not transport intensive: • reliability • speed	• LTL truck load shipments • air	• growth in smaller niche companies
Medical & Surgical Equipment	High-value, time sensitive nature requires: • fast/immediate service • JIT/same-day service • damage/loss control	• air • truck	• overnight shipping • merger/consolidation of medical industry • growth in air cargo
Chemical & Allied Products: Pharmaceuticals	Non-durable, high-value product, sometimes hazardous materials: • damage/loss control • reliability • service quality • ability to handle hazmat	• truck	• overnight delivery • trend toward managed care puts demand on logistics/service
Printing & Publishing	Time-sensitive products: • speed • JIT • reliability	• truck	• digital transmission over phone-lines
Computer & Software	High-value products distributed through retail stores/catalogues, cost is a small percent of total: • speed • reliability • damage/loss control	• air • truck	• expansion of air cargo • electronic transmission

The other industries in the service sector (other than wholesale and retail trade) are more concerned with reliable, low cost transportation access for business travel and for their service fleets, as well as for their customers and employees. This includes good highway/freeway or primary road access, as well as reliable and low-cost access to public transport. Many of the service sector industries rely increasingly on overnight package delivery within the U.S. and North America, as well as 2-day package delivery to far away destinations in other continents. Service industries use such considerations in the choice of business location.

The dramatic growth of overnight package delivery services reflects business needs for speedy, reliable delivery of documents, such as payrolls and contracts, small replacement parts, other

TABLE 2.6 Freight Transportation Requirements of the Service Sector			
Sector/Industry	**Transportation Requirements**	**Modal Selection**	**Observed Trend**
Communications	Generally, few freight transport requirements: • speed • reliability • damage/loss control	• service fleets	• transportation is small part of industry cost
Utilities	• cost (e.g. input coal) • reliability	• rail • service fleets	• deregulation of electric utilities increases pressure to reduce costs
Wholesale Trade	• inventory control • reliability • speed/JIT	• truck • rail	• growth in JIT • outsourcing logistics
Retail Trade	• supply chain management • EDI • TQM • third-party logistics firms • JIT	• truck • intermodal rail	• reduction in inventory • reduce plant-to-store times • use of EDI • use of exactly on time (XOT)
Finance, Business, Personal, Gov't	• generally, few freight transport requirements	• truck • air	• Overnight Package and document express delivery - electronic

high-value goods, and other business documents. Manufacturing industries relying on JIT inventories, and many of the service sector industry groups are increasingly dependent on overnight or 2-day delivery of documents and packages, increasingly to international destinations. One company interviewed in the professional services business sends 95% of its documents by overnight express service. This high-percentage is typical of the requirements for fast document delivery of many service businesses.

Another trend affecting overnight delivery of documents is the growth of facsimile transmission and e-mail, which also reflects the benefits of speedy transmittal of documents. Businesses are finding that a growing share of document deliveries can be done electronically, via dedicated in-house Wide-Area-Networks or the Internet. Although many were started for e-mail and conferencing purposes, Wide-Area-Networks are readily adaptable to distribution of in-house documentation.

Another trend affecting the transportation requirements of businesses is that as consumers are increasingly finding they have less time for shopping, new businesses are developing to sell products by phone, mail, TV, electronic mail, or internet, with fast, reliable delivery expected within an urban area, across the country, and even internationally. The growth of purchases of clothing, appliances, electronic products, and recently groceries by catalog or through the Internet, are examples of this trend that will increase the demand for overnight package deliveries and courier delivery services within residential urban areas. This trend also has potentially significant implications for transportation demand, eventually possibly reducing shopping trips in urban areas.

TABLE 2.7 Passenger Transport Requirements Across all Sectors			
Sector/Industry	**Transportation Requirements**	**Modal Selection**	**Observed Trend**
Employee Access	• labor pool within a certain commuting distance • cost and ease of commuting	• auto • public transit	• ease of commute affects location decisions of fast growing high-technology and knowledge-based manufacturing and service industries
Customer Access for businesses serving local and regional market	• availability of quality public transport • congestion relief • availability of low-cost parking • reliability of travel time • access to interstates, freeways	• auto • taxi and public transit	• transportation access is key aspect of location decision • when congestion or pricing affects demand, businesses provide shuttle services, free/subsidized transit or parking, etc.
Customer Access for Business serving tourism	• cost • modal choice	• air transport • taxi, public transport • AMTRAK	• growing number of leisure travelers
Business Travel	• reliability • speed • comfort • geographic coverage • modal choice • cost	• Amtrak • air • taxi and public transit	• location decisions and business competitiveness affected by road congestion, airport delays, etc.

2.5 Transportation Industry Response to the Requirements of American Business

The previous section discussed the major transportation requirements of American business, particularly in light of the trends that have been previously discussed and increased global competition. It summarized particularly the service requirements for both passenger and freight transportation from a user industry or business perspective. Another important aspect of business transportation needs is the management requirements. This section discusses the latest trends that are affecting both how the user businesses or industries manage their transportation needs and the carriers and companies that are in the business of providing such management support services to other businesses.

By and large, the transportation needs described in the previous section emphasized reliable, fast freight transportation service. In all industries, cost is an important component. Low transportation cost is actually the key requirement for most industries in all sectors, with the exception of

industries producing higher value and perishable products as well as industries that rely on JIT. For passenger transport needs, the requirements included cost; fast, easy access and modal choice.

As the U.S. economy becomes more service-oriented and more integrated into the global economy, and as manufacturing processes are increasingly decentralized at multinational locations, business requirements have then become more complex, requiring transportation from and to a more diverse list of origins and destinations. Furthermore, businesses now require a greater variety of services to meet more specific needs rather than the historical emphasis on similar large volume moves between the same origins and destinations.

Transportation carriers and other service providers in the transportation industry are responding to the changing needs of businesses by broadening their service offerings, so that one company can be held accountable for the overall service and cost.

The transportation industry is broadly defined to include: Railroad Transportation; Local and Interurban Transit; Trucking and Warehousing; Water Transportation; Air Transportation; Pipelines; and Transportation Services. The transportation industry has been growing at an annual rate of 3% from 1977 to 1992. Within this sector, Railroad Transportation, Air Transportation, and Transportation Services are expanding. The growth of Trucking and Warehousing has been in line with the GDP. Other transportation subsectors, such as Water Transportation, Pipelines, and Local and Interurban Public Transportation, have been declining. The growth of railroad, truck and air transportation is related to the increased demand generated by other economic activity, increased leisure time, economic deregulation (that lowered costs and prices), and to the increasing importance that users place on speed, reliability and increased service levels, as was discussed in the previous section of this report.

As a result of deregulation and other industry trends, modal distinctions are disappearing. Many of the services provided by all transportation companies now include multimodal movements and/or intermodal connections that cannot be identified separately or disaggregated using the available national data. For example, the overnight delivery industry includes both trucking firms, air carriers, as well as integrated carriers that operate both trucks and aircraft.

At the same time that modal distinctions are becoming less relevant, the role of carriers, shippers, and middlemen or intermediaries is evolving and their distinctions are also disappearing. In any freight transportation move, there have been typically at least two players, the shipper and the carrier. Depending on the size of the shipment, the type of cargo movement, the origin and destination, whether domestic or international, and other factors, there might have been several other players involved. These other participants include additional carriers, and what are typically referred to as "third party agents, brokers or middlemen." In addition, the shipper can also own a carrier, and in such situations, the department within the company in need of transportation service is typically required to use the company-owned or private carrier.

In many industries, transportation had been an integral part of many companies businesses, e.g.,

many shippers built their own railroads, or operated their own trucks, vessels or airlines. In recent years, the overall trend then has been towards outsourcing transportation services and relying on one or a limited number of outside carriers and firms to manage and control transportation costs and services. Even the administrative and logistics functions are being increasingly outsourced to one or a limited number of logistics companies.

An increasing number of firms have then contracted the management of transportation services, including arrangements with travel agencies for business travel needs, as well as contracting out freight transportation and logistics services. The major trends and emphasis areas in the management of the transportation requirements of American businesses in the U.S. include the following:

1. Quality Management
2. Limited or Single Sourcing
3. Outsourcing Integrated and Innovative Logistics Management Services
4. Global Coverage and Management Capability
5. Equipment Condition and Availability
6. Information Exchange Capability

1. *Quality Management.* Shippers and consignees who are suppliers of or practitioners of "lean manufacturing" or "just-in-time" concepts for inventory management are demanding a high quality, more customer-oriented management approach from the transportation service industries. In the past, a freight transportation move might involve several carriers and agents, making it sometimes difficult to manage the move and assure reliable delivery. The widespread dissemination of Total Quality Management (TQM) principles in American business culture has encouraged businesses to expect and demand more from the freight transport provider. Higher shipper expectations and the demand for more consistent service are prevalent. The distribution pipeline has become a major focal point of the TQM programs because ultimately it is the customer's perception of quality that is most important. In many cases this has meant providing for customer demands within relatively narrow time frames. The rapid growth of the express package shipping services such as Federal Express, UPS, DHL, Roadway Package Service, and Customized Transportation, and their use of trucks, aircraft, and tracking systems and careful management of each move, are examples of the significance and importance of quality management of transportation moves to American business.

2. *Limited or Single Sourcing.* Firms have sought to outsource their business travel and freight distribution activities in order to reallocate their resources toward their core business. They can make significant cuts from their cost stream, redeploy capital (by not financing truck fleets and buildings for warehousing and distribution purposes), and focus on core competency. Travel agencies have been merging and expanding their reporting systems to allow businesses to better monitor and control their business travel costs. Two of the largest agencies, American Express and Thomas Cook, merged in 1994. Price negotiation and rebating of fares is also possible for large volume users, with travel agencies and carriers

offering discounts to large users in return for volume or exclusive use commitments from businesses. The trend has been for large companies to use one or two large travel agencies for their business travel needs.

For freight users, third-party transportation companies have emerged to fulfill a range of distribution and logistics functions including trucking, warehousing, billing, inventory management, and fleet maintenance. Some rail, truckload and LTL firms, in particular, have diversified to provide such services; newly created logistics firms have also formed to serve a market niche (e.g. Kleinschmidt Associates translates bill formats and checks their completeness) or tailor a service to a firm's specific needs.

Some shippers are seeking to diminish the number of carriers in favor of long-term agreements with single suppliers or a limited number of such providers, for delivery of a requisite service level at a negotiated price. These long-term service relationships are frequently developed with carriers, logistics firms, and third party agents. For the shipping firm's logistics manager, the anticipated benefits of such arrangements include special services such as the ability to monitor traffic operations and rate incentives. Carrier firms are willing to make a commitment to deliver greater reliability and on-time performance in exchange for the shipper's commitment to concentrate its business. Where such relationships can be established, carrier firms have added advanced systems to provide real-time tracking for shippers such as GPS and land-based mobile communications. Such partnerships enable carriers to improve the utilization and productivity of their equipment.

3. *Outsourcing Integrated and Innovative Logistics Management Services.* Central to business' efforts to better manage transportation and distribution and their acceptance of outsourcing of services has been a drive toward greater productivity and closer examination of the entire production and supply chain, as well as the administrative functions. As companies face growing competition domestically and globally, efforts have increased to get total freight logistics and business travel costs down and achieve better returns on assets.

   For business travel needs, as already noted, most functions are being outsourced. In cases where a company has large needs, in-house travel departments are being run by separate companies specializing in the travel business, such as travel agencies. The large travel agencies negotiate arrangements with businesses to set up specialized units within the client offices so as to provide the required quality and timely service tailored to each user.

   For freight transportation, the emphasis is on total distribution costs and the reduction of inventory expenses, not necessarily on the cheapest transportation service. Reliability and fast transportation service are key elements to achieve these objectives, depending on the value and other characteristics of the goods and how they are used by the buyer. Inventory is one of the largest assets held by many companies. If a company can expect consistent,

fast, reliable transportation service, it can take steps to reduce inventory levels, redeploy assets and reduce costs.[1]

Partly as a result of transportation deregulation and the reduction in shipment delivery time as well as the increased reliability, American businesses reduced inventory levels from about 26% to about 20% of final sales from 1980 to 1989. It has been estimated that this reduction in inventory levels resulted in an annual savings of about $30 billion by the late 1980s. Inventory savings during the 1980s are actually estimated to have been close to the total freight transportation savings during the period, resulting from reductions in rates and increased competition.

One of the most important trends in manufacturing and trade is the emphasis by many businesses on "Just in Time" (JIT) delivery. Increasingly, not only manufacturers, but also wholesalers, retailers and service providers are carefully scheduling deliveries so that parts or supplies arrive when needed.

The proliferation of JIT practices by manufacturers and retailers has led to smaller and more frequent shipments emphasizing reliability. One consequence of JIT has been additional freight transport demand, particularly upon highway systems. Shippers/agents requiring reliable delivery times for their JIT systems have not widely accepted rail intermodal, despite rail intermodal's generally perceived cost advantages on long-haul freight.

Companies providing Logistics Management services currently fit into one of four categories:

- Asset-Based Logistics Providers offer dedicated logistics through the use of their own assets, such as trucks, warehouses or both.

- Administrative-Based Logistics Companies offer administrative management services for such things as freight billing, data management, and auditing.

- Integrated Logistics Providers own their own assets such as warehouses, and trucks and use these to satisfy a client's distribution requirements. However, these companies also have arrangements with other vendors to provide whatever service or equipment might be required to meet a client's requirement.

- Management-Based Logistics Providers offer consulting services and data base management. They must contract separately for transportation and/or warehouses as they do not own their own.

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[1] Trends in Logistics and U.S. World Competitiveness, Robert V. Delaney, Transportation Quarterly, Vol. 45, No. 1, pp. 19-41.

The perspectives of the outside logistics manager and the transportation carrier are different. The logistics manager struggles with a requirement to deliver products to customers with ever increasing speed while cutting costs. The logistics manager decides which mode or carrier can best meet the delivery schedule. Cost is a secondary consideration in this decision. The transportation carrier competes with other carriers to provide the lowest rate. Once the mode operator is chosen on the basis of rate, the logistics manager will tolerate few, if any, service failures. Each executive interviewed indicated that low rates win the opportunity to move a company's freight. Schedule frequency, reliability, information flow, and quality keep a company's freight returning to a carrier.

4. *Global Coverage and Management Capability.* A growing number of companies are demanding global coverage from their transportation providers. They seek a partnership or alliance with a firm or firms that know or offer the best fares, and can handle routings and carriers for business travel to all areas of the world. Similarly, companies are establishing alliances with a firm or firms that can deliver freight to all the markets they serve, as well as potential future markets. Such global coverage is expected to be provided either directly or through agreements with other carriers and modes. Some of the largest transportation carriers (e.g. CSX-SeaLand) first responded by mergers and diversification, but then expanded coverage with partnerships and alliances (SeaLand-Maersk).

   The global environment has recently encouraged the development of several global partnerships, alliances, and third party relationships to extend coverage and provide specialized services abroad [e.g. the Star Alliance of United-Lufthansa-SAS-Thai-Varig, the KLM-Northwest-Continental alliance, or the American-British Air alliance in the airline business; and the New Grand Alliance (P&O, NYK, Hapag-Lloyd, OOCL, Malaysia International Shipping Co.), the New Global Alliance (APL-NOL, MOL, Hyundai), and SeaLand-Maersk in the steamship line business].[2]

5. *Dedicated and Dependable Equipment Pool.* Management of equipment assets is an increasingly important aspect of assuring adequate service level (e.g. reduce the time waiting for equipment), while at the same time, reducing equipment costs. The dual objectives of high service level (fast availability of equipment) and low cost can only be achieved by large equipment pools, such as those provided by alliances of transportation service providers that assure broad geographic coverage at low costs.

6. *Information Exchange Capability.* Perhaps the most important trend as far as management requirements is the demand for customized information on a real-time basis. Business travel users require access to the latest schedules, air fares, space availability, etc. on a real-time basis. For freight transportation, many shippers want to have real-time access to the location

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[2] P&O and Nedlloyd were on different groups until their merger, and so were NOL and APL. The mergers resulted in a restructuring of the previous Grand and Global Alliances.

and status of their shipments. They want to be able to enter bookings by computer directly from their many production, warehousing and office locations. They need access to shipment status, billing, payment and other information to manage and control their business and be responsive to their customers. Consequently, effective Electronic Data Interchange (EDI) with carriers and agents is an increasingly essential requirement for many companies.

Shippers in general want information on their shipment's status. For companies using a logistics provider to manage their distribution, the thirst for information is more intense. In the case of inbound logistics, production schedules have been set anticipating the timely arrival of raw materials or parts. For outbound logistics, the manufacturer failing to get the product to the market place in the agreed-upon quantities and in the agreed-upon timeframes will loose sales and/or market share. Shippers, by spending money on outside logistics management expect to save money by reducing infrastructure, inventory, and personnel.

Just-in-time business relationships consume more transportation assets than conventional shipping arrangements. Thus there may be more trucks on the road than ever before but they will not be moving more freight, just moving it quicker. Strong business partnerships will render capacity less flexible, as well. Capacity or, perhaps more correctly stated, the flexibility of the transportation capacity of the U.S., may be constrained. As more businesses turn to the logistics process and form business partnerships with mode operators, getting information on shipments as soon as possible can help the carrier in maximizing the utilization of its capacity, and at the same time, increase truck traffic and the required highway infrastructure.

2.6 Conclusions and Implications

The transportation industry, broadly defined to include travel management and freight logistics, has been rapidly evolving to meet the changing requirements of American business. Business travelers have an increasing number of options for their domestic and international travel needs, with expanded geographic coverage involving seamless connections between carriers that have established alliances or marketing agreements (e.g. United Airline's Star Alliance and the proposed American Airlines-British Air alliance). Similarly, companies have an increasing number of alternatives for moving their freight to more destinations with improved reliability, with various alliances and mergers being pursued (such as the APL-NOL merger, the Grand Alliance, the Global Alliance, the CSX-Conrail-NS mergers, etc.). At the same time, logistics and more sophisticated computer systems are evolving to manage both passenger and cargo needs, mostly through outsourcing to companies that specialize in these services. The ability of the industry to further meet the increasing requirement for reliability is dependent on assuring adequate long-term capacity, improving intermodal connections, and reducing congestion, particularly in heavily used urban corridors, ports and airports.

It is interesting to note that better logistics processes, whether outsourced or not, does not only apply to an individual firm's competitive advantage. If enough U.S. manufacturers improve on their supply

chain logistics efficiency, the whole economy is affected positively. This can be seen most clearly during an economic slowdown where a less severe downturn is expected than in the past due to more efficient manufacturers, as Allen Wastler explains in a recent article in *The Journal of Commerce:*

> Some analysts believe such hope [for a softer consequences in a slowing economy] exists because American business is becoming more sophisticated about logistics. [In the past,] a downturn in the country's general economic situation would still leave goods and materials in the inventory and distribution pipeline. Historically, in fact, many economic downturns have been preceded by an inventory buildup, as production stayed at previous levels while demand slackened. As a result, businesses have had to liquidate stockpiled goods, a process economists euphemistically refer to as inventory correction. (JOC, January 23, 1996. Pg. 1A, 10A)

This past inefficiency in the supply chain "worsens recessions" according to analyst Steve Lewins. However, if the supply chain is efficient, there are not many goods in the pipeline, and as demand falls, production will decrease accordingly, thereby saving business losses from over production and over inventory.

As such, the benefits of increased transportation reliability include contributing to U.S. competitiveness, business profitability, and overall economic stability.

Chapter 3
Incorporating Business Transportation Needs into the Statewide and Metropolitan Planning Process

3.1 Overview

This chapter presents an overview of the statewide and metropolitan planning process in the context of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) requirements. It summarizes the major elements of the transportation planning process and the statewide and metropolitan planning factors required by ISTEA. It then presents suggested steps and techniques on how to incorporate the needs of business in the transportation planning process when carrying out each of the planning elements and/or taking into consideration the planning factors required by ISTEA. A categorization of States and Metropolitan Areas based on the structure of their economies and other factors is presented to assist planners in considering strategies to address business transportation needs.

Nearly all transportation demand is derived from economic activity, since freight transportation demand and most individual passenger travel is related to some economic activity. Therefore, the transportation requirements of the businesses and enterprises that make up an area add up to the transportation demand that the transportation planning process for a State or Metropolitan Area needs to address.

Historically, state and metropolitan transportation planning has focused on forecasting the mobility needs of passengers, developing transportation strategies to address these needs, and prioritizing these needs based on various criteria, including demand, safety, and socio-economic and environmental impacts. Other non-quantifiable factors and funding constraints have then been used in formulating strategies and selecting an investment program.

Initially, the state and metropolitan transportation planning processes concentrated on roadway transportation needs of the general public. In general, other modes were the responsibility of separate, independent agencies or private companies (Airport or Port Authorities, Metropolitan Transit Agencies, private carriers, etc.) less directly involved in metropolitan or state-wide planning. Beginning in the late 1960s, metropolitan public transportation needs have also been evaluated using the same planning process. Since ISTEA was approved in 1991, there has also been an increased emphasis on freight transportation needs.

The basic transportation planning methodology used to develop improvement programs is based on the relationship between system capacity versus existing and anticipated future demand and level of service. Origin/destination studies, vehicle counts, level of service analyses, mode splits, and economic and population trends are used to forecast when existing highway capacities will be reached and to compare alternative solutions. This methodology works well for identifying and evaluating highway needs in States and Metropolitan Areas. Over the years, the available models and methodologies have been improved, and substantial data collection and model development

resources have been devoted to its use. Today, these methodologies are used widely to forecast passenger vehicle movements and public transportation demand as a basis for evaluating the feasibility and impacts of proposed highway and public transportation investments.

While person travel demand has been forecasted and evaluated based on a comprehensive system development approach, freight transportation needs have been typically analyzed based on demand studies for individual facilities or to address specific problem areas. Attempts to develop Statewide or Metropolitan Area truck forecasting models or other similar methodologies to compare areawide or State freight transportation demand to system capacity have not resulted in an agreed upon methodological approach with widespread application. There is general agreement in the profession, as cited by NCHRP Report 177 and other later studies on this subject, that the traditional urban transportation planning models and approaches "do not work in the freight field."[1] NCHRP Report 260 also noted that "the ability to forecast freight flows can inherently be no better than the ability to predict changes in the national, state, and local economies."[2] Therefore, today freight transportation needs are not as comprehensively evaluated as part of the planning process as is the case with person travel needs.

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 has focused increased awareness on the need to give more attention in the transportation planning process to freight transportation as well as all the freight and person multimodal transportation requirements of businesses that make up the State or local tax base. The transportation planning process has typically not segmented the market nor analyzed needs, strategies, or investments from the perspective of businesses that make up an area's economy.

The following section presents a framework to consider and evaluate proposed transportation improvements and strategies using a market segmentation approach for both passenger and freight transportation from a user industry or business perspective. The approach is intended to add specific steps in the process to identify and evaluate transportation strategies or projects to specifically consider the perspective of the State's or area's industries and businesses. As such, this approach is intended to provide guidance to planners and give examples of techniques on how the needs of businesses can be more formally considered as part of the transportation planning process.

3.2 A Framework for Considering Business Transportation Requirements

Transportation requirements can be broken down into two broad categories: (1) passenger movement requirements, and (2) freight movement requirements. Therefore, this framework for considering the multimodal transportation requirements of a State's or area's businesses will be divided into those two categories. The following paragraphs will then discuss a proposed approach to consider business transportation needs as part of the transportation planning process for these two categories.

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1 NCHRP Report 177, p. 20.

2 NCHRP Report 260, p. 13.

3.2.1 Passenger Movement

Traditionally, planners have defined passenger travel needs from the perspective of individual travelers, based on origin and destination (O/D) surveys and analysis of Census data on home to work travel. Most studies and surveys of passenger travel behavior have then been carried out with the objective of defining overall person travel needs, rather than considering service requirements of the businesses or economic sector that are related to the travel needs. This approach is appropriate, since in most cases it is the individual traveler who makes a decision as to route and mode. The methodology also produces demand estimates by highway or public transportation route that can be used to further evaluate alternative corridors and alignments.

Yet, most passenger travel is derived from economic activity, just as is the case with freight transportation demand. Because most individual travel is related to some economic activity, it significantly affects the performance of businesses in some industries. Most importantly, in the case of some service industries, passenger travel service requirements affect business location decisions and industry competitiveness to a greater extent than freight transportation.

Box 3.1 presents an overview of how person travel needs have traditionally been categorized in travel surveys and models and how the typical purposes used in travel demand analysis can be reclassified from the perspective of the industries and economic sectors affected. The proposed market segments from the perspective of businesses are as follows:

- *Employee access.* Access to the needed skills and size of labor force required by a business has always been an important factor in location decisions. Although the business typically doesn't pay for the journey to work of its employees, it considers the time, cost, congestion, and ease of access that its employees face when making a site selection. A business typically considers the size, educational background and skills of the labor force that it requires, and the availability of residential areas that already have such a labor pool or that can be attractive and meet the residential location needs of its employees.

- *Customer access.* Customer access is the most important factor for location decisions of the consumer and business service industries, which represent an important part of the growing service sector of the U.S. economy. Access to customers is the most important factor for business location decisions for the retail, food service, and other hospitality businesses. They need cheap, fast, reliable, non-congested access by as many routes and modes as possible to attract the largest number of customers. An important segment of the consumer and business services sector is the travel, tourism and hospitality industry. The travel, tourism and hospitality industry not only serves local area customers, but also serves out-of-area visitors and international travelers, an increasingly growing and important market segment. To remain competitive with other tourist destinations, this industry depends on easy access from local and long distance domestic regions, as well as from foreign locations.

- *Business travel.* The business travel requirements of American firms also are significantly greater for the services sector than for other economic sectors. Some industries (such as finance, insurance, legal, and advertising services) locate in the high density core of urban

Box 3.1 Passenger Travel Market Segments from a Business Perspective

Over the years, there have been a variety of surveys conducted to obtain information on local and long distance travel needs and the travel behavior of passengers. Because the main purpose of urban travel demand surveys has been to forecast demand at the household or individual passenger level, typically urban travel surveys classify demand by purpose, as follows:

- Work
- Shopping
- Personal business
- Social/recreational
- Other

These purpose categories can be reclassified from the perspective of the industries or economic sectors affected.

Work trips are employee access trips, which are generated by all businesses, with the only exception being the increasing trend towards working at home by self-employed people and service employees requiring no face-to-face interaction. Shopping trips are basically customer access trips to retail businesses. Personal business trips are generally customer access trips for consumer or personal service businesses (e.g. banks, other financial services, food services, repair services, educational services, personal legal services, health care services, etc.), as well as non-profit personal services (e.g. public schools, public health care services and other government services). Social/recreational trips are customer access trips to tourism or hospitality industry businesses (e.g. theaters, recreation parks, other entertainment centers, hotels, wedding/party restaurants, etc.), with the exception of visits to relatives or friends. Other miscellaneous trips include business trips to visit a client or attend a business meeting (other than the journey to work), as well as customer access trips to business services (business finance and insurance services, business legal services, business professional services, and other business services). Therefore, not all, but nearly all of the individual or household passenger travel demand is directly related to an economic activity.

In the case of long-distance travel surveys, travel purposes are typically divided into personal travel (vacations, death in the family, medical reasons, weddings or other family related travel) and business travel (conventions, sales calls, attendance at meetings, and all other work related travel). Note that many of the trips typically categorized as personal also represent customer access travel for various businesses (e.g. health care services, tourism oriented services, such as hotels, resorts, restaurants, car rentals, amusement parks, casinos, etc.).

Passenger travel purposes can then be categorized in many ways, but for the purposes of discussing the transportation requirements of American businesses, there are three major market segments:

- Employee access or the daily journey to work.
- Customer access.
- Business travel.

For the purposes of considering and analyzing business transportation requirements, it is also useful to consider two perspectives for each of these three market segments:

- How does the trip relate to a business or economic activity?
- Who pays for the trip?

The importance of each of the three trip market segments to industry competitiveness varies among the various sectors and industries. For example, in some high-tech or research industries, ease of commute is an important factor to attract the brightest, most qualified employees. The importance of customer access to retail industries is well documented. Business travel can also be a significant cost and competitive factor in some service industries.

In terms of who pays for the trip, in the U.S., businesses generally do not pay for the costs of the journey to work, with some exceptions, such as employee car-pooling programs, employee provided or subsidized parking, company autos that can be used for commuting, and employee public transportation subsidy programs. The cost of travel for customers to reach a business is also not generally paid by the company but by the individual, although there are also exceptions, such as businesses that provide free parking, businesses that pick up customers, and casinos or cruises that provide free or reduced transportation. Finally, businesses in nearly all cases pay for the costs of business related travel, local and long-distance, domestic and international.

centers because of the access it provides to customers and business services. The service sector business travel requirements are also particularly important for the high knowledge, information-based business and personal services, with a high percentage of highly paid professionals (e.g. information services, health care, and other professional services) requiring customer face-to-face interaction. These industries require flexibility and speed of access to airports, AMTRAK, and major highways for its frequent local and long distance business travel needs.

3.2.2 Freight Movement

Some efforts have also been undertaken to develop comprehensive truck or freight demand models, but in general, the bulk of the planning resources have been devoted to passenger models and demand analysis, since in most areas, trucks represent a relatively small percentage of highway traffic, typically between 8 to 12%, and most other freight facilities are privately owned. The difficulties in developing comprehensive information on freight movements is due to many factors including confidentiality of data due to competition between carriers and shippers, as well as the complexity of the problem. Freight demand is a function of economic activity and carrier cost and service level, so route and mode choices are affected by global demand and supply factors that are impossible to forecast for long periods. Coordination among carriers and shippers is possible when it is to their joint benefit because they share common difficulties in securing low cost and reliable shipping. In practice, overcoming the competitive aspect often involves creation of a third party public-private entity to collect and analyze information and coordinate lobbying and other activities. In general, State DOTs and MPOs do not get involved in regular collection and updating of freight data.

Although comprehensive data and methodologies are not often developed, specific freight transportation analyses are typically conducted by the transportation planning processes of States and local areas to address:

- The access problems of industries threatening to move,
- Needed improvements to attract a new industry and to address airport, port, and border port of entry access problems,
- Policy positions on carrier merger proceedings, and/or
- Specific congestion problems associated with trucks.

Data collection has typically been restricted to using truck counts to adjust the percentage of trucks on given highway links. National and private data sources are also often used for the special analyses.

Until the advent of ISTEA, freight transportation requirements and issues were then given little attention as an ongoing aspect of the State and metropolitan area transportation planning processes. The shift in attention has in part resulted from the growing awareness of the importance of reliable and efficient freight movements to maintaining the competitiveness of American industry and the local tax base. The globalization of many industries and the ability to relocate both blue and white collar industries in response to national or international opportunities has focused transportation policy on strategies to develop and maintain a competitive infrastructure for freight movements.

Both research and practical experience have demonstrated that improving freight movements is a complex, situation-specific effort, so that the special, specific-area analysis to respond to problem areas and or policy initiatives is an appropriate approach to considering freight movement requirements of businesses as part of an ongoing transportation planning process. However, it is useful to establish a framework to assure consideration of the major freight transportation issues and service needs that affect businesses in an area. Box 3.2 presents an overview of how freight movement needs can be categorized from the perspective of the industries and economic sectors affected. The proposed market segments should be analyzed for the major industries in an area, since requirements vary significantly. The three market segments are briefly discussed below:

- *Foreign Trade (exports and imports).* The growing importance of international freight services is directly related to the growth in international trade. The share of foreign trade as a percent of total GDP has been steadily increasing. In this situation, with the adoption of NAFTA and multinational blocks growing in importance, the competitiveness of U.S. businesses in the international marketplace is not only dependent on production costs, which includes the cost of receiving inbound materials and semifinished products, but also on moving finished products effectively to faraway markets. Improved international intermodal services have grown recently, as a result of deregulation and the creation of multi-modal or

Box 3.2 Freight Transportation Market Segments for Transportation Planning

The service requirements for freight transportation are derived from the way that goods producing industries structure their operations, the raw materials and semi-finished products they use in their production process, the markets they serve from a particular location, and how their products are distributed to other industries, wholesalers, retailers, service providers, and individual consumers. As the nation's economy changes, the trends affecting manufacturing and distribution processes, and the location of economic activity are the main determinants that affect freight transportation requirements.

Freight transportation services can be further examined with respect to three major market segments, i.e., the needs for:

- Movement of raw materials and inbound products that are input to the production process,
- Distribution of products to wholesalers and distribution centers, and
- Local distribution.

These market segments can then be further segmented or analyzed based on geographic scope or market reach of the materials, products, and distribution, i.e., the needs for:

- Foreign trade (exports and imports).
- Long-haul intercity domestic movements.
- Local distribution.

Chapter 2 and Appendix A include a discussion of recent changes in the nature of production and distribution processes and how they affect changing freight transportation demand in different economic sectors and industries.

integrated transportation carriers to meet these needs. Industries then require access to ports, airports, and border ports of entry to handle their import goods and their export production.

- *Long-haul intercity domestic movements.* The U.S. Interstate Highway System and the rail network provide an extensive system of connections to warehouses and distribution centers, as well as ports, airports, and border ports of entry. Shippers require continuing improvements to these networks to remain competitive and increase their market reach. The problems of access to the intercity transportation system are perhaps more serious for freight movements in metropolitan areas than for passengers. These problems are:

  - Wholesale distribution centers tend to be located in metropolitan areas even when manufacturing facilities are not, and are sharply affected by local traffic conditions.

  - The major transhipment points for international cargo, whether sea or air, and in some border ports of entry, are located in metropolitan areas. In fact they are often historically the cause of the existence and growth of the metropolitan areas. And metropolitan congestion caused by commercial vehicles create access problems to airports, ports, border ports of entry, and the intercity system.

  - The use of containers and their transhipment has expanded the land requirements for transfer points and these increased land requirements compete with other metropolitan needs.

- *Local distribution.* Freight movements tend to be thought of as intercity activities, but urban freight haulage is a major economic force constituting about 30% of all freight spending, according to Transportation in America (1991). The patterns of urban goods movements have undergone significant changes. These are described below:

  - The Just-in-Time production process has struck the urban world as well as the manufacturing world. Next day delivery trucks and courier services are now part of the metropolitan environment. Telephone, mail and electronic shopping are also increasing the volume of goods distributed directly from outside the metropolitan areas to the ultimate consumer.

  - The urban landscape is full of vehicles supporting the office environment. Canteen service vehicles, computer/fax/reproduction/communications repair and service vehicles, and utility companies service vehicles, move through downtown as they pursue delivery or service functions.

  - Expressed in ton-miles these movements may be minor - urban trash movements are certainly larger, as are movements of construction materials vehicles - but the high value per pound and high transport costs of delivery, service and courier trucks make them a cause for concern as do their effects on overall metropolitan congestion, competitiveness and productivity.

For the shipper/receiver, one of the key issues is metropolitan congestion that affects delivery. For others, the concern is congestion caused by commercial vehicles in route delivery and site related activities. Documentation of the delays and effects of congestion on route delivery vehicles are anecdotal but still offer persuasive information as to how productivity is sharply curtailed by congestion. In general, the view seems to be that there is inadequate appreciation and public support given to the needs of goods movements requirements in metropolitan areas. The complex split in public and private responsibility in freight movement is perhaps a major cause for the inadequate appreciation of these problems by the public sector.

3.2.3 Summary

In summary, while the planning for people movement in general is relatively well developed and understood, a framework has been proposed for considering passenger travel requirements from a business and industry perspective. Regarding freight transportation requirements, many states and metropolitan regions have little or no freight demand modeling capability and have just recently began to consider freight transportation issues. The proposed framework can be used by transportation planners in further defining their process.

The following sections describe the existing transportation planning process at the State and metropolitan area levels, followed by how the proposed framework can be used in the development of transportation plans to consider key issues critical to businesses. The main conclusions are:

- Transportation planners should analyze person transportation needs not only from an individual or household travel perspective but also from a business perspective.
- Transportation planners should also formally consider freight transportation needs from the perspective of the major sectors and industries that make up an area's economy and taking into consideration the factors that increasingly affect those industries. To increase their competitiveness in today's global economy, American businesses are seeking lower shipment costs, reduced delivery time, lower damage/loss rates, real-time information on shipments, and increased reliability for the transportation and distribution of their products. Reliable transportation services also help businesses lower their investment devoted to inventory without affecting sales volumes. Timely delivery, reliability and quality of service can be as important as, or even more important than, transportation cost, particularly to businesses in the technology and knowledge intensive manufacturing of high value products.

In addition, as noted in Chapter 2, American businesses are increasingly outsourcing the control and management of transportation services to travel agencies for business travel and logistic management providers for freight transportation and distribution services so as to redeploy their capital assets and focus on their core competencies. Therefore, these travel management and logistics management providers are becoming potential sources of data (as long as the information is treated confidentially) and can provide an invaluable understanding of the transportation requirements of the industries they serve. Planners need to consider how these management firms can best contribute to and/or

participate in the transportation planning process.

3.3 Statewide Transportation Planning

While all states had statewide planning processes underway, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) formalized certain requirements of the statewide transportation planning process and mandated consideration of all modes to guide investments toward a fully integrated multimodal transportation system. ISTEA's planning process requirements were "designed to improve the quality and scope of information [officials] receive on transportation options and the impact of transportation investments on their State's economy, environment, and quality-of-life."[3] ISTEA also specifically addressed the need to include freight as a factor to be considered in the planning process.

At the state level, ISTEA requires that states have a comprehensive statewide transportation planning process. This planning process must produce two key products: a statewide transportation plan addressing all modes and a statewide transportation improvement program (STIP) that lists all capital and non-capital projects or phases of projects targeted to use Federal funding from FHWA or FTA for the next three year period.

The statewide transportation plan is a long-term document (20+ year time frame) that considers the full range of modal choices. Important components of the transportation plan include:

- Linkages with the state economic development strategy as well as environmental, social, and land use policies, and
- Coordination with MPOs and providers of transportation services (i.e., transit agencies, airport and port authorities) as well as public and private interest groups.

The statewide transportation improvement program (STIP) provides a short-term view of the state's transportation priorities. They must be consistent with those identified in the statewide plan. ISTEA requires that the STIP be financially constrained by year and that it be consistent with overall State economic and environmental plans. The Transportation Improvement Program (TIP) in Metropolitan Areas is approved by MPOs and included in the STIP, without modification, after approval by the Governor.

ISTEA also included a checklist of planning factors to be used by states as a guide in the development of statewide transportation plans. Table 3.1 presents FHWA's summary of these factors grouped into four major categories:

1. Coordination with Stakeholders
2. Mobility and Access

[3]U.S. Department of Transportation, Statewide Transportation Planning Under ISTEA: A New Framework for Decision Making, Publication No. FHWA-PD-96-026, HEP-10/7-96(4M)E

TABLE 3.1 Statewide Planning Factors

Coordination and Collaboration Among Stakeholders
These factors relate to the need to coordinate State and metropolitan area plans, to consider the needs of rural areas, and to consult stakeholders in the planning and resource allocation process. They include the following:

- Coordination and reconciliation of statewide and metropolitan area plans and programs to ensure connectivity within the State and with metropolitan areas in other States;
- Use of innovative financing mechanisms including improved cash flow tools, tolls, private-public sector partnerships, and congestion pricing;
- Consideration of non-metropolitan area needs (areas outside of the MPO planning boundaries);
- Consideration of investment strategies to improve State and local roads that jointly support rural economic growth, tourism, and recreational use; Federal agency renewable resource management; and multipurpose land practices;
- Addressing the concerns of Indian tribal governments having jurisdiction over lands with the boundaries of the State.

Mobility and Access for People and Goods
These factors relate to ensuring the most effective and efficient use of resources to provide mobility and access to the transportation system. They reflect the importance of ensuring that connections between modes (e.g., truck to rail, bus to rail, airplane to truck) are as smooth as possible and that users have good access to the transportation system and facilities. Factors to be considered include:

- Access from international border crossings to ports, airports, and freight and passenger intermodal transportation facilities;
- Access to major freight distribution routes and intermodal facilities, national parks, recreation and scenic areas, monuments and historic sites, and military installations;
- Long-term needs of the State transportation system for the efficient movement of people and goods;
- Appropriate methods to expand and enhance the use of transit services and facilities.

System Performance and Preservation
These factors include ways to optimize the performance of the transportation system and to preserve its usefulness. These factors emphasize operational strategies to improve performance (e.g., HOV lanes, signal synchronization) and the preservation of potential future transportation assets. Strategies include:

- Transportation system management techniques to make the most efficient use of existing transportation facilities;
- Methods to reduce traffic congestion, prevent congestion from developing in areas where it does not yet occur, and reduce single-occupant vehicle travel;
- Identification and preservation of rights-of-way for construction of future projects, or for future transportation corridors;
- Identification of corridors where action is needed to prevent destruction or loss;
- Methods to enhance the efficient movement of commercial motor vehicles;
- Use of life-cycle costs in design and engineering of bridges, tunnels, or pavement; and
- The transportation needs (strategies and other results) identified through the management systems.

Environment and Quality of Life
This group of factors relates to environmental protection and other issues that affect the quality-of-life in States and communities. ISTEA highlights the importance of linking transportation planning and investment decisions with environmental impacts. Considerations include:

- Recreational travel and tourism;
- State plans developed pursuant to the Federal Water Pollution Control Act and the Coastal Zone Management Act;
- The social, economic, energy, and environmental effects of transportation decisions;
- Federal, State or local energy use goals, programs, or requirements;
- Strategies for incorporating bicycle transportation facilities and pedestrian walkways in appropriate projects;
- The effect of transportation decisions on land development and use, including the need for consistency between transportation decisions and short- and long-term land use and development plans;
- Strategies for identifying and implementing transportation enhancements where appropriate.

Source: U.S. Department of Transportation, Statewide Transportation Planning Under ISTEA: A New Framework for Decision Making, Publication No. FHWA-PD-96-026, HEP-10/7-96(4M)E

3. System Performance and Preservation
4. Environment and Quality of Life

The relevance of each factor will vary depending on each State's needs. It is recognized that each State's decision-making process is unique and that different approaches will be more relevant in different States. These requirements were intended to assure consideration of the best mix of transportation modes for meeting a given need and connections to transportation resources beyond the jurisdiction of local agencies sponsoring a project.

ISTEA also placed a high priority on the protection of existing investments and originally required six management systems, which fall into two categories, as follows:

Performance Management Systems:
- Safety
- Congestion
- Intermodal

Asset Management Systems:
- Bridge
- Pavement
- Public Transportation Equipment and Facilities

These systems were made optional in 1995, with the exception of congestion management systems for transportation management areas (urbanized areas over 200,000 population).

Finally, the statewide transportation plan must meet the conformity requirements of the Clean Air Act Amendments of 1990 (CAAA). In other words, transportation plans and programs in nonattainment and maintenance areas must demonstrate conformity with the Environmental Protection Agency's (EPA) required State Implementation Plan (SIP).

Based on these general factors, Figure 3.1 illustrates the relationship of the various components for a statewide planning process in Pennsylvania.

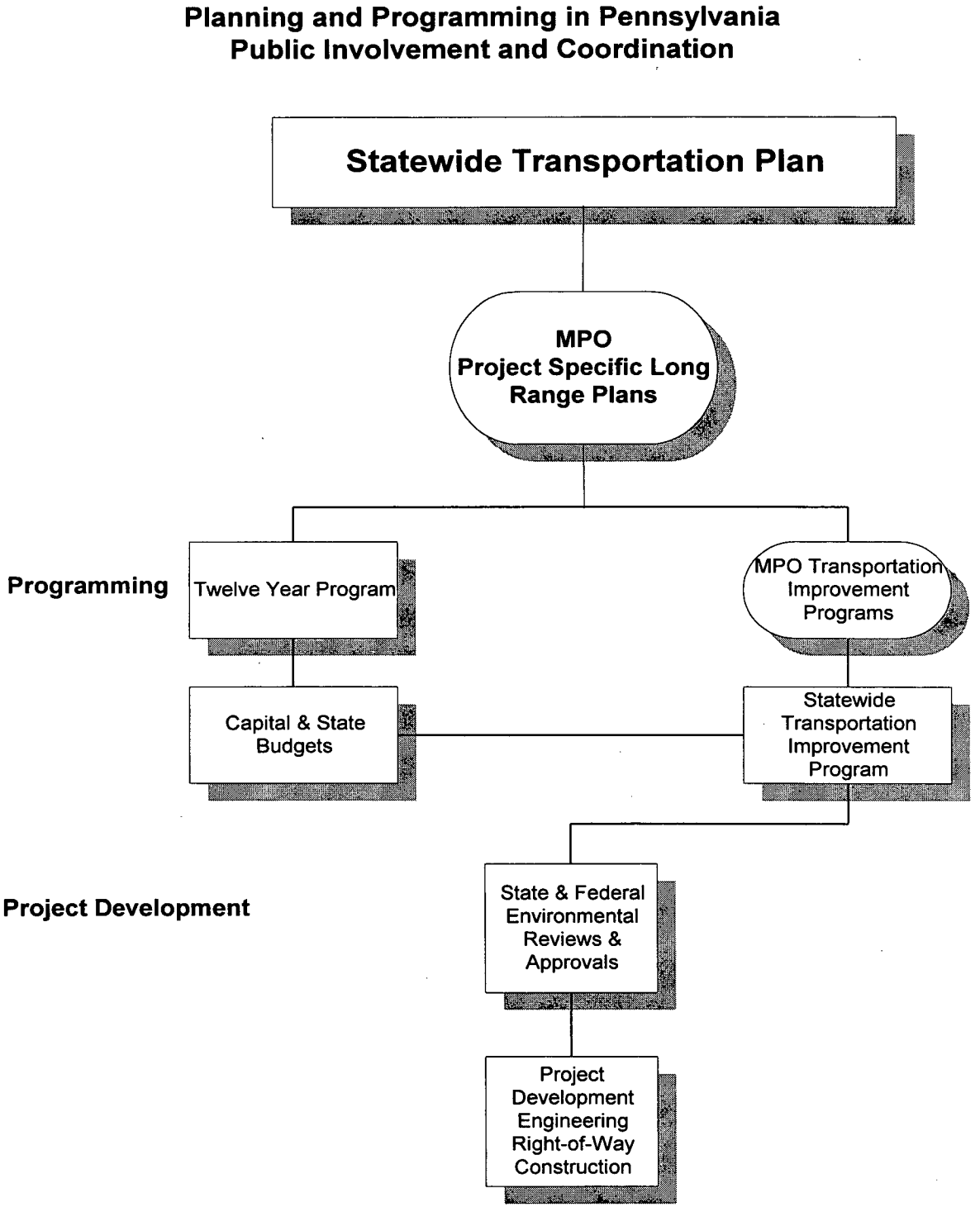
3.4 Metropolitan Transportation Planning

ISTEA's requirements for MPO planning spring from the same policy interest which directs states to integrate the contribution of different modes to solving transportation problems. MPOs must produce a transportation plan and a transportation improvement program (TIPs) including explicit consideration of both passenger and freight needs. The TIP produced at the Metropolitan Area level gets incorporated into the State's MPO.

As listed below and shown in Figure 3.2, ISTEA requires six major elements that apply to MPOs in the development of metropolitan area transportation plans and programs:

1. A proactive and inclusive public involvement process

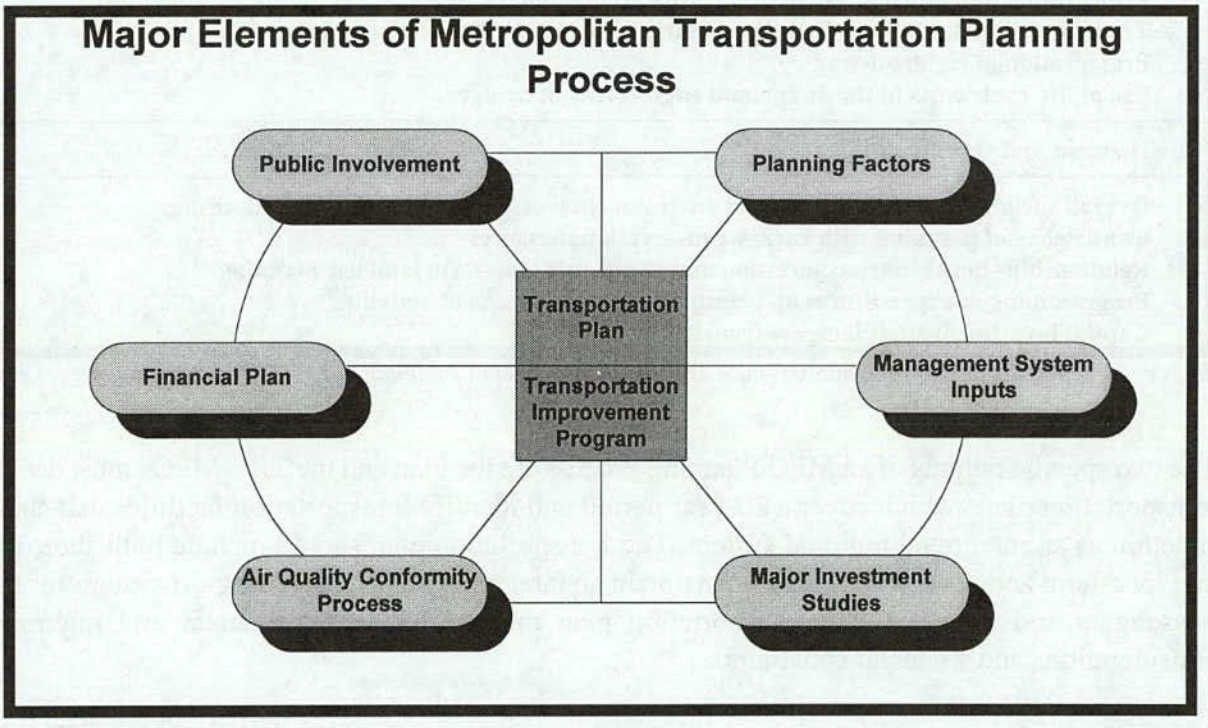
Figure 3.1 Major Components of Statewide Transportation Planning Process



Source: Penn DOT User's Guide to Transportation & Programming, Pennsylvania Dept. of Transportation, 1996

2. Consideration of 15 specific planning factors grouped in three major categories to ensure that the planning process reflects a variety of issues (see Table 3.2)
3. Major investment studies to analyze solutions to significant transportation problems which might involve use of federal funds in a corridor or subarea
4. Development and implementation of management systems including:
   - intermodal management system
   - congestion management system
   - public transit facilities management system
   - pavement management system
   - bridge management system
   - safety management system
5. Development of financial plans for implementing the transportation plan and TIP; and
6. Assurance that the transportation plan and TIP conform to the State Implementation Plan (SIP) with regard to meeting the standards of the CAAA.

Figure 3.2 Relationship of ISTEA Planning Factors in Metropolitan Transportation Planning



As can be seen, the MPO requirements are generally the same as required at the State level, except for the Major Investment Studies (MIS). An MIS is intended to be carried out as a cooperative venture of the MPO, the State, and the transit operator in each metropolitan area to analyze a problem and consider a range of appropriate solutions, including all relevant public and private entities. MISs are used for projects that are likely to have substantial costs and regional transportation policy implications. The MIS is intended to analyze solutions to address significant transportation problems and present them to decision makers in a broad regional transportation

context rather than focusing on a mode- or constituency-specific solution.

ISTEA also requires that metropolitan area planners consider the 15 factors shown in Table 3.2. These factors need to be explicitly incorporated in the planning process, although as is the case at the State level, it is recognized that the relevance of each factor will vary depending upon local circumstances.

TABLE 3.2 MPO Planning Factors

Mobility and Access for People and Goods
• **Effects of all transportation projects** • **International border crossings and the promotion of access to critical areas and activities** • **Road connectivity from inside to outside of metro areas** • **Enhancement of efficient freight movement** • **Expansion and enhancement of transit services and use**
System Performance and Preservation
• **Congestion relief and prevention** • **Preservation and efficient use of existing transportation facilities** • **Transportation needs identified through implementation of management systems** • **Preservation of rights-of-way** • **Use of life-cycle costs in the design and engineering of bridges**
Environment and Quality of Life
• **Overall social, economic, energy, and environmental effects of transportation decisions** • **Consistency of planning with energy conservation measures** • **Relationships between transportation and short- and long-term land use planning** • **Programming of expenditures on transportation enhancement activities** • **Capital investments that increase transit system security**

Source: U.S. Department of Transportation, *A Guide to Metropolitan Planning Under ISTEA-How the Pieces Fit Together*

The two specific outputs of an MPO Planning Process are the Plan and the TIP. MPOs must develop transportation plans which cover a 20-year period and identify transportation facilities that should function as an integrated regional system. The transportation plan should include both short-term and long-term actions that develop and maintain an integrated intermodal transport system for both passengers and freight. The transportation plan must reflect environmental and intermodal considerations and financial constraints.

The TIP is a short-term document covering at least 3 years and updated every 2 years. The TIP includes a list of short-term priority projects. Projects in the TIP must be consistent with the transportation plan. In addition, in nonattainment areas, the TIP must conform with the SIP's purpose of attaining National Ambient Air Quality Standards (NAAQS). This conformity determination is made by FHWA and FTA, in collaboration with EPA that reviews and comments on conformity. Finally, the TIP must be financially constrained by year and include only those projects for which funding has been identified and committed.

3.5 Transportation Project Selection

In the context of state and metropolitan planning, one important issue is the technical process by which transportation projects, programs, and policies are incorporated into the long-range transportation plans and transportation improvement programs (at both the state and MPO level).

While the project selection process differs among the states and MPOs, the general structure of the technical process involves seven basic steps:

1. *Analysis of Existing Conditions and Historical Development.* The first step in the transportation planning and project selection process is an evaluation of current conditions and historical growth patterns in the area. This step requires a comprehensive understanding of the area's demographics and land use pattern to determine existing key corridors of travel within these corridors, including:

   - Historical growth and development patterns
   - Land use surveys and planning studies
   - Travel surveys and analysis of current demand
   - Existing transport system network analysis and condition of the infrastructure

2. *Land Use and Demand Projections.* This step includes an analysis of regional growth, land use and development forecasts, concluding with forecasts of travel demand. This step requires a complete understanding of future area growth and its relationship to travel demand to determine anticipated growth within each travel corridor, including:

   - Regional development goals, growth factors and land use projections/development plans
   - Travel demand forecasts

3. *Identify the resulting problems or issues and propose solutions.* Based on the evaluation of existing conditions and growth, planners identify the current and projected bottlenecks in the system and the short-term and long-term needs. Potential solutions are defined and analyzed to determine how well they address the identified needs. This step includes an analysis of how various projects, operational or non-capital strategies, and/or policy initiatives contribute to addressing the critical bottlenecks and problems that need to be solved in the near-term and in the future.

4. *Project selection criteria/methodology.* To evaluate alternative solutions and strategies, quantitative or qualitative project selection criteria are typically identified, including not only costs and the ability to meet projected demand, but also social, economic, and environmental impacts, citizen views, air quality conformity requirements, etc.

5. *Develop alternative system strategies to address the problem or issues.* Based on the problems identified, planners will define various system alternatives, composed of a combination of projects, programs, and/or policy initiatives that have the potential to address the transportation problems or needs. The strategies proposed should reflect federal and state funding

requirements, as well as conform with the adopted State Implementation Plan (SIP) developed under EPA requirements.

6. *Evaluate alternatives and recommend preferred alternative.* Based on the project selection criteria or methodology, planners will evaluate and rank the system and project alternatives and recommend the system or combination of projects with the highest rank. Table 3.3 presents a typical example of a project selection matrix used for ranking projects. While the project selection criteria presented in Table 3.3 does not directly refer to business and industry

TABLE 3.3 Typical Project Evaluation Matrix

Evaluation Criteria		Project A	Project B	Project C
MOBILITY	(1) Congestion Relief			
	(a) Peak Hour Congestion in JIT Corridor			
	(2) Key Component of Transportation System			
	(3) Promotes Implementation of Local/ Regional Land Use Plan(s)			
CHOICE	(4) Multimodal			
SAFETY	(5) Safety & Security			
EFFICIENCY	(6) Preserves Existing System			
	(7) Supports Efficient Land Use Patterns			
	(8) Cost Effective			
	(9) Transportation Corridor Preservation			
CONNECTIVITY	(10) Intermodal Connectivity			
	(a) Access to International Airport			
ECONOMIC DEVELOPMENT	(11) Economic Development			
ENVIRONMENTAL RESPONSIBILITY	(12) Air Pollution Reduction			
	(13) Energy Conservation			
LIVABLE COMMUNITIES	(14) Positive Social/Community Effects			
	(15) Negative Social/Community Effects			
	(16) Noise Reduction			
OTHER	(17) Complexity of Project Preparation			
	TOTAL POINTS			
	RANK			

transportation needs, certain criteria such as *Intermodal Connectivity*, *Economic Development*, and *Positive Social/Community Effects*, however, are broad criteria that should include consideration of business transportation requirements. Peak hour congestion in a JIT corridor used to access major employers is an example of a congestion relief related criteria of importance to businesses. Similarly, access to international airport is an example of an intermodal connectivity criteria that can be a priority to certain businesses.

7. *Plan and Program Development.* The final step in the process is to present the results of the analysis and, through discussions with all appropriate stakeholders, reach a consensus on the

long-term system and priority projects to be incorporated in the long-range plan and/or transportation improvement program for implementation.

An ideal process under ISTEA will consider how to involve key stakeholders (i.e., general public, public and private interest groups, business representatives, etc.) in providing input or reviewing the results of each of the above steps. While most state and metropolitan planning processes now include public and private involvement in their project selection processes, the level of involvement varies greatly.

The following section presents a suggested approach to incorporating business needs into the transportation planning and project selection process in the context of the existing planning processes. The approach described generally follows the existing processes, and attempts to consider when and how business transportation needs should be considered in a typical situation. As such, this approach is intended to provide guidance to planners on how to incorporate the perspective of businesses in their continuing planning work and when carrying out the various activities and the project selection process previously discussed.

3.6 Incorporating the Changing Requirements of Business into the Planning Process

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) broadly called for the participation of both public and private stakeholder input in the transportation planning process. Prior Federal guidelines and those that have been prepared since ISTEA indicate a clear understanding that transportation planning cannot be conducted in a vacuum and that participation from stakeholder constituencies is critical in planning an efficient transport network. Since enactment of the Act, state and MPO transportation planners have made significant progress in further involving public and private interests in the process. Continued progress to better consider key business/industry concerns requires that transportation planners have a better understanding of the role that transportation plays in the productivity and competitiveness of American businesses in their regions.

As discussed in Chapter 2, the U.S. economy at all levels (national, regional, state, and local) is critically dependent on international trade and the efficient movement of goods and adequate access to places of work and consumption for customers, employees and business travelers. Improving the productivity and competitiveness of businesses frees up resources for other sectors of the economy. The relationship between available transportation infrastructure, investment programs and economic development, therefore, should be an important issue for transportation planners. Although the transportation planning process itself (discussed previously) allows for the incorporation of business interests in the transportation planning process, business needs are usually not formally considered and their importance to an area's development and as a public policy issue does not generate much attention.

It is noteworthy that the list of Statewide and MPO planning factors required by ISTEA does not specifically mention addressing the transportation requirements of an area's businesses and industries. However, ISTEA planning factors do call for the coordination and collaboration among

stakeholders and consideration of mobility and access for goods and people. It also requires consideration of congestion; connectivity; access to border crossings, airports, ports, freight distribution routes, and intermodal facilities; efficient freight movement; commercial motor vehicle needs; and economic effects - factors that reflect some of the major business transportation needs and that are of particular importance to most businesses, in light of recent economic trends. ISTEA then has emphasized the major issues of concern to American businesses, even though it has not presented them from that perspective.

The ISTEA process of involving key stakeholders and understanding their mobility and access needs is just beginning to take shape in most States and Metropolitan Areas. The ISTEA legislation spurred a great deal of attention on the involvement of stakeholders in the state and local transportation decision making process. Most of the attention has focused on the dissemination of transportation plans and policies to civic, community and public interest groups and incorporation of their feedback into the outputs of the planning process, i.e., the adopted plans and programs.

In addition, much of the analysis and forecasting work of planners at the State and Metropolitan Areas has continued to be focused on individual travel needs. As a result much of the attention of the planning process continues to be presented from the perspective of the mobility needs of people. While businesses and industry groups are included as stakeholders in state and metropolitan planning, the efficient movement of freight as well as people has for the most part not been considered from the perspective of the user businesses. The perspective of business needs has then not been typically considered in the analytical and data gathering efforts of most planning agencies and in most cases has also not been adequately presented in the transportation plans and programs. This section presents a suggested step by step approach that can be used by planners to address the needs of businesses and industry in the state and local transportation planning process. These steps are consistent and generally follow the overall ISTEA planning process.

Business Person Travel Needs

As described in Chapter 2, all industries and businesses have similar person transportation requirements. All businesses share the concerns related to employee and customer access and they all need to have adequate and reliable access for their customers and their employees' journey to work trips. However, most of the growth in the U.S. economy has been focused in the service sector as well as in the high-tech and knowledge-intensive manufacturing industries. These industries and businesses are the ones most concerned with reliable, low-cost access for their employee business travel, an area that usually receives little attention as part of the transportation planning process.

As noted in the previous section, transportation planners have well developed data bases and analytical techniques to analyze person transportation needs from an individual or household travel perspective. To formally consider the major business person transportation needs in each economic sector (with emphasis on those sectors that are of greatest importance and/or are targeted in an area's economic growth plans), suggestions and approaches are presented in the next section as to when and how in the planning process planners should add appropriate special analysis and/or present results from a business or industry perspective.

Business Freight Transportation Needs

As emphasized in Chapter 2, business freight transportation requirements vary significantly by economic sector and industry. There are also some service and cost factors and economic trends that are particularly most important to some industries. Transportation planners should formally consider freight transportation needs from the perspective of the major sectors and industries that make up an area's economy and take into consideration the competitive transportation cost and service factors that affect those industries.

In general, to increase their competitiveness in today's global economy, American businesses are seeking lower shipment costs, reduced delivery time, lower damage/loss rates, real-time information on shipments, and increased reliability for the transportation and distribution of their products. Reliable transportation services also helps businesses lower their investment devoted to inventory without affecting sales volumes. Timely delivery, reliability and quality of service can be as important as, or even more important than, transportation cost, particularly to businesses in the faster growing technology and knowledge intensive manufacturing of high value products.

As previously noted, freight transportation analysis is very complex and it is not possible to use the same type of analytical tools that have been well developed for person transportation analysis. As a result, since the enactment of ISTEA, progress in integrating freight business needs in the overall transportation planning process has been decidedly slow. There are two primary reasons for the lack of progress[4]:

1. Planners' lack of experience with freight issues; and
2. Lack of communication between the public and private/business sectors.

These points are emphasized by the results of a 1995 Freight Stakeholders National Network survey of 345 MPOs, including the responses of 19 of the 20 largest metropolitan areas. The survey found[5]:

- 62 percent of MPO respondents have no routine mechanism of receiving input from the freight community;
- Three-quarters of MPOs have not developed criteria to guide freight project selection;
- The number of MPOs with a formal structure to interact with the freight community has actually decreased 5 percent since 1994; and
- 87 percent of MPOs do not have sufficient data for freight planning.

Therefore, the greatest need to consider the transportation requirements of American business in the transportation planning process is to address freight transportation needs and issues that are typically receiving little attention. To formally consider the major business freight transportation needs in

[4]Murray, Dan and Jim Murphy, Moving Freight Planning from Theory to Practice: Four Case Studies in Data Collection and Analysis.

[5]Improving Freight Mobility: An MPO Survey; Freight Stakeholders National Network, 1995.

each economic sector (with emphasis on those sectors that are of greatest importance and/or are targeted in an area's economic growth plans), suggestions and approaches are also presented in the next section as to when and how in the planning process planners should add appropriate special analysis and/or present results from a business or industry perspective.

3.7 Steps to Incorporate Business Needs in Transportation Planning

The proposed steps to more formally incorporate business needs into the transportation planning process are presented in Figure 3.3 and to a large extent follow the analytical steps in the typical planning process. The proposed approach is to mirror the steps in the ongoing state and metropolitan area planning and their project selection processes presented previously. The approach describes suggestions on how business transportation needs can be more formally considered in each of the seven general steps in the project selection process. Figure 3.3 lists some of the steps and analysis that are proposed to be added within the framework of the seven steps of the typical project selection process presented earlier. It is important to note that stakeholder involvement—not just data gathering, analysis and forecasting—is an important component to achieve the objectives of these steps. While an ideal process will involve key stakeholders in each step, the description of each step below and Table 3.4 summarizes where stakeholder involvement is particularly critical.

TABLE 3.4 Critical Steps for Business Development in Transportation Planning

Planning Process	Critical Business Input
Existing Conditions	* **Understand Transport Requirements of Key Industries**
Demand Projections	* **Growth Plans of Existing Businesses**
Problems, Issues and Proposed Solutions	* **Priority Needs** * **Constraints that Affect Businesses**
Plan/Program Development	* **Comments/Inputs from Businesses Prior to Plan and Progress Adoption**

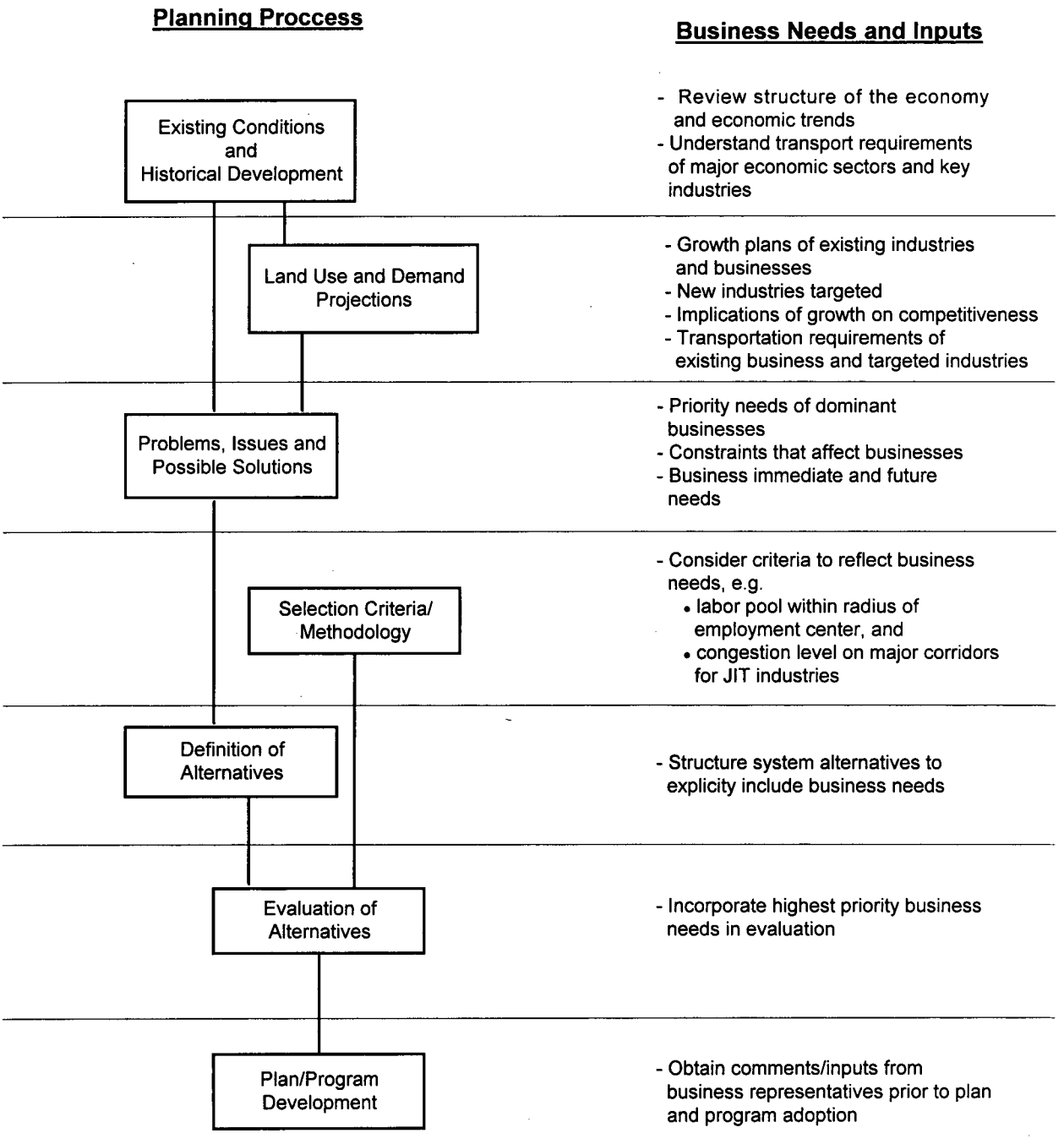
- **Step 1:** *Analysis of Existing Conditions and Historical Development*

  During this initial step of the planning process, it is particularly important to gain a good understanding of the economy of the area, its major industries and businesses, and their competitiveness. For this purpose, the following types of analysis and data assembly are suggested:

  A. *Review available sources of information and assemble national and state reports and/or data bases.*

  An important first step is a thorough investigation of relevant business transportation and economic reports and data sources to determine which ones are required to carry out an area's planning process. Such data sources may provide vital information on:
  - National, state and local transportation statistics and trends that affect business and

Figure 3.3: Incorporating Business Needs into the Transportation Planning Process



industry transportation needs;
- National, state and regional economic statistics, trends, and forecasts;
- Demographics statistics, trends and forecasts; and
- Information and trends in interstate and international trade and commerce.

Box 3.3 presents some examples of the types of data available and their sources.[6] The Bureau of Census and the Bureau of Economic Analysis in the U.S. Department of Commerce and the Bureau of Transportation Statistics in U.S. DOT are major sources of information that need to be contacted in all cases. In addition, private data bases and industry publications and data bases represent important sources for both data and analysis that can be used by states and metropolitan areas in their planning process.

B. Review historical structure of the state and local economy as well as regional and national economic trends.

Chapter 2 and Appendix A include a review of historical changes in the national economy. A similar type of analysis can be carried out at the state or metropolitan area level to gain a good understanding of the present structure of the area's economy and how it has been changing. Some metropolitan areas grew as manufacturing centers (Detroit for autos, Akron for tires, etc.), but most metropolitan economies are primarily centers for financial, government and private sector services. Medical equipment, biotechnology, computer systems, and other high-technology industries are concentrated in some metropolitan areas and states.

Table 3.5 provides an example of the type of available information that can be helpful to planners to understand the contribution to regional and state economies by economic sector. Compiling such information provides an overview of the dominant sectors in the state and/or region. This type of information can also be compiled for various industries. Analysis of the changes in sectoral and industry growth provides an indication of which are the fastest growing industries, where job growth is taking place, and where jobs are declining. This information, combined with a review of national economic trends (i.e., which industries are growing faster relative to GDP), should help focus the planner on which industries are likely to play an even more important role in the region and state.

For example, agriculture, forestry and fisheries are most significant in states like South Dakota, Nebraska, and Idaho (over 10% of GRP). They are of lesser importance in heavily urbanized states like Massachusetts, Maryland, New York, and New Jersey (less than 1% contribution to GRP compared to national average of 1.9%). A transportation planner in North Carolina or Indiana, as another example, will notice that manufacturing accounts for around 30 percent of the state GRP (compared to an 18% national average).

[6]For a complete description of such data sources please refer to the Directory of Transportation Data Sources (multi year), U.S. Department of Transportation, Bureau of Transportation Statistics.

Box 3.3 Sources of Transportation and Economic Data

Department of Transportation

Bureau of Transportation
American Travel Survey 1995
Commodity Flow Survey
National Transportation Statistics 1996
North American Transportation Statistics
Canadian, Mexican, & United States
Surface Transborder Commodity Data
Transportation Statistics Annual Report
United States Waterway Data
Worldwide Transportation Directory

Bureau of Transportation Statistics, Office of Airline Information
Airport Activity Statistics of Certified Route Air Carriers
Origin and Destination Survey
T-100 Domestic Markets

Federal Aviation Administration
FAA Aviation Forecasts
FAA Statistical Handbook of Aviation
National Plan of Integrated Airport Systems and
Airports Capital Improvement Program
Terminal Area Forecast

Federal Highway Administration
1995 Status of the Nation's Surface Transportation
Condition and Performance
Annual Statistical Report
Highway Performance Monitoring System
Truck Weight Study Data

Federal Railroad Administration
FRA National Rail Planning Network
Grade Crossing Inventory System

Federal Transit Administration
National Transit Database

Maritime Administration
Domestic Waterborne Commerce of the United States
Port Facilities Inventory

Other Federal Agencies

Department of Agriculture
Grain Transportation Report

Department of Commerce

Bureau of Census
Census of Transportation, Communications and Utilities
Census of Manufactures
Census of Population
Commodity Flow Survey
Current Industrial Reports
Statistical Abstract of the United States
Transportation Annual Survey
U.S. Exports of Merchandise
U.S. Vessel Clearances
U.S. Waterborne Exports and General Imports

Bureau of Economic Analysis
BEA County Projections
BEA Regional Projections
National Income and Product Accounts
Regional Economic Information System
Survey of Current Business

International Trade Administration
Canadian Travel to the United States
International Air Passenger Data Base
Outlook for International Travel To and From the United States
Pleasure Travel Markets to North America

Department of Defense

Department of the Army, Army Corps of Engineers
Dredging Information System
Estimated Waterborne Commerce Statistics
Geographical Information System
Waterborne Commerce of the United States

Department of the Army, Military Traffic Management Command, Headquarters
Freight information System

Department of Labor
Consumer Price Index
International Prices and Price Indexes
Occupational Employment Statistics

Environmental Protection Agency
National Air Pollutant Emission Trends
National Air Quality and Emission Trends

United Nations
Annual Bulletin of Transport Statistics for Europe
United Nations Statistical Yearbook

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Data Source Book, 1996

Table 3.5 Sector Contribution to State and Regional GDP 1

REGION AND STATE	Farms, forestry, fisheries	Construction	Manufacturing	Services					
				Transportation, public utilities	Wholesale trade	Retail trade	Finance, insurance, real estate	Private Sector Services	Government
United States	1.9%	3.9%	18.0%	8.9%	6.6%	9.3%	18.3%	19.2%	12.3%
New England	0.9%	3.3%	19.6%	7.2%	6.6%	9.0%	21.7%	22.0%	9.6%
Maine	4.3%	4.3%	17.4%	8.7%	4.3%	13.0%	17.4%	17.4%	13.0%
New Hampshire	z	4.2%	20.8%	8.3%	4.2%	8.3%	20.8%	20.8%	8.3%
Vermont	z	9.1%	18.2%	9.1%	9.1%	9.1%	18.2%	18.2%	9.1%
Massachusetts	0.6%	3.2%	18.6%	7.1%	7.1%	8.3%	21.2%	24.4%	9.0%
Rhode Island	z	4.8%	19.0%	4.8%	4.8%	9.5%	23.8%	19.0%	9.5%
Connecticut	1.0%	3.1%	20.8%	7.3%	7.3%	9.4%	24.0%	19.8%	9.4%
Middle Atlantic	0.6%	3.6%	16.5%	8.9%	6.9%	8.2%	22.4%	21.7%	10.8%
New York	0.6%	3.4%	14.1%	8.4%	6.7%	7.8%	25.0%	22.5%	11.3%
New Jersey	0.5%	3.8%	17.4%	9.4%	8.5%	8.0%	20.7%	21.1%	10.3%
Pennsylvania	1.2%	3.9%	20.4%	9.4%	6.3%	9.0%	18.4%	20.8%	10.2%
East North Central	1.5%	3.8%	24.5%	8.8%	7.0%	9.3%	17.0%	17.4%	10.3%
Ohio	1.3%	3.5%	26.3%	8.8%	6.6%	9.6%	15.8%	17.1%	10.1%
Indiana	1.8%	4.4%	28.9%	9.6%	6.1%	9.6%	14.9%	14.9%	10.5%
Illinois	1.4%	3.9%	19.0%	10.0%	8.2%	9.0%	19.0%	19.4%	9.7%
Michigan	1.1%	3.7%	25.9%	7.4%	6.9%	9.5%	16.9%	17.5%	11.1%
Wisconsin	2.9%	3.9%	27.2%	7.8%	5.8%	8.7%	17.5%	15.5%	10.7%
West North Central	4.7%	3.4%	19.2%	9.7%	7.4%	9.5%	16.6%	16.6%	11.8%
Minnesota	2.9%	3.9%	21.4%	8.7%	7.8%	8.7%	17.5%	17.5%	10.7%
Iowa	7.1%	3.6%	23.2%	8.9%	7.1%	8.9%	16.1%	14.3%	12.5%
Missouri	1.9%	3.8%	20.8%	11.3%	7.5%	10.4%	16.0%	17.9%	11.3%
North Dakota	8.3%	z	8.3%	8.3%	8.3%	8.3%	16.7%	16.7%	16.7%
South Dakota	14.3%	z	7.1%	7.1%	7.1%	7.1%	21.4%	14.3%	14.3%
Nebraska	11.4%	2.9%	11.4%	11.4%	8.6%	8.6%	17.1%	14.3%	14.3%
Kansas	3.8%	3.8%	18.9%	11.3%	7.5%	9.4%	15.1%	15.1%	13.2%
South Atlantic	1.9%	4.3%	16.3%	9.2%	6.4%	9.7%	17.1%	19.0%	15.6%
Delaware	z	4.8%	23.8%	4.8%	4.8%	4.8%	33.3%	14.3%	9.5%
Maryland	0.9%	6.3%	9.8%	8.0%	6.3%	9.8%	18.8%	22.3%	17.0%
District of Columbia	z	2.6%	2.6%	5.3%	2.6%	2.6%	13.2%	34.2%	36.8%
Virginia	1.4%	4.1%	15.9%	9.0%	5.5%	9.0%	16.6%	18.6%	19.3%
West Virginia	z	3.4%	17.2%	13.8%	6.9%	10.3%	13.8%	13.8%	13.8%
North Carolina	2.7%	3.4%	30.4%	8.1%	6.1%	9.5%	13.5%	12.8%	12.2%
South Carolina	1.5%	4.5%	25.8%	9.1%	4.5%	10.6%	13.6%	13.6%	16.7%
Georgia	2.1%	3.5%	18.1%	11.1%	9.0%	9.0%	16.0%	16.7%	13.2%
Florida	2.7%	4.7%	9.0%	9.4%	6.7%	11.4%	20.0%	22.7%	13.3%
East South Central	2.4%	3.5%	23.2%	9.0%	5.9%	10.0%	13.8%	15.2%	13.8%
Kentucky	2.9%	4.3%	24.3%	8.6%	5.7%	10.0%	12.9%	14.3%	12.9%
Tenessee	2.0%	4.0%	23.8%	7.9%	6.9%	10.9%	14.9%	17.8%	12.9%
Alabama	2.7%	4.1%	21.6%	9.5%	5.4%	9.5%	13.5%	14.9%	16.2%
Mississippi	2.4%	2.4%	24.4%	12.2%	4.9%	9.8%	14.6%	12.2%	14.6%
West South Central	2.0%	3.6%	17.3%	10.8%	6.4%	9.3%	15.1%	16.4%	11.5%
Arkansas	4.9%	2.4%	24.4%	12.2%	4.9%	9.8%	14.6%	14.6%	12.2%
Louisiana	1.1%	4.2%	18.9%	10.5%	5.3%	8.4%	13.7%	13.7%	10.5%
Oklahoma	3.4%	3.4%	15.5%	10.3%	5.2%	10.3%	15.5%	15.5%	15.5%
Texas	1.8%	3.8%	16.2%	10.9%	6.8%	9.3%	15.4%	17.4%	11.1%
Mountain	2.8%	4.5%	12.1%	9.7%	5.5%	10.0%	16.2%	20.7%	14.5%
Montana	7.1%	7.1%	7.1%	14.3%	7.1%	7.1%	14.3%	14.3%	14.3%
Idaho	10.5%	5.3%	15.8%	10.5%	5.3%	10.5%	15.8%	15.8%	10.5%
Wyoming	z	z	7.7%	15.4%	z	7.7%	15.4%	7.7%	15.4%
Colorado	2.6%	3.9%	13.0%	10.4%	6.5%	10.4%	16.9%	20.8%	14.3%
New Mexico	3.3%	3.3%	13.3%	10.0%	3.3%	10.0%	13.3%	16.7%	16.7%
Arizona	2.9%	5.7%	12.9%	7.1%	5.7%	11.4%	18.6%	20.0%	14.3%
Utah	z	3.0%	15.2%	9.1%	6.1%	9.1%	15.2%	18.2%	15.2%
Nevada	z	6.1%	3.0%	9.1%	3.0%	9.1%	15.2%	36.4%	9.1%
Pacific	2.3%	4.4%	14.8%	7.4%	6.4%	9.8%	20.0%	20.8%	12.5%
Washington	3.4%	5.0%	16.8%	7.6%	6.7%	10.1%	16.8%	18.5%	14.3%
Oregon	3.4%	3.4%	18.6%	8.5%	6.8%	10.2%	16.9%	16.9%	11.9%
California	2.1%	4.3%	15.1%	7.1%	6.4%	9.7%	20.9%	21.9%	11.9%
Alaska	3.8%	3.8%	3.8%	11.5%	3.8%	3.8%	11.5%	7.7%	15.4%
Hawaii	3.2%	6.5%	3.2%	9.7%	3.2%	12.9%	19.4%	22.6%	19.4%

[1] does not include mining

z less than $500 million

Likewise, a planner in the District of Columbia will realize that over 70 percent of the District's GRP is in Private Sector Services and Government. Some states have a comparatively large share of GRP in Wholesale Trade, e.g. Georgia, Illinois, Vermont, and New Jersey. As one might expect, states with a large tourism industry, like Maine, Florida, Arizona and Hawaii, have the largest retail industry contribution to state GRP. Similarly, a state like Delaware that is known as a corporate headquarters and bank processing center, has the largest contribution to GRP in Finance, Insurance and Real Estate.

Once the major industries have been identified, planners can obtain a list of the specific companies in those industries conducting business in the area. A mailing list can be developed for use in selecting companies to be interviewed, asking for participation at meetings or committees, etc.

C. Understand the transport requirements of the major economic sectors and industries.

This step should utilize national and state data sources, industry publications as well as special surveys and analysis of business needs in the planning area, so as to provide an overview of the transportation requirements and priorities of major industries and businesses in the planning area.

Chapter 2 and Appendix A present an overview of the transportation requirements of different economic sectors and industries, based on interviews and an extensive literature review carried out as part of this study. In addition, interindustry tables were analyzed as part of this study to provide a systematic method for assessing the relative importance of various transport sector industries to U.S. industrial production. Benchmark input-output tables prepared by the U.S. Department of Commerce's Bureau of Economic Analysis provide an exceptional level of detail to support an investigation of who uses the services of each transport sector as well as the variation in the input requirements for U.S. industries requiring transport sector services. The input-output tables of the U.S. economy prepared by the Bureau of Economic Analysis can then be used to consider the share of industry output spent for transport services by the various industry groups and the importance of transportation to each industry's output, i.e., how much transportation represents out of the industry's output.

The tables in Chapter 2 summarize the transportation requirements of American businesses by major sectors and industry groups, as identified in this study. This table is a good starting point. Once major businesses and industries in the planning area have been identified, however, the transportation planner should conduct a more thorough investigation of the particular needs of industries in their state or metro area. Box 3.4 presents examples of techniques that can be used to evaluate the needs of business. During this project, a survey of industry requirements was carried out for selected industries. Planners should consider carrying out a similar survey or set up workshops, focus groups or advisory committees to identify specific business needs in their area. Appendix C provides samples of the interview forms that can be used to carry out a detailed evaluation of the changing requirements of American business for key industries in an area. The corresponding

responses by businesses and transportation providers should be most valuable to planners in understanding the needs of the major businesses in their region.

Box 3.4 Techniques to Involve Business Groups in the Transportation Planning Process

- **Forums: Large meetings involving 50 to 100 members of the business stakeholder community. The purpose of these meetings is to provide business groups with available analysis on the implications of transport to their competitiveness as well as discuss the importance of their input in the process. These large meetings are best for problem identification and information dissemination. Many of these large groups often subdivide into smaller, more targeted focus groups.**
- **Focus Group Research: a gathering of six to ten people who are invited to spend a few hours with a skilled moderator to discuss a problem, project or service. Focus group research is an effective exploratory step to take before designing a large scale survey.**
- **Workshops: Workshops are smaller versions of forums. Workshops, because of their size, are more effective in brainstorming activities and obtaining input from stakeholders.**
- **Survey Research: Surveys are best suited for descriptive research. Organizations undertake surveys to obtain information and to learn about people's beliefs, preferences, satisfaction, etc., and measure these magnitudes for a larger group.**
- **Expert Panels: Organizations often obtain the opinions of experts. Expert panels are invitation only groups who review problems and refine project alternatives. A group of experts may be called to help prepare a forecast, exchange views and produce a group estimate (group-discussion methods), produce individual estimates that are combined by an analyst (pooling of individual estimates). The ultimate purpose of expert panels is to obtain "buy-in" to the process or objectives of a study or project.**

■ **Step 2:** *Land Use and Demand Projections*

The next step in the planning process is to develop land use and demand projections. For this purpose, planning agencies usually go through an effort involving their policy committee and key decision-makers to articulate the area's development goals. As part of this effort, it is useful to analyze industry trends and which businesses and industries are targeted and/or likely to play a new and/or more important role in the future state and local economy. The following types of analysis and data assembly are suggested:

A. Consider the growth plans of existing industries and businesses.

Transportation planners need to coordinate their efforts with economic development planners, Chambers of Commerce, and industry groups that may have been established in their area. Planners should obtain copies of economic forecasts and development plans of the state, local areas and major industries and businesses. Similarly, national economic forecasts and data bases can be helpful in understanding how the present situation is likely

to change in the future. Through a review of these economic development and industry plans, planners can then consider the likely growth that can be expected in the industries that presently make up the area's economy.

B. Working with the economic development planners, identify which new industries are targeted for development.

State and local economic development agencies are continuously working on attracting new businesses and industries to their states. Tuscaloosa, Alabama, for example, was successful in attracting the Mercedes-Benz company to build their new line of sport utility trucks in their state. To do so, the state had to convince Mercedes-Benz that the state presented the best combination of factors to encourage automobile manufacturing. Such factors included not only favorable labor costs and availability, but also access to an excellent intermodal transportation network, including major interstates and highways, three railroad systems, access to 18 motor freight companies offering short long-haul and custom trucking service, barge service, and an adequate sized airport.

Transportation planners then need to consider not only the plans of existing industries and businesses, but also the likely results of economic development planning and promotion efforts.

C. Consider transportation requirements of existing businesses and new targeted industries.

Once fast growing industries and new likely industries are identified, transportation planners will need to consider their likely implications on transportation demand. For existing businesses known to be planning to expand on existing sites, a corridor specific analysis can be carried out to assure that the demand projections and the results of other analysis have adequately considered business expansion plans. For targeted industries, this type of analysis cannot in most cases be corridor or site-specific, unless a specific corridor or industrial area has been targeted to attract certain types of businesses. In any case, planners need to consider the type of transportation demand likely to be generated by targeted industries so that these needs can be addressed when proposing strategies and long-term transportation investment plans for the area. As specific businesses announce their plans for expansion (particularly, in those cases where an area may be facing a competitive situation to assure that an existing business expands in the area or to attract a new business), an analysis of transportation demand generated by the expanded or new businesses should be carried out. This demand analysis will be then useful in future analysis steps to be able to identify required improvements and to consider the implications of the expanded or new businesses on the area's transportation policies, priorities and investment plans.

■ **Step 3:** *Identify the Resulting Problems or Issues and Propose Solutions*

A. Understand how the transport needs of businesses and industries are affected by the existing constraints on the transportation system.

Based on the understanding of the current business environment and the likely future economic environment, it is important to analyze how transportation infrastructure, programs, and policies are affecting business performance and what businesses require to help them remain efficient and competitive. The local surveys of area businesses as well as the available information from national and industry publications and analysis can be used to produce a list of problems and issues requiring resolution that should be addressed by the planning process. In addition, planners need to consider the existing constraints in the transportation system which may be acting as impediments to improved freight and passenger movements.

Table 3.6 presents examples of such constraints for selected metropolitan areas. It is important to identify these constraints early on. An area's ozone nonattainment status, for example, may preclude consideration of certain strategies (i.e., strategies which may increase highway capacity, reduce congestion, but at the same time result in increases in vehicular emissions). Regions that presently serve as major distribution centers, air passenger or cargo hubs or international gateways, maritime load centers, or border ports of entry will want to consider their competitive position in those industries and what are the needs of the involved companies and transportation providers so as to help them improve their services through the area. For example, airport, seaport, or border port of entry congestion and/or capacity constraints may affect the ability of the area to expand or continue to serve as an air passenger hub, maritime cargo load center, or major border port of entry.

B. Categorize area by the predominant needs of the dominant business(es) or those identified as targeted.

To assist planners in considering business transportation needs, a suggested categorization of areas has been developed. Based on the investigation of the transportation requirements of businesses identified in prior steps, an area can be categorized based on the predominant needs identified by the area's businesses or the needs of targeted industries in the area's economic development programs. The major factors that should be used by planners in this categorization are:

- Degree of congestion, utilizing for example the TTI Congestion Index
- Extent of manufacturing sector contribution to area's GRP, using either manufacturing share of GRP or manufacturing percent of total employment
- Extent of current and anticipated contribution of high-tech and knowledge-intensive industries to area's GRP
- Extent of current and anticipated contribution of wholesale trade and distribution industries to area's GRP

Table 3.6 Transportation Supply Constraints

Metro Area	TTI Congestion Index[1]	Gateway/Hub Passenger Enplanements[2]	Border Crossings	Ozone Nonattainment Status[3]	Major Seaport
Albuquerque, NM	0.96	2,938,786			
Atlanta, GA	1.16	25,669,559		Serious	
Austin, TX	0.95	2,502,355			
Baltimore, MD	1.04	5,524,703		Severe (2005)	*
Boston, MA	1.07	10,667,886		Serious	*
Charlotte, NC	0.92	9,384,480			
Chicago, IL	1.26	34,048,059		Severe (2007)	
Cincinnati, OH	1.03	5,487,388		Moderate	
Cleveland, OH	0.98	4,830,570			
Columbus, OH	0.93	2,589,423			
Corpus Cristi, TX	0.75	N/A			*
Dallas, TX	1.07	28,851,386		Moderate	
Denver, CO	1.07	14,788,640			
Detroit, MI	1.23	12,256,251	*		
El Paso, TX	0.77	1,870,163	*	Serious	
Fort Lauderdale, FL	0.98	4,612,512			*
Fort Worth, TX	0.95	N/A			
Hartford, CT	0.93	2,196,235			
Honolulu, HI	1.13	8,772,102			
Houston, TX	1.13	13,594,914		Severe (2007)	*
Indianapolis, IN	0.89	2,863,871			
Jacksonville, FL	0.96	1,746,759			*
Kansas City, MO	0.78	4,277,012			
Los Angeles, CA	1.54	19,885,450		Extreme	*
Louisville, KY	0.93	1,537,738		Moderate	
Memphis, TN	0.93	3,459,573			
Miami, FL	1.32	10,831,532			*
Milwaukee, WI	1.00	2,313,217		Severe (2007)	
Minneapolis-St. Paul, MN	1.02	10,892,061			
Nashville, TN	0.93	3,582,530			
New Orleans, LA	1.09	3,915,453			*
New York, NY	1.15	18,713,378		Severe (2007)	*
Norfolk, VA	0.92	1,547,007		Marginal	*
Oklahoma City, OK	0.89	1,656,837			
Orlando, FL	0.82	9,166,580			
Philadelphia, PA	1.04	7,612,424		Severe (2005)	*
Phoenix, AZ	1.08	12,451,569		Moderate	
Pittsburgh, PA	0.82	8,996,598		Moderate	
Portland, OR	1.11	4,837,125		Moderate	*
Sacramento, CA	1.04	2,790,976		Severe (2005)	
Salt Lake City, UT	0.92	7,828,969		Moderate	
San Antonio, TX	0.91	2,944,867			
San Bernardino-Riverside, CA	1.21	N/A			
San Diego, CA	1.21	6,168,430	*	Serious	*
San Francisco, CA	1.33	14,451,891			
San Jose, CA	1.05	4,021,987			
Seattle-Everett, WA	1.23	9,962,385	*		*
St. Louis, MO	0.96	11,602,815		Moderate	
Tampa, FL	1.06	5,439,230	*		*
Washington, DC	1.41	11,213,346		Serious	

1 Texas Transportation Institute, Urban Roadway Congestion - 1982 - 1993, August 1996.

2 US DOT, Bureau of Transportation Statistics, Top 100 U.S. Airport Enplanements, 1994

3 US Environmental Protection Agency, Office or Air Quality Planning and Standards/Office of Air and Radiation, Green Book (as of May, 1997)
/in order of severity: marginal, moderate, serious, severe (2005), severe (2007) extreme.

- Extent of current and anticipated contribution of tourism and hospitality industries to area's economy, using either industry employment and/or industry sales
- Extent of current and anticipated current contribution of finance, insurance and real estate; private sector services; and government services to area's GRP
- Role of state or metropolitan area as a:
  - maritime load center for foreign commerce
  - airport passenger hub and/or international passenger gateway
  - airport cargo hub and/or international cargo gateway
  - border crossing port of entry
- Ozone non-attainment status of area

Consideration of these factors can then help identify the major issues of importance to businesses in an area, as well as point out constraints to future industry development in economic sectors or industries targeted for development by economic development agencies. Interviews with local businesses may, for example, reveal that a state's truck size and weight standards are not compatible with neighboring states, prohibiting the efficient movement of goods in an area whose economy relies heavily on distribution and gateway traffic. Categorizing the importance of these sectors to the area's economy can help planners raise the issue and can also help decision-makers consider the implications of this issue in light of their regional development objectives. The categorization can then help identify priority business transportation needs.

C. Examine strategies to meet business needs.

Once an area has been categorized compared to other states or metro areas, an examination of the potential strategies to deal with the observed problems or anticipated future needs can help assess the area's competitive position with other states or metropolitan areas. Box 3.5 presents a categorization of strategies to deal with some of the business transportation problems in areas facing congestion, with high concentration of certain industries, and/or serving as major gateways, hubs, or border ports of entry. Appendix B presents examples of strategies to address some of these business problems or needs.

D. Produce report on current and future transport requirements.

Based on the planners research and analysis in Steps 1 and 2, as well as the input of business groups and industry representatives, the planning process should periodically prepare a report on the area's transportation requirements and related issues and problems from a business perspective, including:

Box 3.5 Categorization of Potential Strategies to Address Business Transportation Issues

To provide future opportunities for industries to improve their competitiveness by continuing to maintain lower inventories, increasing product delivery reliability, and improving speed of business travel, long-term and short-term strategies include:

1. **Reduce Congestion and Bottlenecks**
   - **assure adequate access to businesses during peak periods for employees and customers**
     eliminate bottlenecks
     efficient control of incidents
     reduce congestion
     real-time tracking of congestion

2. **Border-crossing/Gateway Development**
   - **improve emerging corridors, border ports of entry, international gateways, and other infrastructure to meet the emerging needs of international business and tourism travel and freight movement**

3. **Improve Capacity and Efficiency**
   - **assure adequate access for developed and developing commercial and industrial areas**
   - **facilitate intermodal connections (access to ports, rail stations, truck terminals, rail yards, and airports) and services**
   - **assure adequate capacity in emerging corridors, areas targeted to attract industry, and between airports/other terminals and manufacturers/retailers**

4. **Introduce New Technologies**
   - **introduce new technology (vehicles, facilities and ITS) that can result in further significant reductions in travel time and increase in reliability.**

5. **Address Institutional Roadblocks**
   - **eliminate institutional roadblocks to more efficient, more reliable, and less costly services**
     increased international airline connections
     simplify laws and regulations, e.g. maritime deregulation and uniform truck size/weight regulations
     customs and immigration clearance streamlining

6. **Standardization of Equipment and Processes**
   - **standardize equipment and other standards, e.g. EDI and uniform container standards for all modes**
   - **encourage international standards and regulations that make possible the use of the same equipment around the world and offers the opportunity to establish more integrated international and domestic transportation services**

Person Transportation
- Employee access by corridor or sub-area
- Customer access by corridor or sub-area
- Business travel

Freight Transportation
- Inbound logistics and implications for area production by major industry
- Domestic and international distribution of area products by industry
- Local distribution to consumers in the area

Implications on Area's Competitiveness
- Sector and industry analysis of importance of transportation on industry and company competitiveness, including role of area as border port of entry, international gateway, load center, and/or domestic hub

This analysis should include a review of current needs, anticipated future requirements, and the implications for the area's transportation plans and programs and the growth of the area's economy. It should also identify the most important problems and proposed solutions from the perspective of the major industries and businesses in the area. This report should include a listing of the most important projects, operational or non-capital strategies, and/or policy initiatives that are anticipated can address the critical bottlenecks and problems that need to be solved in the near-term and long-term from the area's economy and industry's and businesses' perspectives.

- **Step 4:** *Project Selection Criteria/Methodology*

The examination and selection of strategies may be made using the same process and criteria that are used to select transportation projects and programs for inclusion in a transportation plan or TIP. Box 3.6 presents examples of additional criteria, special analysis, and/or methodologies that can be used to evaluate alternatives from a business perspective. What is important is that the project selection criteria explicitly and formally include measures that reflect the structure of the area's economy and the important needs of an area's industries and businesses. Examples of such criteria or special analysis that may be used to formally incorporate business transportation needs include:

- Labor pool within 10 mile radius or 30 minute commute of major employment centers (emphasizing major industries and businesses based on analysis of area's economy)
- Resident and visitor population within 3 mile radius or 10 minute travel time of major retail centers and/or cultural/tourist attractions
- Market area within travel time contours from major distribution centers
- Congestion level on significant corridors or routes for just-in-time manufacturing industries

Box 3.6 Additional Criteria and Special Analysis to Evaluate Alternatives from a Business Perspective

There are many techniques that can be used to evaluate complex public policy decisions. The general framework for public policy decision making includes five steps (Stokey, Zeckhauser, 1978):

1. Establishing the Context: What is the underlying problem? What are the specific objectives in addressing the problem?
2. Developing Alternatives: What are the alternative courses of action? What are the possibilities of gathering further information?
3. Projecting the Consequences: What are implications of each of the alternative? What techniques are relevant for predicting these consequences?
4. Valuing the Outcomes: What criteria should be used to measure the potential success for each potential alternative?
5. Decision: From the above analysis, what is the preferred alternative?

Given these general steps, planners have several analytic tools that can be used to evaluate alternatives, including:

- Benefit/Cost Analysis
- Performance Measures
- Cost-Effectiveness Analysis
- Queuing Models
- Simulation Models

Examples of Criteria/Special Analysis:

- Labor pool within reasonable commute of major employment centers
- Market area within travel time contours from retail and/or distribution centers
- Cost and time to move cargo through competitor ports
- Level of service on highways providing access to airport gateway/hub

- Competitive criteria of border crossing ports of entry, international gateways, maritime load centers, and/or airport hubs (based on competitive analysis of relevant factors).
- Rail clearance criteria for key area industries (e.g. double-stack container rail clearances implications for distribution industry and maritime load centers, or tri-level rail clearance for automobile industry exports and domestic distribution)
- Level of service on highways or public transportation routes providing access to major intermodal rail yards, port terminals, airports, passenger rail terminals, etc.

The specific criteria or analysis appropriate in a particular state or metropolitan area will depend on how the area was categorized and the results of the business involvement activities in the previous step. In all cases, it is important that specific criteria and analysis be included in the evaluation process, so as to evaluate alternatives formally considering the transportation needs of business, not just the traditional factors that are mainly commuter travel oriented.

- **Step 5**: *Develop Alternative System Strategies to Address Problems or Issues*

Planners usually identify several system alternatives composed of a combination of projects, programs, and/or policy initiatives that are defined as having a balance to address the problems or needs previously identified. The problems identified as important to businesses in an area as well as the prior evaluation of the implication of specific projects and solutions to address business needs and priorities should be explicitly considered in defining alternative system strategies. If prior steps have clearly identified business needs and priorities, planners should carefully structure system alternatives to assure that these prior findings are incorporated in these alternatives.

- **Step 6:** *Evaluate Alternatives and Recommend Preferred Alternative*

Not all strategies will be able to achieve to the same degree the overall goals of the MPO or the state. During this step, strategies should be evaluated based on the extent that they meet all the evaluation criteria previously identified in step 4. The evaluation of alternatives should be aimed at selecting that alternative that most closely achieves the areas overall transportation and economic goals and programs. In addition, for nonattainment and maintenance areas, the strategies should be evaluated for conformity with the SIP. This evaluation then should review how the various transport strategies (usually defined to solve a specific need) can be made as consistent as possible with other transport, economic, air quality, and other environmental goals. During this evaluation, planners should particularly assure that the *evaluation leads to a recommendation that incorporates solutions to the most important and highest priority business needs*. When it is not always possible to do so because of other constraints, planners should explicitly identify the rationale for their recommendations, for consideration and decision by the appropriate policy body or agency executive.

- **Step 7:** *Select Strategies for Implementation*

The final step is to present draft recommendations for input by all key stakeholders, prior to action by the MPO policy body and /or the State executive that is responsible for plan adoption under State law. The public participation process or comment period should explicitly involve input by the business and economic development interests in the area. Box 3.4 includes examples of techniques that can be used to obtain inputs from business representatives on the alternatives studied and the draft recommendations.

Once a consensus is reached, the selected strategies, projects, programs, and policy initiatives are then added to the state and MPO long-range plan, transportation improvement program and, if necessary, state implementation plan.

In summary, the transportation planning process should incorporate explicitly and formally the perspective of business transportation needs in all steps. Data gathering, analysis of the current situation, identification of problems and solutions, criteria to select projects and initiatives that address the identified needs, and evaluation of alternatives should all be carried out to assure that business transportation needs are adequately considered in the technical analysis and methodologies used. Similarly, the policy committee, technical committee structure, public participation process, and other mechanisms to gain input from various stakeholders and community representatives should be set up so as to incorporate representation from key businesses in the area. Special efforts to involve business groups should be added, such as information meetings, focus groups, workshops, and expert panels, to assure that the business perspective and their needs and priorities are always known as the process defines transportation needs and selects a recommended approach to meet those needs.

Chapter 4
Conclusions

4.1 Overview

This chapter presents a summary of the results of Project 2-20 and the conclusions of the research into how to more formally incorporate business needs into the various steps carried out as part of the transportation planning process at the state and metropolitan area levels. First, a summary of the economic trends and the implications for transportation demand is summarized. The changing service and management requirements of American business are then summarized. Finally, a framework is proposed to more formally consider these trends and business needs as part of the planning process, including suggestions for analysis and steps to increase business participation that should help planners focus more attention on these economic and business issues.

4.2 Economic Trends and Implications for Transportation Demand

1. The major economic trends resulting in an increase and changes in the nature of transportation requirements of American business can be summarized as follows:

   - Globalization of the economy,
   - Growth of service industries,
   - Restructuring of traditional manufacturing to increase competitiveness and emergence of high technology and knowledge based industries,
   - Industrial location and demographics trends, including
     - Increased flexibility of businesses in their location decisions, as most businesses can choose to locate anywhere in the country
     - Aging population and increased leisure time and demand for travel
   - Reduced government role and privatization.

2. Economic forces and free trade policies that are generating increased worldwide trade tend to generate transportation demand, as products move longer distances and regions specialize in products which can be distributed competitively to a large hinterland.

3. Globalization of the economy not only involves manufacturing industries, but all economic sectors, including services. While the U.S. trade deficit has increased, the service sector has experienced an increasing trade surplus. Many service businesses tend to have a small hinterland, sometimes only at a local or metropolitan level. Yet, new technology, improved transportation, and modern communications are increasing the hinterland of many service businesses, including, for example, the retail industry (through mail order) and the food service industry (making possible global chains of restaurants).

4. Economic trends and globalization of the economy are also forcing industries to restructure operations and become more competitive. Industry restructuring also tends to generate increased transportation demand, because, for example, businesses tend to disperse their manufacturing around the world to reduce labor costs, and/or increase transportation requirements by concentrating distribution out of one or a few distribution centers serving the entire nation. Traditional large-scale manufacturers have become more competitive over the past decade, partly by instituting just-in-time inventory control systems that reduce their manufacturing, distribution and inventory costs. These companies not only are searching for ways to reduce transportation costs, but also are pursuing integrated logistics systems that reduce transit times and improve reliability.

5. Just-in-time systems are increasingly being used not only by manufacturing, but also by retailing and service industries. In general, JIT systems consume more transportation assets than conventional shipping arrangements. They require more trucks on the road, not to move more freight, but to move it quicker. The flexibility of U.S. transportation capacity may be constrained, as highway volumes may increase faster than the cargo tonnage that is being carried.

6. Some of the most competitive sectors of the U.S. economy include the newer high technology and knowledge based industries that are generating changes in the nature of transportation demand, since they rely on shorter product cycles that can quickly become obsolete, as well as more frequent shipments of smaller, lighter products. Similar requirements have been introduced by the most successful firms in other industries, e.g. apparel, retailing and food products.

7. The competitiveness of American companies is dependent on whether their products can be transported and delivered reliably at a competitive price from a manufacturing plant or distribution center to a larger hinterland, including both domestic and foreign destinations.

8. An aging population is generating increases in demand for health care and hospitality services, which in turn increases the need for specialized transportation services for customers of those services.

9. One of the fastest growing economic sectors worldwide involves the industries encompassing travel, tourism and hospitality services, which also generate demand for transportation, as people tend to travel more frequently or farther away on vacations.

10. Based on data from the BEA interindustry tables, manufacturing industries are the largest single source of demand (measured in terms of revenue) for transportation service (passenger and freight) among industry sectors, representing about 22 percent of all sales made by transportation companies. In order of relative importance, services (5 percent of all transportation sales) and construction (4 percent of all transportation sales) are the two other economic sectors that represent the largest sources of demand for transportation services.

11. Among economic sectors, manufacturing is the largest source of demand for all modes of transportation, except air transport and transit/highway passenger services. The services sector alone generates 13 percent of all air transport demand, while finance, real estate and insurance generates 8 percent of transit/highway passenger demand.

12. The economic sectors that spend the largest share of their total output and value added on transportation services are:

- Manufacturing of non-durable goods,
- Agriculture, forestry and fishery,
- Utilities,
- Manufacturing of durable goods, and
- Business services.

4.3 Transportation Service and Management Requirements of American Business

1. For an increasing number of industries that rely on just-in-time delivery, including many of the fastest growing industry groups, and most of the technology and knowledge intensive industries, reliability and speed of delivery is the most important freight transportation requirement. These industries select their transportation carrier without regard to which mode is used, based mainly on lowest cost among those that meet their time, reliability, quality and other service requirements. The importance of transit speed and reliability to control inventory costs means that companies increasingly rely more on truck travel and air cargo. When necessary, companies are sending materials needed for the production line by air rather than shutting down assembly lines. Similarly, retailers move products by air when necessary to avoid shortages during advertised sales.

2. The major passenger transportation requirement of American businesses is for fast and frequent service to meet their business travel needs. Business travelers are generally not very sensitive to price. However, for some industries, business travel represents a significant share of total costs (as high as 10 percent). For these companies, business travel costs and service level affect their competitiveness and their area of operation.

3. Employee and customer accessibility by road, public transportation, and, in some areas, by rail is an important factor in locating businesses. Most service sector companies consider access to be an employee or customer concern once the business has been located, except when congestion affects their business. Some larger companies in downtown or urban/suburban fringe locations now have to participate in transportation management measures to reduce air pollution. Congestion causes inconvenience and minor inefficiencies and does not typically affect competitiveness, but when it does, companies consider relocation.

4. Businesses are increasingly relying on outside travel agencies and integrated logistics firms to manage their passenger business travel needs and their inbound materials, product distribution, and inventory systems. These outside firms offer opportunities to reduce costs and increase the efficiency of a company's core business. Integrated logistics services are now improving the transportation cost efficiency and/or reliability for more than one-third of U.S. businesses, typically the market leaders and the most competitive companies in an industry.
5. Transportation carriers have been reducing their operating costs by consolidating their operations; creating larger, more efficient operating units through mergers, alliances, and partnerships that also increase their geographic coverage; and introducing new technologies, more efficient vehicles, and information-exchange services aimed at meeting the changing needs of businesses. Although truck-rail intermodal services have grown rapidly in the past decade, shippers are still not confident as to their reliability.

4.4 A Framework for More Formally Considering Business Transportation Requirements in the Transportation Planning Process

1. Business transportation requirements should be explicitly considered in State and Metropolitan Area transportation plans, taking into consideration the needs of the main economic sectors and industries that make up the local or State economy and their changing transportation needs to remain competitive. Approaches to reduce congestion in business travel corridors and international gateways and ports of entry should be explicitly considered in developing transportation plans and programs.

2. Transportation planners should analyze person transportation needs in their plans not only from an individual or household travel perspective but also from a business perspective, i.e.,

   - Employee access,
   - Customer access to retail businesses,
   - Customer access to consumer or personal service businesses
     (e.g., banks, financial services, repair services, educational services, personal legal services, health services),
   - Customer access to non-profit personal services
     (e.g., public schools, public health care services and other government services),
   - Customer access to tourism or hospitality related businesses, and
   - Customer access to business services
     (e.g., finance and insurance services, professional services).

3. Each of the typical steps of the planning process should incorporate analysis of business requirements and/or input from the business community, e.g., the following types of analysis should be regularly carried out:
   - Review structure of area economy and economic trends,
   - Analyze transport requirements of key area industries,
   - Review growth plans of area businesses,

- Consider new industries targeted in economic development plans,
- Analyze implications of business growth on transportation demand and competitiveness of area businesses,
- Identify priority transportation needs of dominant businesses,
- Consider transportation constraints that affect businesses,
- Summarize immediate and anticipated business needs,
- Develop evaluation methodology that formally incorporates criteria reflecting business transportation needs,
- Structure transportation alternatives to include highest priority business transportation needs, and
- Obtain comments/input from business representatives prior to plan and program adoption.

4. Possible strategies that can contribute to increased industry competitiveness should be considered in the planning process, i.e., strategies to

   - Reduce congestion and bottlenecks,
   - Encourage border-crossing/gateway development,
   - Improve capacity and efficiency,
   - Introduce new technologies,
   - Address institutional roadblocks, and
   - Standardize equipment and processes.

5. Strategies that appear to have the greatest potential to increase the competitiveness of American business should be selected if they:

   - Benefit a large number or at least several economic sectors (e.g., those investments that can increase reliability and reduce congestion, such as incident management, congestion management, ITS, etc.);
   - Appear to result in more significant reductions in transportation costs or increases in service level (e.g., improved highway access to rail yards, ports and airports so as to reduce time and cost of intermodal connections);
   - Address specific issues or obstacles that presently hinder industry competitiveness or address unique economic development opportunities (e.g., new highway corridors or intermodal connections that significantly reduce costs or increase service level along newly emerging corridors connecting Canada to Mexico as a result of the NAFTA agreement); and/or
   - Provide opportunities for industries to improve competitiveness by helping them lower inventories, increase product delivery reliability, and improve speed of business travel.

6. The type of analysis on economic trends and their implications on changing transportation demand and the needs of American businesses that was carried out as part of this study should be updated periodically. This study was based on 1987 data (the last BEA interindustry tables available at the time the research was conducted). BEA has now released 1992 comparable interindustry data, similar to the 1987 data the study team used. It is also suggested that similar analysis be carried out with older BEA data to determine changes in

transportation use over time. In the future, the increased use of electronic commerce may have significant implications for transportation demand and business transportation requirements. This research should then be updated periodically to analyze changes in business transportation needs and use over time using the latest available data.

APPENDIX A

Economic Trends and Transportation Requirements

APPENDIX A
ECONOMIC TRENDS AND TRANSPORTATION REQUIREMENTS

1.0 Introduction

A. Background

Chapter 2 of this report presents an overview of economic trends and multimodal transportation requirements of American business. This appendix supplements the summary presented in Chapter 2.

As part of Project 2-20 of the National Cooperative Highway Research Program (NCHRP), information was gathered on economic trends and transportation requirements of American business. To gain a better understanding of the changing transportation requirements of each economic sector and their implications on future transportation demand, a three pronged approach was followed. First, previously available research and information was compiled. Second, a quantitative analysis of available input/output tables of the U.S. economy (latest available based on 1987 data) was conducted to obtain consistent information on the transportation inputs of the products and services of the various economic sectors and industries. Third, to supplement this analysis, a limited telephone survey was conducted with knowledgeable individuals to obtain a more recent, although qualitative, perspective based on the views of users, carriers, and other transportation industry companies (the questionnaires used for the interviews are included in Appendix C). A total of 27 interviews were completed.

B. Organization

Section 2 of this appendix describes the broad structure of the U.S. economy and the major economic sectors and industries that make up the American economy. Section 3 presents information on some of the major economic trends affecting transportation requirements. Section 4 then presents an overview of the multimodal transportation requirements of the various economic sectors and industry groups for both freight and passenger transportation. The information in Section 4 is based primarily on the results of the survey and the literature review, as well as the analysis of interindustry tables. Section 5 presents the transportation industries' response to the requirements of American business.

2.0 The Structure of the Economy

In 1993, the Gross Domestic Product (GDP) of the U.S. was estimated at $6,343 billion. Following the Government's Standard Industrial Classification (SIC) system, output is divided into the following major economic sectors:

- Agriculture, Forestry and Fishing;
- Mining;
- Construction;

- Manufacturing; and
- Services, that is broadly defined to include all other sectors, i.e.,

    - Transportation and Public Utilities;
    - Wholesale Trade;
    - Retail Trade;
    - Finance, Insurance and Real Estate;
    - Private Sector Services; and
    - Government Services.

These sectors are further broken down into major groups (with 2-digit codes); then into industry groups (3-digit codes); and finally into industries (4-digit codes).

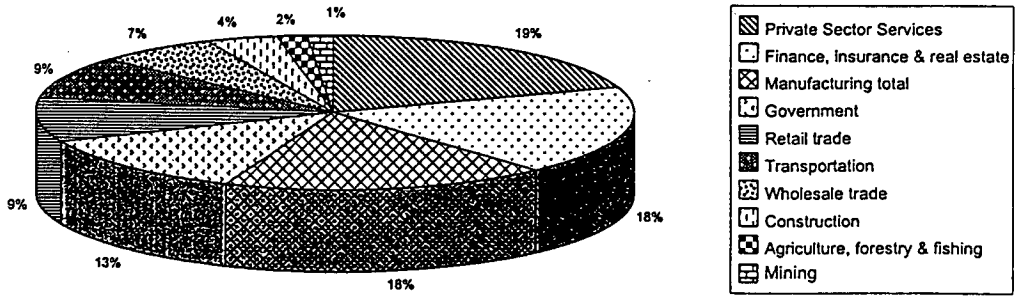
Economic trends and industry changes due to increasing use of technology are blurring the lines between some of the sectors and industry groups. The printing and publishing industry, for example, falls under the manufacturing sector. The industry, however, performs many service related activities (i.e., journalism functions, copy writing, editing, etc.). Furthermore, the increasing use of electronic media for the dissemination of "products" raises questions as to whether these industries are part of the manufacturing (e.g., producers of computer software or entertainment compact disks) or services sectors (distributors of these products over the Internet). These trends and changes on how industries produce their output requires reconsideration of the definition of some industry groups and may result in changes in the share that each sector contributes to the economy.

Some important and fast growing "industries" cannot be aggregated within the government classification of industries and sectors. Tourism, for example, is one of the most consistent growth industries in the world, representing about 12% of the world's GNP. Tourism ranks third among all export industries, and second in terms of employment generation among all industries in the U.S. Travel and tourism is the first, second, or third largest employer in 37 states. However, this industry is not included in the SIC codes generally used to analyze the U.S. economy. Tourism includes several service industries, or segments of these industries. Based on expenditures, travel and tourism is the nation's third largest retail industry (as defined by the Tourism Works for America Council), after automotive dealers and food stores. Some of the services provided by the transportation industry also can be considered part of the tourism industry (e.g., air travel, car rental, tour providers, etc.). There have been some efforts by the World Trade Organization to better define the various segments of the tourism industry. Through such analysis, the relative importance of tourism to a national or state economy can be better understood.

The definition of industries, to better reflect the impact of technology, better categorize sectors and parts of industries that are inter-related (such as tourism), and consider the implications of changes in the production processes, is presently also being discussed by U.S. government agencies.

Figure A.1 presents the contribution of the major economic sectors to the GDP of the U.S. in 1994. As has been widely reported, service activities contribute the largest share of GDP. Furthermore, private sector services and the finance, insurance and real estate sectors are now the largest economic sectors nationally.

Figure A.1
Contribution of Major Industries to U.S. GDP



U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, June 1997.

A. The Role of the Economic Sectors on the Economy

Agriculture, Forestry and Fisheries Sector

This sector is one of the primary or basic economic activities. It involves harvesting crops, animals and trees for human consumption and/or industrial purposes. This economic sector, that accounts for 1.7% of GDP, includes the following groups: Farms; Agricultural Services; Forestry; and Fisheries. In turn, Farms covers categories such as: Field Crops; Fruit and Vegetables; Livestock; and Others. In 1993, Farms output was estimated at $75 billion. Agricultural Services include activities such as grain milling, veterinarian services, etc. Agriculture services, forestry and fisheries has been a particularly rapidly expanding subsector of the economy, growing (in real terms) by 7.6% over the 1977-92 period. In 1993, this group contributed $32 billion to GDP.

The trend of these activities during the period from 1977 to 1992 indicate that this economic sector is of growing importance nationally. A sector or an industry's growth rate relative to the GDP growth rate indicates whether this sector or industry is expanding or contracting. As noted above, while the U.S. GDP over the 1977-92 period is estimated to have grown at 2.5% per year, the agriculture sector is, interestingly enough, an expanding industry. In particular, Agricultural Services, Forestry, and Fisheries has increased at a rate three times that of the overall GDP rate (7.6% vs 2.5%). Further inquiries with BEA officials indicates that the growth is derived mainly from the expansion of Agricultural Services.

Mining Sector

This sector, that is also one of the primary or basic economic sectors, involves the harvesting of ores

for human or industrial use. It accounts for 1.4% of GDP, and includes the following groups: Metal Mining; Anthracite Mining; Bituminous Mining; Crude Petroleum; Natural Gas; Other Petroleum and Gas; Sand and Gravel; Chemical Mining; and All Other Non Metallic Mining. Available data from the BEA shows that from 1977 to 1992, metal mining output has increased on average by 11.0%, the fastest growth rate of the economic subsectors reviewed. The value of shipments reached $32 billion in 1993. Spurred by recent improvement in motor vehicle sales, metal mining activities should maintain the upward trend of the past few years.

Coal production in the U.S. is also influenced by global demand and competition, as the U.S. is a major exporter of coal. Assuming there are no changes in U.S. laws and regulations beyond those already adopted, coal consumption can be expected to expand. Aggregate production of crude oil and natural gas has been on a declining trend (an annual decrease of 0.9% per year), mainly as a result of depleting resources. Value of shipments of crude petroleum and natural gas are estimated at $86 billion in 1994. Economic growth, OPEC behavior and export rates of crude oil from the former Soviet Union are the basic forces behind international energy markets.

Construction Sector

This sector covers activities such as private, residential construction; prefabricated buildings; private, nonresidential construction; publicly owned construction; and international construction and engineering. The construction sector is mostly dependent on growth in other economic sectors that generate demand for additional housing, offices, industries, and facilities. As a result, the location of the construction industry follows closely the location of other economic activity. In 1993, the construction sector accounted for 3.7% of GDP. However, this measure tends to understate the importance of construction in the economy because several types of construction activity that are not included in new construction data have grown rapidly during the past decade, e.g., maintenance and repair; and commercial/industrial renovation.

From 1977 to 1992, construction showed a slight annual growth rate of 0.4%, that is far below the 2.5% GDP growth rate. In 1994, the value of new construction was estimated at $436 billion. In the medium term, new construction is expected to increase modestly from current levels, but with a slower growth than GDP. The construction business has become increasingly international during the past 20 years. In 1992, U.S. contractors won about 49% of all international construction contracts. Many of the world's largest foreign construction firms have entered the U.S. market, but have not made significant inroads: foreign-owned companies accounted only for 4% of all construction awarded in the U.S. in 1992.

Manufacturing Sector

The Manufacturing sector currently contributes 17.6% to the U.S. GDP and has faced increasing competition from foreign countries. Manufacturing activities can be broken down into two categories: Manufacturing of Durable Goods, and Manufacturing of Nondurable Goods. From 1977 to 1992, manufacturing of durable goods has increased on average by 1.3% per year; and manufacturing of nondurable goods, by 1.8%. Both growth rates are below the GDP growth rate of 2.5%.

However, not all manufacturing industries have been growing at a slower pace than the GDP. Within the Durable Goods category, Electronic and Other Electric Equipment has increased at an annual rate of 3.7%; Other Transportation Equipment (including aircraft) has increased at 2.8%; and Professional Instruments and Related Products has grown rapidly at 5.6%. Therefore, although some of the largest durable goods manufacturing industries have declined (e.g., autos and primary metals products) and the manufacturing sector as a whole, including most of the nondurable goods industries, has grown recently at a slower rate than the national economy, some manufacturing industry groups, particularly what can be referred to as the "knowledge and technology based" industry groups, are clearly on a rapidly expanding trend.

Services Sector

This economic sector has been defined broadly to include all activities not classified as goods-producing (i.e., everything except agriculture, forestry and fishing; mining; construction; and manufacturing). Service industries are typically not as affected by economies of scale, so they are generally not as concentrated in a few locations. Services have also been categorized into five major groups:

- Services to **goods-producing industries**, otherwise referred to as distributive and retail services (such as transportation, wholesale trade and retail trade);
- Services to **individuals** (such as food services, tourism, education, and health services), sometimes categorized as consumer services;
- **Business** services (such as accounting, engineering, information, computer, legal and other services);
- **Non-profit** services (including education); and
- **Government** services.

Services usually are located in metropolitan areas, although the location needs of various types of service businesses vary. Most services have a smaller hinterland, or service area, than goods-producing industries, with individual service locations, requiring face-to-face interaction, providing services to small geographic areas in a metropolitan area.

The broadly defined service sector of the economy (including transportation and public utilities; wholesale trade; retail trade; finance, insurance, and real estate; private sector services; and government services), represents more than 75% of GDP. Although there are variations in each of the subsectors or industries, all of the above major economic sectors (broadly defined as "services") have been growing faster than the national economy, with the exception of government services. The faster increase in the service sector, compared to other economic sectors, is one of the most important trends affecting the national and global economy. The following paragraphs will describe each of the major sectors that are broadly included under Services, and their growth trends.

- *Transportation and Public Utilities Subsector.* This economic sector which accounts for 8.8% of GDP, is made up of Transportation (3.3% of GDP); Communications (2.7% of GDP); and Electric, Gas and Sanitary Services (2.8%). Several of the transportation

subsectors (e.g., air transportation, rail transportation, and transportation services, which includes the services of firms that arrange business transportation and travel, contract logistics services, etc.) as well as the communications subsector, have been growing at a much faster rate than the national GDP. Both transportation and communications services have expanded due to lower costs and new service offerings, made possible by deregulation and the introduction of new technology. Communications services will likely remain a fast growth sector of the economy in the future, as business and individual use of wireless communications, data communications and other new services expand rapidly.

- *Wholesale Trade Subsector.* This economic sector is highly fragmented, consisting of a few large companies and many small firms. The numbers of wholesalers was estimated at 280,000 companies in 1993. This sector has three categories of agents: merchant wholesalers; manufacturer's sales branches and offices; and agents, brokers, and commission merchants. Of the three, the merchant wholesalers account for the largest share of sales, employment and number of firms. Wholesale trade accounts for 6.5% of GDP.

  Wholesale trade has been expanding faster than the overall economy, with an average growth of 4.7%. Merchants wholesale trade was estimated at $1.6 trillion in 1994. Continued restructuring, and indirect sales that bypass wholesalers in favor of alternative distribution channels, will continue to siphon off wholesale sales from certain product lines. At the same time, outsourcing of functions by major corporations will provide new business opportunities for this sector.

- *Retail Trade Subsector.* Sales of retail establishments can be divided into two groups: durable goods (consumer products) and non-durable goods (restaurants, drugs, food, etc). Retail trade, which represents 9.3% of GDP, is expanding at a slightly faster rate than the overall economy, with an average growth rate of 2.9% over the 1977-92 period.

  Total retail sales reached $2.2 trillion in 1994. This industry is one of the major sources of jobs in the U.S. economy, consistently accounting for 21% of all non-farm jobs in the private sector. Some of the retail trade industries, such as restaurants, have been growing at a faster rate than the rest of the sector, reflecting the trends of eating out and two-income families.

- *Finance, Insurance and Real Estate Subsector.* This sector accounts for 18.6% of GDP, and includes the following groups: depository and non-depository institutions; holding companies and investment services; insurance carriers; insurance agents, brokers, and services; and real estate services.

  Overall, this sector is also expanding at a slightly higher rate than the national economy. One of the fastest activities in this group, holding companies and investment companies, is growing at a very rapid rate, as the contribution to GDP of this group registered an annual growth rate of 8.0% per year from 1977 to 1992. Commercial banks, savings institutions and credit unions increased assets a modest 1% to $5 trillion in 1994, reversing from a slight decline in 1993.

- *Private Sector Services.* This sector is the largest group within the broadly defined services sector and is also the largest of all the sectors in the U.S. economy, accounting for 19.9% of GDP. It includes the following activities: Hotels; Personal Services; Business Services; Auto Repair; Miscellaneous Repair Services; Motion Pictures; Amusement and Recreation Services; Health Services; Legal Services; Educational Services; Social Services; Domestic (Household) Services; and Other Services.

  From 1977 to 1992, private sector services grew by 3.4% per year. Within this sector, the faster expanding industry groups include the following: business services; motion pictures; amusement and recreation services; and social services. Many of these expanding services reflect the growing need for outside services by other economic sectors, the growth of information and entertainment based services, and the trend towards increased leisure time (long weekends, more vacations) coupled with a larger population with increased disposable income.

- *Government Services.* Government services is broken down into federal and state and local government services and enterprises. Not surprisingly, reflecting the public concerns about government growth and the budget deficit, government services have been contracting, with an average growth of 1.4% versus the 2.5% GDP growth between 1977 and 1992. Reflecting political developments worldwide, and national priorities and policies, the growth rate for all government service subsectors has been lower than the national average. The slowest growth rate has been experienced by the military, followed by federal civilian services, while the highest growth rate has been at the state and local levels.

- *Tourism.* Tourism is one of the most consistent growth industries in the world, representing about 12% of the world's GNP. Tourism ranks third among all export industries, and second in terms of employment generation among all industries in the U.S. Travel and tourism is the first, second, or third largest employer in 37 states. However, as noted above, this industry is not included in the SIC codes generally used to analyze the U.S. economy. Tourism includes several service industries, or segments of these industries. Based on expenditures, travel and tourism is the nation's third largest retail industry (as defined by the Tourism Works for America Council), after automotive dealers and food stores.

  The businesses most associated with travel and tourism are the companies providing intercity transportation services, lodging, food service, entertainment, and travel support businesses located in recreational areas and tourist destinations. The U.S. Trade and Tourism Administration (USTTA) reports that in 1994 more than 45 million visitors came to the U.S. Of those 45 million, 23% (or more than 10 million people) came for business reasons. Both international pleasure and business travelers spent close to $77.6 billion in transportation, lodging, food, entertainment, retail shopping and taxes. These expenditures, in turn, generated 953,000 jobs with an estimated payroll of $17 billion dollars.

  The U.S. Department of Transportation (DOT) defines intercity travel as travel away from home, usually requiring overnight stay and exceeding a distance of 100 miles or more to the

destination. DOT also reports that the number of intercity passenger miles has doubled since 1970, from 2.2 trillion passenger-miles in 1970 to more than 4.2 trillion in 1992. Most of this travel is generated by U.S. residents. The USTTA calculated that in 1993, U.S. resident travelers and tourists spent close to $323 billion in food services, lodging, shopping, etc., out of a total $380 billion (includes $57 billion estimated as generated by international visitors). In addition, these domestic and international visitor expenditures generated $56 billion in federal, state and local tax receipts, of which $48 billion is estimated to have been generated by domestic travelers. For that same year, domestic travel and tourism provided employment for over five million people across the U.S., out of a total estimated industry employment of 6.1 million (including 909,000 generated by international travelers).

B. Rapidly Growing Sectors of the Economy

During the period from 1977 to 1994, the U.S. economy grew at an average 2.59% annually. Table A.1 shows the annual growth by sector during the period. The main economic sectors that grew at a higher than average rate during this period were: Agriculture, Forestry and Fisheries; and several sub-sectors within the broadly defined Services sector, i.e. Transportation and Public Utilities; Wholesale Trade; Retail Trade; Finance, Insurance and Real Estate; and Private Sector Services. Figure A.2 presents an index of the growth of these sectors relative to the GDP.

TABLE A.1 GDP by Sector in Real Terms (Billions of 1992 dollars)

	1977	1980	1990	1994	Annual Growth 1977-94
GDP	$4,279.3	$4,611.9	$6,138.7	$6,604.2	2.59%
Agriculture, forestry, and fisheries	$60.6	$57.7	$101.5	$115.7	3.88%
Mining	$82.4	$82.0	$96.9	$96.7	0.95%
Construction	$213.8	$214.7	$247.5	$253.1	1.00%
Manufacturing	$796.5	$822.8	$1,090.1	$1,168.0	2.28%
Transportation and public utilities	$350.3	$388.9	$494.7	$585.3	3.07%
Wholesale trade	$201.1	$226.0	$360.6	$450.0	4.85%
Retail trade	$364.5	$374.5	$546.4	$595.4	2.93%
Finance, insurance, and real estate	$743.3	$863.5	$1,109.9	$1,192.8	2.82%
Private Sector Services	$712.5	$810.8	$1,181.7	$1,249.6	3.36%
Government Services	$717.4	$748.8	$867.0	$875.8	1.18%

Source: Economic Report of the President, Transmitted to the Congress, February 1997; U.S. Department of Commerce, *Survey of Current Business*

Viewed from a longer historical perspective, the U.S. economy has undergone dramatic changes since the 1950s. From an industrial base, built around mass production of standardized goods, the U.S. economy has been transformed into a post-industrial economy (Stanback et al., 1981; U.S. Department of Commerce, 1987). The post-industrial economy produces a wider variety of specialized goods and is more service-oriented.

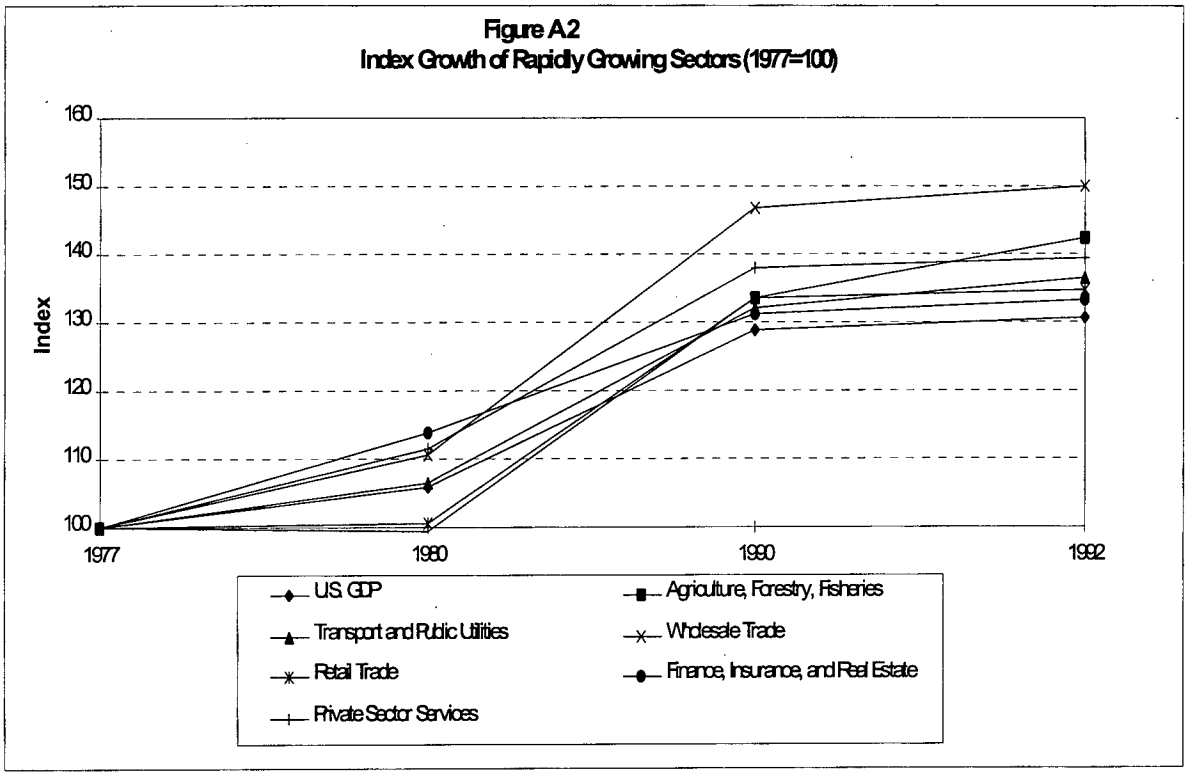


Table A.2 shows how the contribution of each economic sector has changed over the past four decades. Figure A.3 highlights the changes in the contribution of the five major economic sectors to GDP from 1950 to 1993. All of the economic sectors, except the broadly defined "services," have experienced significant declines in terms of their contribution to national GDP, or their share of the national economy. The Agricultural, Forestry and Fisheries sector, which accounted for more than 7% of GDP in 1950, now accounts for less than 2% of GDP. Similarly, mining declined from 3.2% to 1.4% of GDP and construction declined from 4.6% to 3.7% of GDP. The largest economic sector, other than the broadly defined "services" in 1950, was manufacturing, representing 29.3% of GDP. By 1993, manufacturing contributed only 17.6% of GDP, partly as a result of growing foreign competition. Most of the increase in contribution to GDP by the Services sector has then been a result of a decline in the GDP contribution by the manufacturing sector.

While the GDP contribution of the Manufacturing sector has declined, particularly as traditional heavy manufacturing industries have faced increased competitive pressures from abroad, technology-based and knowledge intensive industries have grown rapidly and are forecasted to continue growing faster in the future. In addition, all of the sectors broadly defined as "services" grew significantly, or maintained close to their share of GDP. Table A.3 shows some of the fastest growing industries and their forecasted growth rate for the period from 1992 and 2005. All of these 15 industries forecasted to grow rapidly are in the services and/or high-tech and knowledge intensive manufacturing sectors.

Table A.2 Share of Gross Domestic Product by Sector

	1950	1960	1970	1980	1990	1992	1993
Gross Domestic Product (in Current $ Billion)	$2,870	$5,133	$10,107	$27,080	$55,461	$60,202	$63,433
GDP (in %)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agriculture, Forestry and Fisheries	7.2%	4.1%	2.9%	2.5%	2.0%	1.9%	1.7%
Mining	3.2%	2.5%	1.9%	4.2%	1.9%	1.4%	1.4%
Construction	4.6%	4.7%	5.1%	4.8%	4.3%	3.7%	3.7%
Manufacturing	29.3%	28.2%	25.0%	21.7%	18.5%	17.7%	17.6%
Durable Goods	16.0%	16.1%	14.5%	12.9%	10.2%	9.4%	9.5%
Non-durable Goods	13.3%	12.1%	10.6%	8.8%	8.3%	8.2%	8.1%
Transportation & Pub. Utl.	9.3%	9.2%	8.7%	8.9%	8.7%	8.8%	8.8%
Wholesale Trade	6.9%	6.9%	6.8%	7.1%	6.5%	6.6%	6.5%
Retail Trade	11.0%	9.8%	9.9%	9.0%	9.3%	9.3%	9.3%
Finance, Ins. & Real Est.	11.3%	14.3%	14.5%	15.5%	17.7%	18.4%	18.6%
Priv. Sect. Services	8.4%	10.1%	11.9%	13.9%	18.8%	19.6%	19.9%
Government	8.4%	10.8%	13.3%	12.0%	12.2%	12.6%	12.3%

Source: Survey of Current Business, U.S. Department of Commerce, April 1995

Figure A.3
Share of Gross Domestic Product by Sector

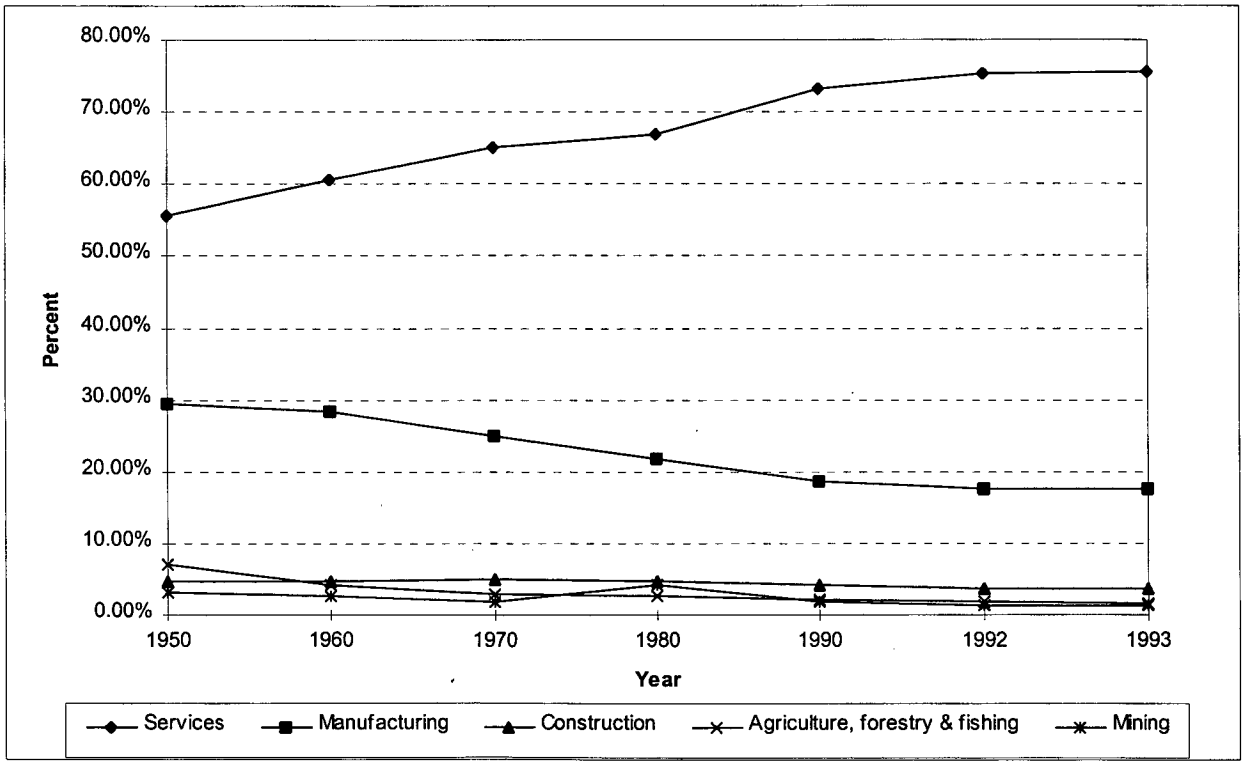


TABLE A.3 Selected Fastest Growing U.S. Industries- Growth Rate 1992-2005

Rank	BLS Categories	Percent Growth
1	Computer Equipment	330.5%
2	Residential Care	175.2%
3	Semiconductors and Related Devices	169.4%
4	Medical Instruments and Supplies	116.8%
5	Child day care services	107.4%
6	Computer and Data Processing Services	97.7%
7	Security and Commodity Brokers	92.6%
8	Individual and Miscellaneous Social Services	91.5%
9	Business Services, not elsewhere classified	88.8%
10	X-Rays and Other Electromedical Apparatus	84.3%
11	Museums and Noncommercial Organizations	71.0%
12	Management and Public Relations	69.9%
13	Broadcasting and Communications Equipment	69.1%
14	Amusement and Recreation Services	68.4%
15	Health Services, not elsewhere classified	67.2%

Source : U.S. Department of Labor, "American Work Force: 1992-2005" , 1994.

The growing importance of the service sector and the high-tech and knowledge-intensive manufacturing industries is not only affecting the structure of the U.S. economy, but similar trends can be observed in other developed economies. These and other economic trends affecting transportation demand will be discussed in the next section.

3.0 Economic Trends Affecting Transportation Demand

As noted in the previous section, the U.S. economy has undergone dramatic changes since the 1950s. From an industrial base, built around mass production of standardized goods, the U.S. economy has been transformed into a post-industrial economy. The post-industrial economy produces a wider variety of specialized goods, particularly in what is referred to as the technology-based and information-intensive industries, and is more service oriented.

Along with the expansion in information, technology and entertainment-based services in the U.S., there has been a rapid growth in the sales of services abroad by U.S. firms. Underpinning the continuing metamorphosis of the U.S. economy from an industrial to a post-industrial economy, are several concurrent developments, including the following five major recent trends:

1. Importance of international trade and globalization of the economy
2. Growth of services industries and the role of service functions within corporations

3. Changes in the manufacturing sector and its competitiveness and growing importance of high-tech and knowledge-intensive manufacturing
4. Changes in industrial location, development and demographics
5. Reduced government role and privatization

Each of these major economic trends affecting transportation demand are discussed in the following paragraphs.

A. International Trade and Globalization of the Economy

The U.S. economy is increasingly becoming integrated into the global economy. It is well known that over the past two decades there has been a dramatic expansion in the volume of world trade.

The U.S. has shared in the unprecedented growth in international trade over the last 20 years, and the impact of foreign trade on the American economy has increased significantly. As shown in Table A.4, the share of trade (imports and exports) as a percentage of GDP (in current dollars, not adjusted for inflation) increased from 11.2% in 1970 to 21.2% in 1980. Table A.5 shows similar information in constant dollars. However, most of the information available about the growth of the various sectors of the U.S. economy does not readily provide information about the extent that the U.S. economy has been integrated into the world economy. The data does not separate, by economic sector, the share of GDP that is involved in foreign trade. The data includes both domestic production of goods and services that are shipped or delivered to foreign locations, and domestic consumption of foreign products and services.

Foreign trade, broadly defined, includes trade of merchandise and goods, as well as services and capital flows across national boundaries. Available statistics (adjusted for inflation) indicate that over the 1980s, U.S. GNP grew 30%, while imports and exports of goods and services increased 72% and capital inflows and outflows grew 60%. Clearly, the U.S. economy is now to a large extent interdependent with, and closely related to, the economies of its main trading partners.

Part of the increase in foreign trade is related to the evolution of industrial firms into large multinational corporations. The emergence of multinational corporations has clearly contributed to the growing integration of the U.S. into the world economies. In such an integrated world economy, international trade will influence the structure of U.S. industry, as well as the future demand for domestic infrastructure services. If the domestic transportation costs to move products from inland production centers are higher than the transportation costs to move them from foreign locations across the ocean to consumer centers along the coasts (as is the case today for many products), U.S. industries may face a competitive disadvantage in those markets. NAFTA, in particular, is likely to significantly affect cross-border movements and domestic transportation patterns.

The importance of foreign trade on the American economy has increased significantly over the last four decades. Part of the large growth in the 1970s was related to the increase in petroleum costs. However, as already noted, the share of international trade in the U.S. economy has grown in importance, particularly since the 1980s, as U.S. trade policy has emphasized free trade and the elimination of regulatory obstacles and trade barriers.

TABLE A.4 Foreign Trade and the U.S. Economy (in Current $ Billion)

	1970	1980	1990	1993	Annual Growth Rate	
					1970-80	1980-93
GDP	$1,010.3	$2,708.0	$5,546.1	$6,379.4	10.4%	6.8%
Exports	**$56.9**	**$279.2**	**$557.1**	**$661.7**	**17.2%**	**6.9%**
Goods	$44.5	$226.0	$398.7	$461.5	17.6%	5.6%
Services 1/	$12.4	$53.2	$158.4	$200.2	15.7%	10.7%
Imports	**$55.8**	**$293.9**	**$628.5**	**$724.9**	**18.1%**	**7.2%**
Goods	$40.9	$248.6	$509.0	$592.1	19.8%	6.9%
Services 1/	$14.9	$45.3	$119.5	$132.8	11.8%	8.6%
Trade Balance	**$1.1**	**($14.7)**	**($71.4)**	**($63.2)**	**n/a**	**n/a**
Goods	$3.6	($22.6)	($110.3)	($130.6)	n/a	n/a
Services 1/	($2.5)	$7.9	$38.9	$67.4	n/a	3.8%
Exports (as % of GDP)	**5.6%**	**10.9%**	**10.%**	**10.4%**	**6.2%**	**-0.3%**
Goods	4.4%	8.3%	7.2%	7.2%	6.6%	-1.5%
Services 1/	1.2%	2.0%	2.9%	3.1%	4.8%	3.8%
Imports (as % of GDP)	**5.5%**	**10.9%**	**11.3%**	**11.4%**	**7.0%**	**0.4%**
Goods	4.0%	9.2%	9.2%	9.3%	8.5%	0.0%
Services 1/	1.5%	1.7%	2.2%	2.1%	1.3%	2.6%
Exports & Imports	**11.2%**	**21.2%**	**21.4%**	**21.7%**	**6.6%**	**0.1%**

1/ Include Travel; Passenger Fare; Other Trans.; Royalties & Licenses; Others
Sources: Table II.14-A U.S. Foreign Trade Highlights 1993 (Table 5) for 1970-93;
Table II.14-B Economic Report of the President, February 1995.

Not only has merchandise trade grown faster than GDP, exports of services have grown even faster, especially since 1980. While in 1950 services exports represented one-sixth of total exports, by the end of 1993, services exports accounted for a bit less than one-third of total exports. It is also interesting to note that while imports of merchandise have grown faster than exports, the reverse is true for services. As other countries develop, the integration of the U.S. into the global economy has also resulted in a faster increase in exports from areas other than the U.S. As evidenced in Table A.6, in 1960, U.S. exports accounted for 17% of total world exports. By 1993, this share had decreased to 12%. On the other hand, as other countries' exports have gained access and become competitive in the U.S. market, U.S. imports have increased from 12% of world imports in 1960 to nearly 16% in 1993.

TABLE A.5 Foreign Trade and the U.S. Economy (in Constant 1987 $ Billion)

	1970	1980	1990	1993	Annual Growth Rate	
					1970-80	1980-93
GDP	**$2,876**	**$3,776**	**$4,897**	**$5,138**	**2.8%**	**2.4%**
Exports	**$161**	**$321**	**$511**	**$598**	**7.1%**	**4.9%**
Goods	$125	$248	$369	$441	7.1%	4.5%
Services 1/	$36	$72	$142	$158	7.2%	6.2%
Imports	**$196**	**$290**	**$565**	**$675**	**4.0%**	**6.7%**
Goods	$142	$236	$461	$571	5.2%	7.1%
Services 1/	$54	$54	$104	$103	0.0%	5.1%
Trade Balance	**($35)**	**$31**	**($55)**	**($76)**	**n/a**	**n/a**
Goods	($17)	$13	($93)	($131)	n/a	n/a
Services 1/	($18)	$18	$38	$55	n/a	8.8%
Exports (as % of GDP)	**5.6%**	**8.5%**	**10.4%**	**11.6%**	**4.2%**	**2.5%**
Goods	4.4%	6.6%	7.5%	8.6%	7.7%	-2.2%
Services 1/	1.3%	1.9%	2.9%	3.1%	7.8%	-0.6%
Imports (as % of GDP)	**6.8%**	**7.7%**	**11.5%**	**13.1%**	**1.2%**	**4.2%**
Goods	4.9%	6.2%	9.4%	11.1%	2.4%	4.5%
Services 1/	1.9.%	1.4%	2.1%	2.0%	-2.7%	2.6%
Exports & Imports	**12.4%**	**16.2%**	**22.0%**	**24.8%**	**2.7%**	**3.3%**

1/ Include Travel; Passenger Fare; Other Trans.; Royalties & Licenses; Others
Sources: Table II.14-A U.S. Foreign Trade Highlights 1993 (Table 5) for 1970-93;
Table II.14-B Economic Report of the President, February 1995.

Table A.6 U.S. Share of World Merchandise Trade

	1960	1970	1980	1990	1993
World Export	$120	$290	$1,911	$3,425	$3,774
U.S. Exports	$20	$43	$226	$394	$465
U.S. Share of World Exports	16.7	14.8%	11.8%	11.5%	12.3%
World Import	$131	$306	$1,958	$3,432	$3,733
U.S. Imports	$15	$42	$257	$517	$603
U.S. Share of World Imports	11.5%	13.7%	13.1%	15.1%	16.2%

Source: International Financial Statistics, International Monetary Fund, 1991 and April 1995

Emergence of Multinational Economic Blocks

World trade trends are also setting the stage for further integration of the economies of individual countries into several economic blocks. In North America, Canada and the United States signed a Free Trade Agreement in January 1989 covering trade between the world's largest trading partners. The U.S., Canada and Mexico signed NAFTA in December 1992, which was approved in 1993, and became effective January 1994.

Many countries in Central and South America are emulating the example set by their northern neighbors. Countries in the Central American Common Market, the Caribbean Common Market, along with the Andean Pact countries (Peru, Bolivia, Ecuador, Colombia, and Venezuela), and the Mercosur countries (Argentina, Uruguay, Paraguay, and Brazil) have all been discussing or beginning to lift barriers and strengthen economic ties among themselves. The Common Market of the Southern Cone (MERCOSUR), for example, is the outcome of the Treaty of Asuncion, signed on March 26, 1991 by the Presidents of Argentina, Brazil, Paraguay, and Uruguay. The instruments in MERCOSUR include a trade liberalization program, gradual coordination of macroeconomic policies, a common external tariff, and adoption of sectoral agreements. Chile has also been admitted as an Associate Member of Mercosur. A Free Trade Area of the Americas covering the entire American continent is also under discussion, with specific goals set by the leaders of all the countries to achieve steps towards integration by 2005.

In Europe, a single economic market was established in accordance with previously finalized agreements in January 1993. The Maastricht Treaty on European Union took effect in November 1993. The Treaty prepared the way for economic and monetary union (EMU) and a single currency by giving extra power to the European Parliament. Although there are still many obstacles to be overcome, the major economies in the European continent are beginning to function to a large extent as a single market.

Finally, in November 1989, foreign ministers and economic ministers from 12 Asia-Pacific countries attended the inaugural Ministerial Meeting of the Asia-Pacific Economic Cooperation (APEC). Since then, the APEC group of countries have met annually to discuss issues of mutual importance. In November 1994, APEC adopted the Bogor Declaration, a statement of common resolve by APEC economic leaders aimed at achieving free and open trade and investments by 2020 (2010 for industrialized economies).

The pattern of U.S. foreign trade is then likely to change as efforts to create multinational trade blocks evolve. Table A.7 presents the trade flows between the U.S. and these economic blocks. For the U.S., over the past decade, the largest growth in U.S. foreign trade has been with the Far East, which became the U.S. largest foreign trade area during the 1980s. Coupled with the significant trade volume with Europe, the double stack rail system in the U.S. has grown mostly along east-west corridors. In the future, with free trade hopefully extending "from Alaska to Tierra del Fuego," there are possibilities of new transportation corridors emerging with a north-south orientation.

TABLE A.7 Trade Flow Between U.S. and Major Economic Blocks ($ millions)

	Exports				Imports			
	1990	1991	1992	1993	1990	1991	1992	1993
TOTAL	$393,592	$421,730	$448,164	$465,091	$495,310	$488,453	$532,665	$580,659
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
European Union	24.9%	24.5%	23.0%	20.9%	18.5%	17.6%	17.6%	16.9%
NAFTA	28.4%	28.1%	29.3%	30.5%	24.5%	25.0%	25.1%	26.0%
Canada	21.3%	20.2%	20.2%	21.6%	18.4%	18.6%	18.5%	19.2%
Mexico	7.2%	7.9%	9.1%	8.9%	6.1%	6.4%	6.6%	6.9%
Caribbean	1.6%	1.5%	1.4%	1.5%	1.0%	1.1%	1.1%	1.0%
Central America	1.0%	1.0%	1.2%	1.3%	0.6%	0.7%	0.7%	0.8%
South America	3.8%	4.6%	5.1%	5.0%	5.3%	4.7%	4.5%	4.1%
Argentina	0.3%	0.5%	0.7%	0.8%	0.3%	0.3%	0.2%	0.2%
Bolivia	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Brazil	1.3%	1.5%	1.3%	1.3%	1.6%	1.4%	1.4%	1.3%
Chile	0.4%	0.4%	0.6%	0.6%	0.3%	0.3%	0.3%	0.3%
Paraguay	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Peru	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%	0.1%
Uruguay	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Others (in South America)	1.5%	1.8%	2.2%	1.9%	2.8%	2.5%	2.3%	2.2%
Asian APEC 1/	26.7%	26.6%	26.4%	27.0%	36.9%	38.6%	39.5%	40.1%
China	1.2%	1.5%	1.7%	1.9%	3.1%	3.9%	4.8%	5.4%
Japan	12.3%	11.4%	10.7%	10.3%	18.1%	18.7%	18.3%	18.5%
East Asia NICs 2/	10.3%	10.8%	10.8%	11.3%	12.2%	12.1%	11.7%	11.1%
Brunei	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Indonesia	0.5%	0.4%	0.6%	0.6%	0.7%	0.7%	0.9%	0.9%
Malaysia	0.9%	0.9%	1.0%	1.3%	1.1%	1.2%	1.6%	1.8%
Philippines	0.6%	0.5%	0.6%	0.8%	0.7%	0.7%	0.8%	0.8%
Thailand	0.8%	0.9%	0.9%	0.8%	1.1%	1.3%	1.4%	1.5%
All Others	13.6%	13.9%	13.6%	13.8%	13.2%	12.3%	11.5%	11.1%

1/ Includes China, Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, and Thailand, 2/ Includes Hong Kong, Singapore, South Korea, Taiwan
Source: U.S. Foreign Trade Highlights 1993

B. Growth of Services

As noted in the previous section, the broad definition of the services sector includes all activities not classified as goods-producing. As a whole, the services sector has been shown to be the fastest growing in recent decades. However, not all services have exhibited rapid growth since 1950. The three major economic sectors experiencing significant growth during the last 40 years have been Finance, Insurance and Real Estate; Private Sector Services; and Government. The fastest, most consistently growing sectors of the economy have been Finance, Insurance and Real Estate, which increased from 11.3% to 18.6% of GDP, and Private Sector Services, which has expanded from 8.4% to 19.9% of GDP. Although over the 40-year period, government services shows an increase, this growth took place before the 1970s. Since then, government services have actually declined, as a percentage of GDP.

Table A.8 details the breakdown of GDP contribution of each service subsector. The shares shown in this table are computed from the GDP series—expressed in constant 1987 dollars—prepared by the Bureau of Economic Analysis.

As shown in Table A.8, over the 1977-92 period, a few industries in the services sector have been growing faster, relative to others sectors and the national economy. The fastest growing industries in the services sectors are:

- Communications;
- Wholesale Trade;
- Motion Pictures and Amusement Services; and
- Business Services.

Tourism, entertainment, technology, and information-based services have exhibited the fastest growth in the service sector. As might be expected, the Government's share of GDP has decreased from more than 19% to less than 16% during the period since 1977, including declines in the federal civilian, military, and state/local government shares of GDP.

As is well known, most of the nation's jobs created in recent years have been in the service sector. While the absolute number of manufacturing employees decreased, all the major service sectors grew in employment from 1970 to 1993. Table A.9 shows that the share of employment in the service sector has risen from 73% in 1970 to 80% by 1993. However, the faster growth in employment has been chiefly accounted for by some sub-sectors. Of particular interest is the employment share of the Private Sector Services sub-sector, that has gone from 18.4% to 29% during this time period. This increase reflects the rapid rise in employment in some of these industries, such as Business Services, Motion Pictures and Amusement Services, Health Services, and Legal Services, each nearly tripling their share of economic activity between 1970 and 1993. The location and transportation requirements of these growing business sectors will be discussed in the next section.

Table A.8 Breakdown of The Services Sector Contribution to GDP

	1977	1980	1990	1992
Services Sector (in constant 1987 $ billion)	$2,399	$2,643	$3,562	$3,676
(in %)	100.0%	100.0%	100.0%	100.0%
Broken-down into:				
Transportation and public utilities	13.1%	12.7%	13.0%	13.5%
Transportation	4.9%	4.5%	4.7%	5.0%
Railroad transportation	0.7%	0.7%	0.7%	0.7%
Local and interurban passenger transit	0.4%	0.3%	0.2%	0.2%
Trucking and warehousing	2.2%	1.9%	1.9%	2.1%
Water transportation	0.4%	0.4%	0.2%	0.2%
Transportation by air	0.7%	0.7%	1.1%	1.2%
Pipelines, except natural gas	0.3%	0.2%	0.1%	0.1%
Transportation services	0.3%	0.3%	0.4%	0.4%
Communications	3.1%	3.6%	4.0%	4.2%
Electric, gas, and sanitary services	5.2%	4.6%	4.3%	4.3%
Wholesale trade	7.1%	7.2%	9.0%	9.3%
Retail trade	13.3%	12.1%	13.4%	13.2%
Finance, insurance, and real estate (FIRE)	24.9%	26.2%	24.4%	24.3%
Depository institutions	3.9%	4.1%	3.8%	3.4%
Non depository institutions	0.7%	0.8%	0.5%	0.5%
Holding companies and investment services	0.9%	1.0%	1.6%	1.9%
Insurance carriers	2.2%	2.3%	1.7%	2.0%
Insurance agents, brokers, and services	0.9%	0.9%	0.9%	0.9%
Real estate	16.2%	17.1%	15.9%	15.6%
Private Service Sector	22.5%	23.0%	24.4%	24.2%
Hotels and other lodging places	1.4%	1.2%	1.3%	1.3%
Personal services	1.2%	1.0%	0.9%	0.8%
Business services	3.3%	3.9%	4.8%	4.7%
Auto repair, services, and parking	1.2%	1.2%	1.1%	1.0%
Miscellaneous repair services	0.5%	0.5%	0.4%	0.4%
Motion pictures	0.3%	0.3%	0.4%	0.4%
Amusement and recreation services	0.7%	0.7%	1.0%	1.1%
Health services	7.3%	7.4%	6.8%	6.9%
Legal services	1.9%	1.9%	1.9%	1.8%
Educational services	1.0%	1.0%	0.9%	1.0%
Social services & membership organizations	1.4%	1.4%	1.5%	1.6%
Other services	1.8%	2.0%	3.2%	3.1%
Private households	0.4%	0.3%	0.3%	0.2%

Source: Bureau of Economic Analysis

Part of the reason for the fast growth in business services employment has been the increasing importance of functions other than direct production, such as finance, marketing, advertising, product research and development, personnel management, and employment related to regulatory

Table A.9 Share of Service Sector in Total Employment

Items	1970	1980	1990	1993
All Sectors (thousands)	87,194	109,928	135,813	137,553
Services Sector	70.9%	74.0%	78.3%	79.6%
Broken Down into:				
Transportation & Public Utilities	5.6%	5.1%	4.9%	4.8%
Wholesale Trade	4.8%	5.2%	4.9%	4.8%
Retail Trade	15.7%	16.2%	16.9%	17.1%
Finance, Insurance & Real Estate	7.0%	7.9%	7.9%	7.5%
Credit Institutions	1.7%	2.0%	2.0%	1.9%
Insurance and Real Estate	5.3%	6.0%	5.9%	5.7%
Private Sector Services	19.2%	22.3%	28.1%	29.7%
Hotels and Other Lodging Places	1.1%	1.1%	1.4%	1.3%
Personal Services	1.9%	1.6%	1.8%	1.8%
Business Services	2.3%	3.8%	5.5%	5.7%
Auto Repair, Services, and Parking	0.7%	0.8%	1.1%	1.0%
Miscellaneous Repair Services	0.5%	0.5%	0.5%	0.5%
Motion Pictures	0.2%	0.2%	0.4%	0.4%
Amusement and Recreation Services	0.8%	1.0%	1.4%	1.5%
Health Services	3.8%	5.4%	6.6%	7.0%
Legal Services	0.5%	0.7%	1.0%	1.0%
Educational Services	1.5%	1.3%	1.5%	1.5%
Social Services & Membership Organizations	2.0%	2.5%	2.8%	3.0%
Other Services	1.2%	1.9%	3.3%	4.1%
Private Households	2.6%	1.5%	1.0%	1.0%
Government Services	18.7%	17.1%	15.6%	15.6%

Source: Bureau of Economic Analysis

requirements. However, corporate downsizing in recent years has particularly reduced employment in some of these service functions not directly related to production. There are several other reasons for the fast growth in business services, such as:

- Rise of computers, expanded communications and related technologies, enabling efficient organization of more complex multi-location and multinational production and distribution, and creating demand for additional, specialized services, such as consulting, engineering, logistics, etc.;

- Increasing size of markets, including the removal of trade barriers and the trend toward multinational, free trade, economic blocks; and

- The rise in international services and the services associated with large multinational corporations.

C. Changes in the Manufacturing Sector and Its Competitiveness and Growing Importance of High-tech and Knowledge-Intensive Manufacturing

Recent changes in the manufacturing sector of the economy have been the result of several, related trends, led by increased foreign competition, that affected the competitiveness of U.S. produced goods. Due in part to this foreign competition, basic manufacturing industries have declined in importance. To regain their competitiveness, during the past decade American companies have been modernizing their manufacturing, distribution, and financial systems, and have been downsizing and restructuring their operations. In addition, new, smaller manufacturing industries have also emerged, producing a wider variety of specialized and high-tech goods.

Today, the manufacturing sector of the U.S. economy is much more efficient than in the recent past. It produces fewer, heavy, bulky products and more, lighter, higher value goods, using processes that are quickly adaptable to changing demand. Increasingly, final assembly of U.S. 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. Consequently, a larger number of American manufacturers today require more frequent shipment of low volume, higher value goods, involving not only domestic, but also international origins and destinations.

Other trends that have affected U.S. manufacturing production include the emergence of multinational companies; the rise of new "high-technology," less concentrated industries with different labor, location and distribution needs, composed of smaller firms; and the need for companies to modernize and restructure their operations to be able to maintain U.S.-based production while increasing their competitiveness.

Increasing Importance of Technology-Based and Knowledge Intensive Industries

Of the rapidly growing industries, the Technology-based and Knowledge Intensive Industries are particularly important. The composition of the U.S. manufacturing sector has changed. Basic industries have declined, as new industries have emerged. These new industries are characterized by the knowledge-intensity and technological innovation of their products. In many instances, the physical inputs and outputs of these new industries are small, light, but highly valuable. Table A.10 underlines the increasing importance of U.S. industries in the manufacturing sector, considered as high technology or information-intensive in their production process. Table A.10 has included the following industries as those involving a high degree of technology and/or knowledge and innovation:

- Industrial Machinery and Computer Equipment;

- Electronic and Electrical Equipment;
- Scientific/Laboratory Instruments;
- Other Transportation Equipment (aircraft); and
- Chemicals and Allied Products.

TABLE A.10 Growth of Some High Tech/Information Intensive Manufacturing Industries

	1977	1980	1990	1992
Manufacturing	$741,552	$725,428	$928,483	$924,616
(in constant 1987 U.S. $ billion)	100.0%	100.0%	100.0%	100.0%
of which:				
Industrial machinery and equipment	11.0%	11.2%	11.0%	11.6%
Electronic and other electric equipment	7.3%	9.6%	9.8%	10.1%
Other transportation equipment	4.8%	5.3%	6.9%	5.8%
Instruments and related products	3.0%	3.3%	5.4%	5.4%
Chemicals and allied products	8.8%	7.9%	9.4%	9.5%
Total	34.8%	37.4%	42.6%	42.4%

Source: Bureau of Economic Analysis

These "high-technology" industries, e.g., drugs, medical equipment and supplies, electronic products, office and computer equipment, have been growing and are anticipated to continue growing at a faster rate than other manufacturing industries. From 1977 to 1992, the share of technology-based and information-intensive manufacturing industries has increased from 35% to 42% of total manufacturing. This development is particularly interesting, considering that the contribution to GDP of the manufacturing sector has been decreasing during this period.

One characteristic of the newer manufacturing industries is that they are typically composed of a large number of smaller firms, with less concentration in the larger firms than is the case in the older industries. As new, smaller firms, they also typically depend on other firms for supplies and basic services and are not as integrated in their manufacturing and distribution processes. They also typically require higher-skilled labor.

Emergence of Multinationals

The emergence of multi-national corporations contributed to the growing integration of the U.S. into the world economies. In many industries, the trend has been towards one global market. There are fewer and fewer products today that can be easily categorized as being only foreign or domestic.

The best example is the automobile industry, where it is no longer possible to neatly categorize American versus import cars. While some Ford models for sale in the U.S. are made in Korea, the Toyota Camry and the Honda Accord are assembled in the U.S. The Toyota Corolla and the GEO Prizm are actually manufactured in the same assembly plant in California. BMW also has developed a plant in the U.S. A large percentage of the parts used in vehicles, assembled by foreign and domestic manufacturers in the U.S., originate in foreign countries. Many of the foreign manufacturers have also begun to export the U.S. assembled cars to other countries. There are few industries today in the U.S. that do not face the challenge or are considering the opportunities of international markets.

Rise of New "Knowledge-Based" Industries

As already noted, new high-tech industries have emerged. These include industries manufacturing semi-conductors, biotechnology products and computers. These new industries are characterized by the knowledge-intensity and technological innovation of their products. Today, for example, the U.S. leads the world in the development and manufacturing of high-tech computer related equipment and parts. Competition from around the world (i.e., Japan, Korea, Taiwan), however, continues to place competitive pressure on American companies.

Lower Volume - Higher Value Products

Another trend in the U.S. and world economies is the shift from heavier, lower value, manufacturing products towards higher value, less bulky, lighter products typically associated with the new high technology based industries. One of the differences in the outputs or products of high-technology industries, compared to traditional basic industries, is their production of low volume, high value goods, and increasing demand for fast transportation of small quantities. As evidenced in a 1987 U.S. Department of Commerce report, the physical inputs of these goods tend to be also small, but highly valuable. Even the older, traditional manufacturing of durable goods now produces smaller and less bulky products through greater use of plastic and other less bulky and lighter materials.

The U.S. Department of Commerce Study (1987) concluded that businesses in the future will require less transportation of industrial, raw materials per unit of output. Instead, expanding industries will produce lighter, less bulky goods, with an increasing value-per-ton, and the physical inputs of these products will also tend to be smaller, but highly valuable. These developments may have important implications for the relative use of competing transportation modes in the future. For example, demand for air freight and truck services will increase relative to water and rail services.

Increasing Productivity and Competitiveness

Recently, as reported by Enderwick (1989), changes in the industrial structure in the U.S. have been mainly a result of the need to maintain or regain competitiveness. While economies of scale (based on mass production) and product diversification have been conventional, sources of competitive

advantage, changes in both marketing and production processes, have raised doubts about the continuing significance of high volume production.

The restructuring strategies of U.S. companies in recent years—aimed at maintaining and/or regaining competitiveness—include the following: intensification, rationalization, investment in new technologies, deintegration, and internationalization.

First, downsizing of the labor force and intensification of the labor process seeks an increase in productivity without new investment or reorganization of the work process. Second, the strategy of rationalization, involving the elimination of capacity, dictates that companies withdraw from areas of declining advantage, and/or simplify their organization by the elimination of peripheral or unprofitable activities. Multinationals are also rationalizing their overseas operations. Leading companies like United Technologies, Carnation, and Gulf Oil have divested overseas assets in recent years.

A third approach to increasing productivity and competitiveness of manufacturing industries has been pursued by many major U.S. corporations by investing in new technology. Enderwick (1989) reports that in the late 1980s the number of U.S. factories that used extensively computer-integrated manufacturing technologies is well in excess of that in Europe and Japan. The U.S. has also invested in second-generation robot technology (capable of far more tasks than their predecessors) and flexible manufacturing systems.

Another approach to restructure operations to increase productivity is deintegration, which occurs as firms reduce the degree of organizational integration. This is implemented through outsourcing of work; organizational changes to increase autonomy within business units; and servicing of overseas markets through non-equity participation (multinational collaboration is playing an increasing important role in the global strategies of many U.S. multinationals). Deintegration has resulted in Johnson & Johnson now comprising hundreds of autonomous companies. Similar developments are occurring within Hewlett Packard, GE, and Eastman-Kodak.

A fifth approach to restructuring of operations involves internationalization. A deterioration in the location of a source nation may force its enterprises to locate overseas to take advantage of more prosperous markets or lower costs production factors. To increase competitiveness, production facilities requiring low skilled and inexpensive labor have shifted from industrialized countries to lower cost developing countries.

Changes in Nature of Manufacturing Processes

While the overall manufacturing sector has been declining, the following changes in the nature of the manufacturing processes can be discerned: the trend toward smaller and technology-based production processes; the trend toward specialized and differentiated products; and reduction in product cycle time.

- *Smaller, Technology-Based Production Processes.* One of the characteristics, and an important cost element of mass production, is the need for large volume production runs of the same product, requiring a large inventory of raw materials and intermediate parts, as well as resulting in a large inventory of finished products until customer delivery. Frequently, there is also great uncertainty as to future demand levels, that result in larger or smaller-than-required inventory levels at certain times in the economic cycle. As the value of products have increased, particularly for the new high-technology industries, many manufacturing units have adopted new techniques that permit rapid adaptation to changes in demand. In the previously cited study carried out in 1987, the U.S. Department of Commerce observed that "the computer integrated flexible manufacturing system will break the hold that the search for economies of scale has had on manufacturing up to now. Big scale, single purpose, long production run plants will be a thing of the past."

- *Just-in-time (JIT) Inventory Systems.* One of the most important trends in manufacturing over the past two decades has been the emphasis of many businesses in "Just-in-Time" delivery and the shift of their operations to run on the basis of JIT inventory control systems. The JIT system was developed in response to the high interest rates of the 1970s and the high inventory carrying costs it generated. However, it continues to be increasingly used as a means of reducing inventory requirements and costs. The use of JIT is especially important to the electronics and automobile industries.

  More and more manufacturers are carefully scheduling deliveries so that parts arrive when needed, not a day before or a day after. Through careful management of the transportation pipeline to the assembly plant, the inventory costs in storage and transit are kept to a minimum, thereby reducing warehouse and carrying costs. JIT requires more frequent, smaller shipments, emphasizing reliability.

  The emphasis on reduced inventory levels, JIT delivery, quality, and quick response, means a significant change in the nature of transportation demand. First, it requires more frequent, smaller shipments. Second, it means that the transportation infrastructure must be able to function with sufficient reliability, so that businesses can count on their deliveries being on-time, without being affected by congestion at airports, highways, intermodal terminals, or ports. Yet, as noted by Michael Cusumano in "The Limits of 'Lean'," published in the Summer 1994 issue of Sloan Management Review, some Japanese companies are recognizing that trying to run a production line based on a few hours of inventory and counting on delivery of parts several times a day increases traffic, and does not work well in congested urban areas. Some companies are now working with a full day inventory, compared with the old practice of a month or so, but not the extreme of a couple of hours requiring JIT delivery.

- *Specialized and Differentiated Products.* In the past, the direction of change in production processes has been toward mass production to capture economies of scale. Today, to

respond to changing preferences and tastes of various markets segments, many firms have adopted production processes that allow for specialized, differentiated products (Piore & Sable, 1984; Hickling, 1992). Many manufacturing units have adopted new techniques that permit quick responses to market needs, and the production of various goods with the same production line. The new production processes often involve multi-use machines, complex task programming, higher skills, and the ability to receive inputs just-in-time.

- *Reduction in Product Cycle Time.* Another trend is the importance that companies are placing in reducing "cycle time," i.e., the time that it takes for a company to respond to changes in the marketplace. For example in the garment industry, seasons and changing fashions demand quick turnaround if a company is to remain competitive.

  Reduction in the cycle time for manufacturing and distribution are increasingly important as they provide a competitive advantage. Today, competition based on reducing the time necessary for producing or distributing goods is as real as price or style competition. Products that take too long to develop or that do not move quickly through the distribution system can quickly become obsolete, due to cost or style. A faster inventory turn-over also represents a more optimal allocation of the firm's resources.

  For several industries, including auto parts, electrical components and apparel, the need for a reduction in time for products to move from concept to manufacturing to the selling floor requires more frequent, and smaller size shipments, even if transport costs are higher. As reported by Green (1995), reducing the product-cycle time has been an objective of the Lee Apparel Company that developed a "market response system" to reduce the costs and time needed to turn out apparel. The system combines business philosophy and inventory control to support suppliers and retailers in order to whittle down the production cycle, sometimes to as low as 30 days from the traditional 18 months. The technology improvements include bar-code tags, point-of-sale computers and telecommunications. Stock replenishment can now be done in as little as seven days compared with the typical time of three months.

- *Lean or Just-in-Time Manufacturing.* Roby (1995) reported the emergence of "lean manufacturing," developed in the early 1990s by Hughes Space & Communications (HSC), a division of Hughes Aircraft Company. Following a comprehensive study on cycle time undertaken by HSC, it was found that the existence of generous work-in-process inventories, supplied in abundance, to increase work options and guard against employee idle time was one of the factors that limited overall productivity. This is because non-value added activity (such as transportation and other related functions involved in delivery of intermediate products, such as moving, packing, unpacking, counting, and tracking) was found to be associated with high levels of work-in-process.

  As a consequence, HSC developed a model based on a "lean manufacturing strategy for low-volume production" (Roby, 1995). The essence of "lean manufacturing" is low work-in-

process supported by multi-disciplinary teams working in a nurturing environment. Low work-in-process is expected to result in quality improvement, since work-around options are limited, and low work-in-process forces shorter cycle times, because fewer items are worked in parallel. Short cycle time, in turn, makes learning effective and continuous quality improvement possible.

The lean manufacturing model is based on many of the underlying principles of JIT production. A critical distinction, however, is in the focus on low work-in-process rather than JIT delivery as a strategic factor, so the intent is not only to have parts or intermediate products delivered just in time for final production, but producing those intermediate products just in time.

As a result of implementing these changes, a manufacturing group in HSC's government electronics business unit realized the following improvements:

- Manufacturing costs reduced in half;
- Cycle time reduced ten-fold;
- Asset productivity increased 250%; and
- In-process quality improved 50%.

- *Decentralization of Manufacturing.* Although in some sub-sectors the trend is towards "lean manufacturing" and reduction of intermediate steps that produce "work-in-process" inventories, industries are continually searching for opportunities to restructure their manufacturing operations, reduce plant locations, consolidate production of certain parts at fewer locations, and assemble products at fewer plants or at locations closer to major consumer markets, etc. These restructuring efforts by the manufacturing sector typically result in decentralization of production processes, sometimes to foreign locations with lower costs. Decentralization of manufacturing processes leads to an increase in the total number of freight movements required for production. Many products are partially assembled at different locations, sometimes different countries, and then moved to final assembly locations. Domestically, as trucking accounts for a large share of intercity and intra-metropolitan transport, this trend puts added pressure on the roadway system.

D. Industrial Location, Development and Demographic Trends

The trends that have affected the structure and growth of the U.S. economy have also affected the location of economic activity. Some of the resource-based sectors of the economy, such as agriculture and mining, are restricted to those regions of the country where productive land and mines are located. Historically, basic manufacturing industries selected locations close to raw materials. As has already been mentioned, most of the recent growth has taken place in the high-tech, information and knowledge-based manufacturing sector, and in the service sector. In both of these cases, businesses have more flexibility and can choose to locate anywhere in the country. For states and metropolitan areas competing to attract additional jobs, it means that there is increased competition to keep existing businesses and attract new ones. Consequently such factors as climate, amenities, and ease of travel, become important to their competitiveness.

In addition, in the past, geographical areas in the U.S. used to be differentiated by a dominant sector: New York dominated the garment industry, Detroit, the automobile industry, Pittsburgh, steel production, Akron, tire manufacturing, and Toledo, glass production. This came from considerations for "economies of agglomeration" that resulted in savings of unit costs accruing to individual firms when a large number of them concentrated in one area. Source of savings came from the presence of highly specialized suppliers, whose operations can only be supported by sufficient local demand (created by agglomeration), and from the availability of a large pool of specialized labor, similarly dependent on the high level of local demand.

The recent trends affecting location of economic activity involve several related but different factors that can be summarized as follows:

- Continuing relative growth of Sunbelt areas that attracted significant shares of the growth associated with the new "knowledge-based" industries;
- Continuing growth in large metropolitan regions, because of their large cultural amenities, consumer services and markets, and availability of banking, international trade, and other specialized services, that attract national and regional headquarters;
- Faster growth in suburban-exurban areas, with many service activities, not requiring face-to-face interaction, moving away from the core urban centers;
- Greater dispersion of economic activity and greater flexibility or "foot-looseness" in terms of the factors that influence industry location, resulting from multi-location manufacturing, dispersion of certain functions and/or services to different locations, and agglomeration of certain activities in a few locations to make use of specialized skills required in the labor force, specialized suppliers, and other services, or large consumer markets.

The reasons for these changes in the location of economic activity vary, but in general they have resulted in the dispersion of economic activity across regions, and away from populated central urban areas to the suburbs that has continued over the last two decades. In general, most fast-growing knowledge-based and service industries are more "foot-loose," able to locate almost anywhere.

In many cases, location of new high technology industries has involved an interesting pattern of agglomeration as well as separation of functions at different locations as they evolve from a few small firms to larger companies. For example, startup companies' research and development functions are usually concentrated close to leading universities and major research institutions. Early on, production facilities are concentrated in a few nearby areas, such as Silicon Valley, Route 128 in Boston, or Research Triangle in North Carolina. These agglomerations also generate similar concentrations of related supplier and service-providers to these new industries. However, many of the production facilities eventually move to low cost locations in the U.S. or abroad. And with improved communications and easier, faster, low cost, long distance travel, corporate headquarters may move to locations with more amenities and better climate.

Regional Growth and Employment

The available data on regional economic growth clearly demonstrate the effect of recent trends on business location. Time series on Gross State Product (GSP) are compiled and published by the Bureau of Economic Analysis (BEA), U.S. Department of Commerce. The GSP figures were aggregated into Gross Regional Products (GRP) for the period 1977-1992 for the following areas: West (comprised of the Far West and Rocky Mountain BEA Economic Regions); South (comprised of the Southeast and Southwest BEA Economic Regions); Midwest (the Plains and Great Lakes BEA Economic Regions); and Northeast (the New England and Mideast BEA Regions). The share of these areas and regions in total output are shown in Table A.11.

Table A.11 Regional Share of Total Output

Region	1977	1980	1990	1992
West	**18.5%**	**19.6%**	**21.0%**	**20.7%**
Far West	15.8%	16.6%	18.3%	17.8%
Rocky Mts.	2.7%	3.0%	2.7%	2.9%
South	**29.1%**	**30.2%**	**30.5%**	**31.1%**
Southeast	19.5%	20.0%	20.9%	21.4%
Southwest	9.6%	10.2%	9.6%	9.7%
Midwest	**26.9%**	**25.1%**	**23.0%**	**23.2%**
Great Lakes	19.6%	18.0%	16.3%	16.4%
Plains	7.3%	7.1%	6.7%	6.8%
Northeast	**25.5%**	**25.1%**	**25.5%**	**25.0%**
Mideast	20.2%	19.7%	19.6%	19.3%
New England	5.3%	5.4%	5.9	5.7%
All Regions	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Bureau of Economic Analysis

Table A.11 shows that the output of the Sunbelt areas (the South and West regions) has grown more rapidly than the national average. The annual average GRP growth rate of the South and West regions, over the 1977-92 period, is estimated at 2.9% and 3.2%, respectively. The respective growth rates for the Midwest and Northeast Regions are 1.4% and 2.3%. The contribution to GDP of the Midwest region has decreased from 27% to 23% over the 1977-92 period, while the share of the other regions has increased or remained stable. Interestingly, over the 1990-1992 period, the Midwest region shows a slight increase in its contribution to GDP.

In terms of employment, the South region has generated more than 20 million of the nearly 50

million new jobs in the U.S. over the time period of the study, growing from 26.5 million jobs in 1970 to 47.5 million in 1993. During this period, employment in the West also increased from 14.5 million to 27.4 million.

As a percentage, the employment shares of the South and West have increased from 29% and 16% to 34% and 20%, respectively. In contrast, the employment shares of the Midwest and Northeast have decreased, although all regions have experienced significant increases in employment. It is interesting to note that the South has continued its strong growth path recently, although the West has been a region of sharp contrasts, and regional growth has slowed or experienced declines. Employment in the Far West sub-region actually declined between 1990 and 1993, while in the Rocky Mountains sub-region, employment continued to grow. The loss of jobs associated with defense downsizing and the collapse of the Los Angeles-area real estate market during that period accounted for this situation.

Population Growth Patterns

The above trends and changes in the structure of the economy have affected the pattern of national population growth, resulting in relative growth in the Sunbelt regions (South and West), while the Northeast and Midwest have grown at a slower rate. As evidenced in Table A.12, in 1970, the Northeast accounted for 24% of total population; and the Midwest, 28%. By 1993, the Northeast accounted for about 20% of total population, and the Midwest, 24%, while the West and South increased their share of total population. Similarly, the population of older urban centers has declined while suburban and exurban areas have grown rapidly during the past two decades.

Pattern of Regional Economic Activity

The pattern of economic development and the role of the economic sectors within the regions of the U.S. differ. The figures below present the distribution of activities, at the sector level, over the eight regions defined by the Bureau of Economic Analysis (Far West, Rocky Mountains, Southwest, Southeast, Great Lakes, Plains, Mideast and New England) at two points in time: 1977 and 1992. Table A.13 shows the distribution of activities, at the sector level, over the eight regions defined by the Bureau of Economic Analysis (Far West, Rocky Mountains, Southwest, Southeast, Great Lakes, Plains, Mideast and New England) at two points in time: 1977 and 1992. Table A.14 shows the contribution of each economic sector to the GRP in each region.

As expected, in 1992, agricultural, forestry and fisheries activities were mostly concentrated in the Plains, Rocky Mountains, Far West and South East regions, reflecting the location of natural resources relevant to this sector. Similarly, mining is concentrated in the Southwest and Southeast. Construction is dispersed throughout all regions, although a greater share of GRP is concentrated in the growing Sunbelt areas.

Wholesale and retail trade are dispersed throughout the country, although wholesale trade represents a slightly higher share of GRP in the Midwest, and retail trade is slightly higher in the Sunbelt regions. Government services represent a larger share of GRP in those regions with a larger concentration of federal, military and/or civilian employment.

TABLE A.12 Resident Population in the U.S.

	1970	1975	1980	1985	1990	1993
Total Population in Thousands	**203,300**	**215,465**	**226,545**	**237,925**	**248,710**	**257,909**
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
West	**17.1%**	**17.9%**	**19.1%**	**20.1%**	**21.2%**	**21.7%**
Mountain	4.1%	4.6%	5.0%	5.4%	5.5%	5.7%
Pacific	13.1%	13.3%	14.0%	14.7%	15.7%	16.0%
South	**30.9%**	**32.3%**	**33.3%**	**34.2%**	**34.4%**	**34.7%**
South Atlantic	15.1%	15.9%	16.3%	16.9%	17.5%	17.7%
East South Central	6.3%	6.4%	6.5%	6.3%	6.1%	6.1%
West South Central	9.5%	9.9%	10.5%	11.0%	10.7%	10.8%
Midwest	**27.8%**	**26.9%**	**26.0%**	**24.7%**	**24.0%**	**23.7%**
East North Central	19.8%	19.1%	18.4%	17.4%	16.9%	16.7%
West North Central	8.0%	7.8%	7.6%	7.3%	7.1%	7.0%
Northeast	**24.1%**	**22.9%**	**21.7%**	**21.0%**	**20.4%**	**19.9%**
New England	5.8%	5.6%	5.5%	5.4%	5.3%	5.1%
Mid-Atlantic	18.3%	17.3%	16.2%	15.6%	15.1%	14.8%

Source: Bureau of Economic Analysis, U.S. Dept. of Commerce.

Finance, insurance and real estate, as well as private sector services, two of the faster growing service sectors, are concentrated in the Mideast, New England, and Far West, particularly in the large metropolitan areas in the East Coast and California.

Comparing the distribution of activities in 1977 with 1992 and their contribution to regional GRP shows the following trends:

- Although manufacturing has declined in importance nationally, its importance to the Rocky Mountains, Southwest and Plains regions has actually grown;
- All regions have increased their contribution to manufacturing GDP (or their market share of total manufacturing output) except for the Great Lakes and Mideast regions;
- Finance, insurance and real estate have concentrated further in three regions, the Far West, the Southeast and Mideast, while the Great Lakes in particular experienced a decline in its market share of these activities;
- Private sector services, the largest service sector and the largest economic sector nationally, is only the largest sector in contribution to GRP in the Far West region, representing over 20% of GRP. Overall, however, it has grown in importance in all regions over the 1977-1992 period; and

Table A.13 Sector and Regional Contribution to National Economy

1977	Far West	Rocky Mtn.	South West	South East	Great Lakes	Plains	Mid East	New England
GRP ($87 Billions)	$548,364	$95,628	$333,324	$679,164	$681,269	$254,308	$701,419	$185,042
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agric. Forestry & Fshr.	2.0%	2.7%	1.7%	2.0%	1.8%	5.3%	0.6%	0.7%
Mining	1.3%	6.0%	11.1%	3.6%	0.6%	1.1%	0.4%	0.1%
Construction	6.4%	8.0%	7.3%	5.8%	4.9%	5.9%	4.1%	4.2%
Manufacturing	15.7%	11.9%	15.3%	21.7%	31.0%	19.2%	20.3%	23.3%
Trans. & Pub. Utilities	7.8%	9.7%	9.8%	9.0%	8.7%	10.0%	9.8%	8.0%
Transportation	3.1%	4.0%	3.5%	3.3%	3.2%	4.6%	3.4%	2.2%
Communications	2.1%	2.2%	1.9%	2.2%	1.8%	1.9%	2.5%	2.3%
Pub. Utilities	2.6%	3.4%	4.3%	3.5%	3.7%	3.5%	3.9%	3.5%
Wholesale Trade	4.8%	4.5%	4.6%	4.8%	4.7%	5.8%	5.2%	4.7%
Retail Trade	9.8%	9.9%	8.9%	9.5%	9.0%	9.6%	8.3%	9.0%
FIRE	19.2%	16.9%	15.4%	15.0%	15.6%	16.4%	19.7%	19.7%
Private Sector Services	18.0%	14.8%	13.2%	13.7%	13.8%	14.2%	17.9%	18.1%
Government Services	15.1%	15.6%	12.7%	15.1%	9.9%	12.4%	13.8%	12.2%

1992	Far West	Rocky Mtn.	South West	South East	Great Lakes	Plains	Mid East	New England
GRP ($87 Billions)	$892,167	$141,639	$490,329	$1,068,054	$817,737	$339,420	$965,107	$286,992
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agric. Forestry & Fshr.	2.7%	3.5%	2.2%	2.4%	1.8%	5.7%	0.8%	1.0%
Mining	1.7%	5.5%	6.4%	2.2%	0.6%	0.9%	0.3%	0.1%
Construction	4.5%	4.7%	4.0%	4.1%	3.9%	3.8%	3.8%	3.3%
Manufacturing	14.5%	12.9%	15.6%	19.8%	26.0%	19.6%	15.6%	20.7%
Trans. & Pub. Util.	8.5%	11.9%	11.7%	10.7%	9.6%	10.6%	9.7%	7.9%
Transportation	3.6%	4.8%	4.2%	3.9%	3.6%	4.9%	3.1%	2.1%
Communications	2.8%	3.9%	2.9%	3.3%	2.5%	3.0%	3.6%	2.8%
Public Utilities	2.2%	3.2%	4.6%	3.4%	3.4%	2.6%	3.1%	2.9%
Wholesale trade	6.6%	6.0%	6.7%	6.6%	7.1%	7.7%	6.9%	6.9%
Retail trade	10.2%	10.2%	10.2%	10.4%	9.5%	9.8%	8.5%	9.4%
FIRE	19.4%	15.4%	15.2%	15.1%	16.2%	15.8%	22.4%	21.3%
Private Sector Srvs	20.2%	16.8%	16.4%	15.8%	15.8%	15.2%	20.5%	20.4%
Govt. Services	11.7%	13.1%	11.6%	12.8%	9.6%	11.0%	11.6%	9.1%

Source: Bureau of Economic Analysis, U.S. Dept. of Commerce

Table A.14 Regional Contribution to National Economy

1977	Far West	Rocky Mts.	South West	South East	Great Lakes	Plains	Mid East	New England	Total U.S.
GRP($87 Billions)	$548,364	$95,628	$333,324	$679,164	$681,269	$254,308	$701,419	$185,042	$3,478,518
Share of Total	15.6%	2.7%	9.5%	19.3%	20.4%	7.2%	20.0%	5.3%	100.0%
Agr., Frstr, & Fshrs	0.3%	0.1%	0.2%	0.4%	0.3%	0.4%	0.1%	0.0%	1.8%
Mining	0.2%	0.2%	1.1%	0.7%	1.2%	0.1%	0.1%	0.0%	3.4%
Construction	1.0%	0.2%	0.7%	1.1%	0.9%	0.4%	0.8%	0.2%	5.4%
Manufacturing	2.4%	0.3%	1.4%	4.2%	6.0%	1.4%	4.0%	1.2%	21.1%
Trans. & Pub. Util.	1.2%	0.3%	0.9%	1.7%	1.7%	0.7%	2.0%	0.4%	8.9%
Transportation	0.5%	0.1%	0.3%	0.6%	0.6%	0.3%	0.7%	0.1%	3.3%
Communications	0.3%	0.1%	0.2%	0.4%	0.3%	0.1%	0.5%	0.1%	2.1%
Public Utilities	0.4%	0.1%	0.4%	0.7%	0.7%	0.3%	0.8%	0.2%	3.5%
Wholesale trade	0.7%	0.1%	0.4%	0.9%	0.9%	0.4%	1.0%	0.2%	4.8%
Retail trade	1.5%	0.3%	0.8%	1.8%	1.7%	0.7%	1.7%	0.5%	9.0%
FIRE	3.0%	0.5%	1.5%	2.9%	3.0%	1.2%	3.9%	1.0%	17.0%
Private Sector Srvs	2.8%	0.4%	1.3%	2.6%	2.7%	1.0%	3.6%	1.0%	15.3%
Govt. Services	2.4%	0.4%	1.2%	2.9%	1.9%	0.9%	2.8%	0.6%	13.1%

1992	Far West	Rocky Mts.	South West	South East	Great Lakes	Plains	Mid East	New England	Total U.S.
GRP($87 Billions)	$892,167	$141,639	$490,329	$1,068,054	$817,737	$339,420	$965,107	$286,992	$5,001,445
Share of Total	17.8%	2.8%	9.8%	21.3%	16.4%	638.0%	19.3%	5.7%	100.0%
Agr., Frstr, & fshrs	0.5%	0.1%	0.2%	0.5%	0.3%	0.4%	0.2%	0.1%	2.2%
Mining	0.3%	0.2%	0.6%	0.5%	0.1%	0.1%	0.1%	0.0%	1.8%
Construction	0.8%	0.1%	0.4%	0.9%	0.6%	0.3%	0.7%	0.2%	4.0%
Manufacturing	2.6%	0.2%	1.5%	4.2%	4.2%	1.3%	3.0%	1.2%	18.5%
Trans. & Pub. Util.	1.5%	0.1%	1.1%	2.3%	1.6%	0.7%	1.9%	0.5%	9.9%
Transportation	0.6%	0.4%	0.4%	0.8%	0.6%	0.3%	0.6%	0.1%	3.7%
Communications	0.5%	0.3%	0.3%	0.7%	0.4%	0.2%	0.7%	0.2%	3.1%
Public Utilities	0.4%	0.1%	0.5%	0.7%	0.6%	0.2%	0.6%	0.2%	3.2%
Wholesale Trade	1.2%	0.1%	0.7%	1.4%	1.2%	0.5%	1.3%	0.4%	6.8%
Retail Trade	1.8%	0.1%	1.0%	2.2%	1.6%	0.7%	1.6%	0.5%	9.7%
FIRE	3.5%	0.2%	1.5%	3.2%	2.6%	1.1%	4.3%	1.2%	17.9%
Private Sector Srvs	3.6%	0.3%	1.6%	3.4%	2.6%	1.0%	4.0%	1.2%	17.8%
Govt. Services	2.1%	0.4%	1.1%	2.7%	1.6%	0.7%	2.2%	0.5%	11.4%

Source: Bureau of Economic Analysis, U.S. Dept. of Commerce

- Although private services are not the largest service sector in the Mideast region, this region has the largest concentration and makes the largest contribution to the private services portion of national GDP (about 20%). Furthermore, the largest economic sector in the Mideast—finance, insurance, and real estate—has actually declined in importance as a contributor to GRP during the 15 year period.

Aging Population and Increased Leisure Time

Recent population trends indicate that by the year 2000 the "over 65" population will be 13% of the total. This percentage is expected to increase to 21% by the year 2030. An aging population can be expected to have more time for leisure activities including travel. At the same time, the number of "empty nesters" and double income households has also been increasing. These households tend to have more disposable income and/or generate greater demand for leisure activities. The increases in the older, dual income, and single households is one of the factors that explains the trend towards more one-week vacations and weekend trips that has influenced the fast growth of the tourism industry.

E. Reduced Government Role and Privatization

The role of government services in the U.S. economy grew significantly during the post-WWII period, from about 8.4% of GDP in 1950 to more than 13% in 1970. From the emergence of "Reaganomics" in the early 1980s to the more recent "Contract with America," the role of Government in the economy has been on a decreasing trend. This development is further accentuated by the end of the Cold War, which has resulted in cuts in defense spending and a lower rate of growth in defense expenditures. Military expenditures have grown at an annual 0.3% growth rate during the period from 1977-1992, while GDP grew by an average of 2.5%.

At the same time that defense expenditures have been constrained, federal civilian expenditures have also grown at a lower-than-average rate compared to the overall U.S. economy. The budget deficits have resulted in continuing efforts to reduce discretionary and non-discretionary expenditures. In many cases, these efforts have resulted in a transfer of responsibility to state and local governments.

During the last 15 years, state and local governments have also experienced budget crises and voter concerns about tax increases. Although efforts have been underway in many states and local areas to reduce the role of government, the rate of growth in their share of GDP (1.8%) was higher than that for federal expenditures, although still representing a lower rate than the 2.5% average annual growth for GDP.

The decrease in government and defense expenditures and the emphasis on privatization of government services, ranging from health services to welfare and education, have significant implications for future economic growth. This trend is likely to result in the growth of additional private service businesses aimed at meeting the needs of consumers, governments and businesses,

that were, until recently, considered a government function.

With many previously federal functions being turned over to the states, state and local governments are also increasingly willing to examine commercialization and outsourcing of government services. At first a European phenomenon, which then also caught on in emerging economies, privatization is also being pursued to implement changes in governmental processes and for financing government infrastructure and operations in the U.S. For example, Virginia DOT has contracted out the maintenance of a portion of its highway system. Proposals have also been put forth regarding the possible privatization of some of the Federal Aviation Administration's functions. Increasingly, governments are turning to privatization of infrastructure services, such as airports, highways, and transit systems. In addition, some local governments are attempting to commercialize services such as health care, welfare services, prisons, etc.

4.0 Transportation Requirements of American Business

As some of the nation's economic sectors producing higher value products and services grow in importance and as businesses restructure their operations to be more competitive, their transportation requirements have been changing. An increasing number of businesses now place increasing emphasis on faster, more efficient services and reliability, and are not only looking for the lowest transportation cost.

This section discusses transportation service requirements from a user industry or business perspective. This discussion starts with a summary of the multimodal transportation requirements of the various economic sectors. It then presents an overview of the freight transportation requirements for each major economic sector in five summary tables, which are followed by a discussion of general service requirements, the implications of these service requirements for modal selection, and trends affecting transportation needs. The final part of this section deals with the passenger transportation requirements of businesses in general.

A. Overview of Transportation Service Requirements of Economic Sectors

Although each sector (and industry group or individual firm) has its own unique transportation requirements, these requirements can be generalized into three broad categories:

1. Sectors which produce raw materials, or bulky, low-market-value products with less emphasis on time delivery or reliability requirements;
2. Sectors which rely on just-in-time inventory systems and/or produce higher-market-value products with time-critical delivery and reliability requirements; and
3. Service industries, other than wholesale and retail trade, which have few freight transportation requirements (apart from overnight package delivery), and are more concerned with access for their service fleets and the transportation of their customers and employees.

In general, many of the industries in the Agriculture, Mining, and, to some extent, Construction and Traditional Manufacturing fall within the first category and emphasize low cost freight transportation

service. There are exceptions, such as high-value perishable agricultural products and construction materials that affect project schedules with penalties for delay and/or incentives for early completion. For relatively low-market value products, the transportation cost component as a percent of the product's total selling price can be very high, having important competitive implications. In general, these industries, therefore, tend to use the least expensive modes of freight transport such as rail and ships.

Transportation cost remains important for industries within the second category (such as the high-tech and knowledge intensive manufacturing industries, wholesale and retail trade, and those that rely on JIT). However, it is frequently a secondary requirement to service reliability, speed, and damage/loss control. The transportation cost component of higher market value products tend to be smaller, while trends such as JIT inventory control systems are requiring more reliable and faster service. In addition, because of the higher value nature of the products, damage and loss control are important transportation requirements as well.

The other industries in the service sector (other than wholesale and retail trade) are more concerned with reliable, low cost transportation access for business travel and for their service fleets, as well as for their customers and employees. This includes good highway/freeway or primary road access, as well as reliable and low-cost access to public transport. Many of the service sector industries rely increasingly on overnight package delivery within the U.S. and North America, as well as 2-day package delivery to faraway destinations in other continents. Service industries use such considerations in the choice of business location.

The dramatic growth of overnight package delivery services reflects business needs for speedy, reliable delivery of documents, such as payrolls and contracts, small replacement parts, other high-value goods, and other business documents. Manufacturing industries relying on JIT inventories and many of the service sector industry groups are increasingly dependent on overnight or 2-day delivery of documents and packages, increasingly to international destinations. One company interviewed in the professional services business sends 95 percent of its documents by overnight express service. This high-percentage is typical of the requirements for fast document delivery of many service businesses.

Another trend affecting overnight delivery of documents is the growth of facsimile transmission and e-mail, which also reflects the benefits of speedy transmittal of documents. Businesses are finding that a growing share of document deliveries can be done electronically, via dedicated in-house Wide-Area-Networks or the Internet. Although many were started for e-mail and conferencing purposes, Wide-Area-Networks are readily adaptable to distribution of in-house documentation.

Another trend affecting the transportation requirements of businesses is that as consumers are finding that they have less time for shopping, new businesses are developing to sell products by phone, mail, TV, electronic mail, or Internet, with fast, reliable delivery expected within an urban area, across the country, and even internationally. The growth of purchases of clothing, appliances, electronic products, and recently groceries by catalog or through the Internet, is an example of this trend that will increase the demand for overnight package deliveries and courier delivery services within

residential urban areas. This trend also has potentially significant implications for transportation demand, eventually possibly reducing shopping trips in urban areas.

Table A.15 presents an overview of the major products, their characteristics, typical modes used and the service requirements of the major economic sectors.

Economic Sectors as Sources of Transportation Demand (Revenues)

Based on data from the BEA interindustry tables, manufacturing industries are the largest single source of demand (measured in terms of revenue) for transportation service (passenger and freight) among industry sectors, representing about 22 percent of all sales made by transportation companies. In order of relative importance, services (5 percent of all transportation sales) and construction (4 percent of all transportation sales) are the two other economic sectors that represent the largest sources of demand for transportation services.

Among economic sectors, manufacturing is the largest source of demand for all modes of transportation, except air transport and transit/highway passenger services. The services sector alone generates 13 percent of all air transport demand, while finance, real estate and insurance generates 8 percent of transit/highway passenger demand. Some service industries generate substantially higher transportation demand than manufacturing, agriculture, mining, and other industries known for their dependence on transportation. For example, banking and credit, wholesale trade, and business services are among the top 10 industry users of transportation services.

Personal consumption generates the largest transportation demand—25 percent of total transport sales. It also generates the largest share of air transport and transit/highway passenger demand.

Significance of Transportation to Economic Sectors and Industries

The 1987 data from the BEA interindustry tables indicates the economic sectors that spend the largest share of their total output and value added on transportation services are:

Manufacturing of nondurable goods
Agriculture, forestry and fishery
Utilities
Manufacturing of durable goods
Business services

Stone, clay glass and mining is the industry group with the largest transport share of its total industry output (6.5 percent), mostly requiring truck, warehousing, and rail transport services. Membership organizations is the third largest of the industry groups in terms of the transportation share of industry output (3.8 percent), mostly spent on air transport services.

TABLE A.15 Transportation Services Requirements by Sector

Sector	Commodities	Particular Characteristics	Current Transportation	Transportation Services Requirements Mode
AGRICULTURE	Grains	Large Volume, not Time Sensitive	Barge	Low Cost, Low Speed, Low Damage
	Fruit Vegetable	Time Sensitive	Truck, Rail, Air	Frequent & Reliable Services
	Livestock	Large Volume	Rail	Low Cost, Low Speed, Low Damage
	Forestry Products	Large Volume, not Time Sensitive	Barge, Ship, Rail	Low Cost, Low Speed, Low Damage
	Fish Products	Time Sensitive	Truck, Air	Frequent & Reliable Services
MINING	Metal Ore	Large Volume, not Time Sensitive	Rail	Low Cost, Low Speed, Low Damage
	Crude Petroleum	Lareg Volume, not Time Sensitive	Barge Ship	Low Cost, Low Speed, Low Damage
	Natural Gas		Pipeline	Regular Movements
	Sand & Gravel	Large Volume, not Time Sensitive	Barge	Low Cost, Low Speed, Low Damage
	Coal	Large Volume, not Time Sensitive	Barge, Rail	Low Cost, Low Speed, Low Damage
CONSTRUCTION	Construction Material	Large Volume, not Time Sensitive	Truck	Low Cost, Low Speed, Low Damage
MANUFACTURING	Food Products	Non-bulk	Air, Truck *	Frequent, Reliable, Fast Services
	Frozen Foodstuff	Non-bulk, Time Sensitive	Air, Truck *	Frequent, Reliable, Fast Services
	Textile & Apparels	Non-bulk	Air, Truck *	Door to Door, Innovative Services
	Wood Products	Non-bulk	Air, Truck *	Frequent, Reliable Services
	Paper Products	Non-bulk	Air, Truck *	Frequent, Reliable Services
	Printing Publishing	Non-bulk	Air, Truck *	Frequent, Fast Services
	Chemicals & Allied Products	Non-bulk	Air, Truck *	Frequent, Reliable Services
	Rubber & Plastics	Non-bulk, Time Sensitive	Air, Truck *	Frequent, Reliable Services
	Industrial Machinery & Equip.	High Value, Time Sensitive	Air, Truck *	Frequent, Reliable, Fast & Innovative Services
	Electronic & Electrical Equipment	High Value, Time Sensitive	Air, Truck *	Frequent, Reliable, Fast & Innovative Services
	Motor Vehicles	Non-bulk, High Value	Truck, Rail, Ship	Frequent, Reliable Services
	Prof/Scientific Instruments	High Value	Air, Truck *	Frequent, Reliable, Fast & Innovative Services
WHOLESALE	Motor Vehicles	Non-bulk, High Value	Truck, Rail	Frequent, Reliable Services
	Chemicals & Allied Products	Non-bulk	Air, Truck	Frequent, Reliable Services
	Apparel	Non-bulk, can be Time Sensitive	Air, Truck	Door to Door, Innovative Services
	Groceries and Food	Perishable	Air, Truck	Frequent, Reliable, Fast & Innovative Services
	Machinery	Non-bulk	Air, Truck	Frequent, Reliable, Fast & Innovative Services
	Paper Products	Non-bulk	Air, Truck	Frequent, Reliable, Fast & Innovative Services
	Lumber & Construction Material	Non-bulk	Air, Truck	Frequent, Reliable, Fast & Innovative Services
RETAIL		Time Sensitive, Direct Human Interaction	Air, Truck	Frequent, Reliable, Fast & Innovative Services
SERVICES		Time Sensitive, Direct Human Interaction	Air, Truck	Frequent, Reliable, Fast & Innovative Services

*** May include some Rail**

B. Freight Transportation Service Requirements by Economic Sector

In order to consider the freight transportation service requirements of the major economic sectors, a summary table of the requirements for each sector is first presented, followed by a discussion of general service requirements, the implications of these service requirements for modal selection, and trends affecting transportation needs. Overnight and express document delivery requirements are then presented for all the economic sectors combined (since all economic sectors have these requirements), although the significance of these needs vary by industry.

Table A.16 presents the major freight transportation requirements for the Agriculture, Mining, and Construction sectors. These three sectors are discussed in the following paragraphs.

Table A.16 Freight Transportation Requirements of the Agriculture, Mining and Construction Sectors

Sector/Industry	Transportation Requirements	Modal Selection	Observed Trend
Agriculture	Normally low-value, bulky products: • transportation is a significant component of total cost • refrigeration/temp control • reliability, speed for perishables • damage/loss control	• emphasis on low-cost • initial movement by truck • consolidated onto rail/water for long-distances • perishables by air and/or truck	• dedicated transport contracts with service clauses
Mining	Generally dry/liquid bulk products and not time-sensitive: • cost • access to more transport providers • access to ports	Bulk products requiring low-costs: • rail • inland waterways • ships (for export) • pipelines	• shorter contracts between utilities and railroads • deregulation/changes in sales and purchases may change transport requirements
Construction	Transport accounts for a significant portion of costs/also characterized by freight movement over various and changing origins and destinations: • cost • speed • reliability/JIT	Emphasis on low-cost, bulk nature over distances: • rail • water • truck (to specific sites) • some air charters for international transport	• increasing use of service contracts • inventory and tracking system increasing level of sophistication

1. The Agriculture, Forestry and Fisheries Sector

Agricultural activities are located mostly in rural and small towns in the Far West, Southeast, and Plains regions. Commercial fishing is concentrated near fishery resources in the coastal areas, while forestry production is concentrated in the forest lands in the Pacific Northwest and Southeast. The U.S. is one of the major producers of agricultural products and remains a major exporter.

Transportation Requirements

U.S. agricultural, fisheries and forestry production is transported to locations around the world. Most agricultural products are low-value, bulky products that are moved in large volumes. Typically, the transportation cost component of the value of these products is a significant factor affecting the competitiveness and market reach of the industry. Some of the agricultural or fishery products are perishable (e.g., meats, fruits, seafood). With a limited shelf life, these products require specialized, or refrigerated, transportation services. Increasingly, agricultural products are moving in standard containers, which in the case of perishables, are refrigerated. Forestry products require very careful handling to avoid damage. Low costs are the key requirement.

More specifically the transportation requirements of this economic sector are:

- *Cost.* Low cost per unit is the most important requirement for the transportation of agricultural, fishery and forestry products. Most of the high volume bulk shipments move at unit costs of 2 or 3 cents per ton-mile. Domestic agricultural and forestry products can have a high transportation cost component as a percentage of the total product value (e.g., about 10 percent for forestry products and 15 percent for cotton). Any reduction in their transportation costs, even a small reduction of less than a penny a ton-mile, may create a significant improvement in an agricultural shipper's bottom line, or shift sales from one continent to another, because transportation is such a large part of costs.

- *Reliability.* Although the majority of bulk agricultural products, such as grains, sugar, and coffee, do not have a critical need for reliable delivery, some products rely on the product being supplied more frequently to meet production needs. In the case of perishable products, such as fish, seafood, and bananas, delays in delivery schedules can make the product worthless.

- *Speed.* For most agricultural, fishery, and forestry shippers, speed is not an important requirement. The exceptions are perishable agricultural products such as fish, fruits, frozen potatoes, and raw materials for production, such as cotton. Many of these agricultural shippers are being pressed to meet just-in-time (JIT) delivery requirements from their customers and supermarket chains.

- *Other service requirements.* Besides cost, reliability and speed, these industries have other requirements such as specialized equipment, differing capacity requirements at different times of the year (higher at peak of harvest), high weight limits for trucks (to minimize costs), and temperature controls for perishable products.

For all these industries, low loss or damage rate is an important requirement. Low damage rate and careful handling was cited by forestry industry representatives as the third most

important service characteristic, after cost and reliability.

Implications for Modal Selection

Because of the emphasis on low cost, and the bulky nature of most of these products, agricultural, fisheries and forestry industry output moves to distribution and processing centers and consumption locations throughout the world, primarily through water, rail, and road networks. These products move initially mostly by truck to grain elevators or transportation terminals where they are consolidated. They then move long distances mostly by water and/or rail at average costs of no more than 2 or 3 cents per ton-mile. Products that are input to industrial production (e.g., cotton) move domestically almost always by rail or truck, and internationally by water. Certain perishable and high-value products increasingly move long distances by air to serve specialized markets requiring products not available regionally at certain times of the year (e.g., seafood or fish for the restaurant market, or flowers).

Trends in Transportation Service Requirements: Agricultural, Fisheries and Forestry

Long and short-term dedicated transportation contracts with service performance clauses are becoming more frequent in the agricultural and forestry sector. Service contracts, as seen in nearly every industry, benefit shippers by: 1) giving them volume discounts that reduce their transportation costs, and 2) providing service guarantees. These guarantees are increasingly significant for buyers of agricultural inputs using JIT production who rely on on-time delivery.

2. The Mining Sector

Mining activities take place at the location of the resources being mined and are concentrated in the Western, Rocky Mountains, Southwestern and Southeastern states.

The mining industry is composed of establishments primarily engaged in producing and developing various metals, bituminous coal, lignite, and anthracite. The oil and gas extraction industry is made up of establishments engaged in operating oil and gas fields.

Mining Freight Transportation Requirements

Generally, mining products are dry or liquid bulk products shipped in large volumes and are not time-sensitive. Thus, the major requirement would involve low-cost transportation services with sufficient frequency to meet the user's needs.

Transportation requirements in the mining sector vary depending on the material being mined. Transportation of most products in this sector (such as coal, gas, sand, gravel, oil, and

most metals), requires moving products in very large bulk quantities. In addition, the value of these bulky materials var a great deal.

- *Cost.* For relatively high value products, such as crude oil, there is a small transportation cost component of as little as 2-3 percent as a percent of the product's total selling price. For a low value commodity like coal, however, the transportation cost component can be very significant, as much as 50 percent or more (depending on the distance of the shipment) of a product's delivered price. Mining products are commodity goods, which means their price is the most important competitive factor. Therefore, cost is the number one transportation requirement for most producers, even for high-value commodity producers. After cost, service reliability is the next most important transportation requirement.

- *Reliability.* Reliability is a major transportation requirement for the high-value mining sector. The industry is holding less inventory than in the past to save on carrying costs. Although speed is not as crucial an issue because demand can be predicted and production cycles altered to prepare for increases or decreases, reliability and on-time performance are key in delivering the product at the right place at the right time before inventory runs out. The product has to be moved in such a way so as to meet the refinery's production schedule—that is what reliability is—but the shipping schedule allows enough time so that the freight being shipped can use low cost (and therefore low speed) methods of transportation that are really the only viable approach to move these high-volume bulk products.

  Reliability is also increasingly important for coal users. To keep customers, the product must be available when needed. In fact, coal customers (primarily utility companies) have significantly cut down on the inventory they keep to reduce costs and reflect the relative improvements in the reliability of railroad service compared to 10 years ago. As utilities lower inventory levels that reduce utilities' costs, there is more reliance on the transportation system to move the coal to the customer on-time.

- *Geographic coverage.* Geographic coverage for the high value oil products industry is also an important transportation requirement because the modes use—supertankers, pipelines, and railroads—are not very flexible and tend to serve only certain destinations. Moreover, the speed at which they move product cannot be increased significantly. Therefore, geographic coverage is important because, according to one industry expert, many refineries operate with only several days' crude supply, and having the flexibility to bring product from different areas can be a competitive advantage.

- *Other service considerations.* One typical problem facing some mines is having access to only one carrier, resulting in what is referred to as a captive cargo, or monopoly situation. Another transportation, service-related, competitiveness issue

in the coal industry is the contractual agreement used between a utility and a railroad. Utility companies usually buy their coal directly at the mine and then ship the product from the mine to the power plant. These shipments are usually made based on long-term contracts signed with the railroads. If a railroad provides poor service (which according to one producer is not uncommon), then the customer might not receive all of the coal needed for that year. Therefore, based on the contract provisions, the utility will extract a penalty from the railroad for the missed shipments.

Implications for Modal Selection

Since most of the nation's mining output moves as bulk products, with low costs being the key requirement, mining products typically move by rail and water to industrial plants and/or ports. Coal typically moves by rail in long-unit trains at some of the least expensive rates (about 2 cents per ton-mile). Coal is the single largest market for rail and the largest source of rail carrier profits. Where available, inland or coastal water barge rates are even lower.

To remain competitive in world markets, the coal industry requires inexpensive rail access to ports that can handle and store large volumes efficiently, and serve large, dry, bulk vessels. These large vessels can help reduce unit costs for the long distance transportation cost of coal, but also require harbors and port facilities with deeper navigation channels.

Trends in Transportation Service Requirements

- *Contract Arrangements*. Contracts between utilities and railroads for coal delivery are getting shorter. What was commonly a 10 or 20-year contract, is now usually a 3- to 5-year contract. Nearly everything in the low-value commodity industry is done using long- or short-term contracts.

- *Electric Utility Deregulation.* Electric utilities are going through deregulation that will enable them to buy the cheapest electricity available (either their own or another producer's) from the national electric grid. As a result, utilities are reluctant to enter into long term contracts for coal. Deregulation may lead to utilities located far from coal fields or without competitive access to coal to idle their coal-fired plants. Coal producers may have to become more involved in delivering their product at competitive costs.

- *Consolidation of the Rail Industry*. Another trend affecting transportation in the mining industry, which is so dependent on rail, is the further, and continuing, consolidation of the railroad industry. The question is whether there will be enough competition in the market so that the more efficient railroads will pass on their lower costs to their customers.

3. The Construction Sector

The construction sector covers activities such as private, residential construction; prefabricated buildings; private, non-residential construction; publicly owned construction; and international construction and engineering. The construction business has become increasingly international during the past 20 years. In 1992, U.S. contractors won about 49 percent of all international construction contracts, indicating that U.S. firms are very successful and competitive in this industry.

Construction Freight Transportation Requirements

Most construction materials move as bulk products, using the cheapest available option, although depending on the project, reliability may be as important as cost. Typically, construction materials move from the closest available supply source to minimize costs. The mobilization and demobilization of large, heavy equipment to and from distant sites can be a significant part of total project costs. In all cases, the key transportation service characteristics are low cost and reliability.

One characteristic that differentiates the construction industry freight transportation requirements from other sectors that transport heavy, bulky materials, is the lack of steady, long-term volumes between one origin and destination. Because construction sites change once a project is completed, a company cannot guarantee volumes on a certain route in the same way that a utility can by means of a long-term contract for moving coal from a mine to a power plant.

- *Cost.* Transportation can make up from 4 to 10 percent of a typical construction job's cost—depending on whether the job is international or domestic and the type of structure or project being built. Transportation, therefore, is a significant part of a construction company's cost.

- *Reliability.* The most important transportation requirement for the construction industry is reliability. There are two reasons for this. First, the construction industry does not hold a significant amount of inventory, which means they rely very heavily on the transportation system to deliver materials and equipment before it is needed. Second, construction projects typically follow a construction management schedule known as the "critical path." If something on the critical path fails to occur at the proper time, then the whole schedule is delayed.

- *Speed.* Speed and delivery time are the third most important requirements for the transportation needs of a construction company. Fast delivery means that supplies do not have to be purchased too early and that equipment can be used at another project without jeopardizing the schedule of the next project.

- *Geographic Coverage and Other Service Considerations.* Large construction companies increasingly compete for projects nationally and internationally. Having the ability to move their equipment wherever is needed and use suppliers that can provide the cheapest materials can make their bids more competitive. With the trend towards global logistics and service contracts, construction companies are reducing the number of carriers and forwarders they use to improve the quality of service and on-time delivery.

Implications for Modal Selection

Since emphasis is on low cost, materials for domestic construction projects move mostly by water and rail (if they involve longer distances), and by truck as necessary to access specific construction sites. Similarly, heavy and specialized construction equipment moves by rail or water, depending on construction site location. The exceptions are short distances or to access the construction site, which generally involves truck movements.

In some cases, particularly for moves involving long distances to remote international destinations, construction companies are known to use airplane charters to move construction materials to a site. Air transportation is used to assure the arrival of the materials at the right time on schedule.

Trends in Transportation Service Requirements: Construction Sector

Large construction companies are increasing their use of service contracts and logistics providers, sometimes shipping as much as 50 percent of their total freight volume with a limited number of carriers. Companies however, do not guarantee any volumes to carriers, as their freight requirements vary from year to year, depending on type of projects and sites. Construction firms, however, get a significant discount in their contract rates, due to the large volumes involved, and hold carriers to extremely high service requirements. These efforts are aimed at improving the competitiveness of the construction industry.

4. The Manufacturing Sector

Manufacturing activities can be broken down into two major categories based on the type of products: Manufacturing of Durable Goods and Nondurable Goods. Manufacturing industries can also be subdivided into what is referred to as basic and "traditional" manufacturing (including fabricated metals, wood products, textiles, furniture, food and tobacco products, apparel, paper products, etc.) and knowledge and technology-intensive manufacturing (including electronics, semiconductors, computers, aircraft, telecommunications equipment, medical and surgical equipment, pharmaceuticals, etc.).

In general, basic and "traditional" manufacturing industries are located near low-cost labor, raw materials and consuming industries or markets. Historically, U.S. basic manufacturing industries were located mostly in the Great Lakes Region, which remains the region where manufacturing contributes the largest share to regional economic activity. Recently, however, some of the larger manufacturing industries have been taking advantage of

decentralized operations and multinational production opportunities to increase their competitiveness. At the same time, the growing knowledge and technology-based industries (pharmaceutical; electronics; aerospace, etc.) consider other factors in their location decisions. These factors include access to universities, highly trained labor, warmer climate, amenities, cultural activities, and transportation facilities, such as airports. As a result, manufacturing is no longer as concentrated geographically as it once was.

For the purposes of this report, in order to consider the transportation requirements of the manufacturing sector, industries will be classified using three of the previously mentioned production factors:

- Raw material and natural resource input materials to production (e.g., volume and weight),
- Scale of production, and
- Knowledge-technology intensity.

"Traditional large-scale" manufacturing industries generally use higher volumes of raw materials or natural resource inputs and have a bigger production scale (large volume production), while knowledge-technology intensive industries rely more on semifinished or smaller volumes of less bulky inputs as well as lower production volumes (see Table A.17 for major differences between the traditional large-scale and knowledge-technology intensive manufacturing industries).

Table A.17 Characteristics of Manufacturing Industries

Industry Category	Examples	Input Materials	Output Production
Traditional	Lumber products Power equipment Automobiles Sugar refining Petroleum refining Agricultural chemicals	Natural resource based Large Volumes Bulky Heavy	Large Scale Lower value per ton
Knowledge intensive and technology-based	Computers Medical Equipment Pharmaceuticals Multimedia software Telecommunications	Semifinished Smaller Volumes Lighter	Lower scale High value per ton

Although each industry has its own set of requirements and competitiveness issues, traditional large-scale manufacturing industries (requiring significant natural resource inputs

and/or using very large production facilities) generally have more complex inbound transportation requirements as well as a larger market reach from one plant location.

The faster growing knowledge intensive and technology based industries have a smaller production scale, do not require large volumes of inbound raw materials, and are more dependent on the latest technology and research.

Some of the traditional large-scale industries have been increasing their use of technology and revamping their production processes to increase their competitiveness. For example, automobiles and auto parts increasingly use electronics and lighter-weight materials. Some of these industries are becoming more technology intensive. Therefore, the list of industries that should be classified as traditional large scale is continuously changing. In general, all industries are continuously modernizing their technology.

Furthermore, traditional large-scale manufacturing industries comprise a variety of manufacturers, all of which do not necessarily have the same transportation requirements. The transportation cost component of these industries also varies significantly, as does the value of the goods they ship. However, they generally have larger more complex requirements, bulkier and higher weight inputs and outputs, and lower value per ton products than the knowledge-intensive and technology based industries.

Overview of Manufacturing Sector Transportation Requirements

This section presents an overview of the manufacturing sector transportation requirements. Manufacturing industries typically have three types of transportation requirements:

- Transportation of raw materials or intermediate products that are inputs to a manufacturing or final assembly plant location;
- Transportation of products from plants to distribution centers, suppliers, and/or other user industries (for industrial markets); and
- Transportation of products from plants to distribution centers, retailers, and/or consumers (for consumer markets).

The user industry generally pays for the transportation costs of raw materials and intermediate products that are input to its production. In cases where transportation cost of raw materials and other semi-finished inputs to their production is a significant cost of total production costs, these industries will carefully evaluate plant locations and transportation options for such moves. Generally, industries that use large volumes of raw materials will locate close to abundant sources of their material inputs, so as to lower their transportation costs for input materials. However, industries requiring high-labor cost component inputs will use plant locations in low-cost labor locations, even though transportation costs are higher.

For manufactured products serving industrial markets, both producer and user are concerned about transportation costs of the manufactured product as they affect their competitiveness, market reach, inventory levels, and profitability. Besides the transportation costs of input materials and parts, a manufacturer serving industrial markets will also carefully evaluate the

location of its plants, warehouses or distribution centers, and user industries, so as to lower its total logistics costs. In many cases, wholesale distributors are used to manage inventory levels and distribute the product to user industries.

Besides the transportation costs of input materials and products and the implications of inventory levels and other production logistics factors, manufacturers of consumer products will also consider the size and location of consumer markets to be served by the production from a manufacturing location. Manufacturers of consumer products have various distribution options for their products, including wholesale distributors, retailers, or direct consumer sales. They can also concentrate their production at one, or a few, plant locations or at many locations. Depending on the product's market value, the economies of large-scale production, the product's size and weight, and an industry's or company's distribution and market strategies, consumer product manufacturers will have different transportation requirements to move their products to consumers. These different requirements will in turn affect their selection of transportation options to fit their product distribution and marketing strategy.

The significance of raw materials and other inputs to various industries, the types of markets served (industrial or consumer), and their transportation requirements will be discussed more specifically for selected industries in the following sections. Tables A.18 and A.19 present an overview of the freight transportation requirements for the Manufacturing Sector, separated into traditional industries (Table A.18) and Knowledge-Intensive and Technology-Based industries (Table A.19).

5. The Services Sector

This economic sector has been defined broadly to include all activities not classified as goods-producing (i.e., everything except agriculture, forestry and fishing; mining; construction; and manufacturing).

The fast-growing, services sectors of the economy generally place greater importance on different transportation requirements than the basic and/or goods-producing industries. By their very nature, service industries do not have freight transportation requirements as intensive as the previously discussed sectors. These industries are also typically not as affected by economies of scale, and locate their facilities to serve consumer or business markets, so they are generally not as concentrated in a few areas.

Services have also been categorized into five major groups:

- Services to **goods-producing industries**, otherwise referred to as distributive and retail services (such as transportation, wholesale trade and retail trade);
- Services to **individuals** (such as food services, tourism, education, and health services), sometimes categorized as consumer services;
- **Business** services (such as accounting, engineering, information, computer, legal and other services);
- **Non-profit** services (including education); and

Table A.18 Freight Transportation Requirements of the Manufacturing Sector (Traditional and Heavy Manufacturing Industries)

Sector/Industry	Transportation Requirements	Model Selection	Observed Trend
Lumber & Woods Products	Transport costs are a significant portion of total costs: • cost • damage/loss control	• truck • small amount by intermodal rail • specialized equipment/port terminals	• development of new rail and truck equipment to increase payloads
Industrial & Commercial Machinery	Large, heavy, high-value equipment with time-sensitive delivery requirements: • cost • speed • specialized equipment (cranes)	Large size requires: • truck • rail • ship for exports/imports	• bulkier equipment shipments due to increased assembly at plant • long-term carrier contracts
Motor Vehicles & Equipment	Requires a large number of items shipped to assembly plants with simultaneous control of inventory: • JIT/reliability • damage/loss control • speed • cost • long-term contracts with carriers	• truck • rail • some auto parts by air	• consolidation of carriers • long-term carrier contracts • use of express package services • outsourcing logistics
Fabric Mills	Industry faces competition from low-cost imports: • cost	fragmented nature of industry requires: • truck • intermodal for longer distances	• operating fully integrated facilities to reduce transport costs
Food & Kindred Products	Industry requires reliability and consistency of delivery: • cost • reliability/JIT	• bulk products by barge • finished foods by rail and truck	• information exchange between suppliers and customers
Paper & Allied Products	• cost • damage/loss control for higher-value products • reliability	• rail • truck • break-bulk vessels for foreign shipments	• new equipment to handle greater loads • long-term contracts
Chemicals & Allied Products			
Fertilizers	Low value commodity requires low cost shipping	• rail • water • truck	• consolidation of fragmented shipping
Pesticides	High value often hazardous materials require reliability and speed	• truck (specialized for hazmat)	• expanding warehousing on short-term contracts

Table A.19 Freight Transportation Requirements of the Manufacturing Sector (Technology-Based & Knowledge-Intensive Industries)

Sector/Industry	Transportation Requirements	Modal Selection	Observed Trend
Computer Equipment	High-tech, high-value products require: • speed • reliability • door-to-door service • damage/loss control • high level of service	• 80% of computer equipment moves by truck • air	• growth in home-based PC market • growth in mail order
Telecommunications Equipment	High-value, low-volume product/not transport intensive: • reliability • speed	• LTL truck load shipments • air	• growth in smaller niche companies
Medical & Surgical Equipment	High-value, time sensitive nature requires: • fast/immediate service • JIT/same-day service • damage/loss control	• air • truck	• overnight shipping • merger/consolidation of medical industry • growth in air cargo
Chemical & Allied Products: Pharmaceuticals	Non-durable, high-value product, sometimes hazardous materials: • damage/loss control • reliability • service quality • ability to handle hazmat	• truck	• overnight delivery • trend toward managed care puts demand on logistics/service
Printing & Publishing	Time-sensitive products: • speed • JIT • reliability	• truck	• digital transmission over phone-lines
Computer & Software	High-value products distributed through retail stores/catalogues, cost is a small percent of total: • speed • reliability • damage/loss control	• air • truck	• expansion of air cargo • electronic transmission

- **Government** services.

Freight transportation requirements are more significant for the goods-producing and utility services than for the rest of the service sector. Most of the consumer services, business services, non-profit services, and government services do not have significant, freight transportation requirements. Instead, these service industries place increasing importance on access to labor and customers, and, therefore, rely more on the movement of people, rather than goods. All service industries increasingly rely on the overnight delivery of documents that is so important to the professional, financial, government and other business services industries, and on the fast, timely delivery of supplies for their daily business needs (e.g.,

ingredients for food services, medical supplies for health services, and paper supplies for offices). Passenger and overnight delivery services will be discussed separately for all economic sectors. This section will then specifically consider only the freight transportation requirements of the following subsectors of the services sector:

a. Communications and Utilities
b. Wholesale Trade
c. Retail Trade
d. Supplies for Business, Personal, and Government Service Industries

Table A.20 presents a summary of the transportation requirements, trends, and implications on modal selection for these selected industries within the service sector.[1]

Table A.20 Freight Transportation Requirements of the Service Sector

Sector/Industry	Transportation Requirements	Modal Selection	Observed Trend
Communications	Generally, few freight transport requirements: • speed • reliability • damage/loss control	• service fleets	• transportation is small part of industry cost
Utilities	• cost (e.g., input coal) • reliability	• rail • service fleets	• deregulation of electric utilities increases pressure to reduce costs
Wholesale Trade	• inventory control • reliability • speed/JIT	• truck • rail	• growth in JIT • outsourcing logistics
Retail Trade	• supply chain management • EDI • TQM • third-party logistics firms • JIT	• truck • intermodal rail	• reduction in inventory • reduce plant-to-store times • use of EDI • use of exactly on time (XOT)
Finance, Business, Personal, Gov't	• generally, few freight transport requirements	• truck • air	• Overnight Package and document express delivery - electronic

6. Passenger Transportation Requirements for all Economic Sectors

Businesses have three major types of passenger transportation requirements, although the importance of each to industry competitiveness varies among the various sectors and industries:

[1]For a more detailed discussion of the transportation requirements and trends, see Phase II Report: Economic Trends and Multimodal Transportation Requirements.

- Employee access for the daily journey to work,
- Customer access, and
- Business travel.

Table A.21 presents a summary of these three types of passenger transportation requirements, trends, and implications on modal selection for all economic sectors.[2]

Table A.21 Passenger Transport Requirements Across all Sectors

Sector/Industry	Transportation Requirements	Modal Selection	Observed Trend
Employee Access	• labor pool within a certain commuting distance • cost and ease of commuting	• auto • public transit	• ease of commute affects location decisions of fast growing high-technology and knowledge-based manufacturing and service industries
Customer Access for businesses serving local and regional market	• availability of quality public transport • congestion relief • availability of low-cost parking • reliability of travel time • access to interstates, freeways	• auto • taxi and public transit	• transportation access is key aspect of location decision • when congestion or pricing affects demand, businesses provide shuttle services, free/subsidized transit or parking, etc.
Customer Access for Business serving tourism	• cost • modal choice	• air transport • taxi, public transport • AMTRAK	• growing number of leisure travelers
Business Travel	• reliability • speed • comfort • geographic coverage • modal choice • cost	• Amtrak • air • taxi and public transit	• location decisions and business competitiveness affected by road congestion, airport delays, etc.

All economic sectors have some employee access requirements. Nearly all businesses also have some business travel requirements, although the extent and its importance varies by industry and company. Finally, only certain industries have major customer access needs. Based on the results of the industry surveys, the following are some of the observations that

[2]For a more detailed discussion of the transportation requirements and trends, see Phase II Report: Economic Trends and Multimodal Transportation Requirements.

can be made regarding business passenger transportation requirements of the various economic sectors and industries.

Employee Access Requirements

All industries and businesses generate journey-to-work trips, with the only exception being the increasing trend towards working at home by self-employed people and service employees requiring no face-to-face interaction.

Employee access to the work place is perceived primarily as an individual rather than a business issue. Since trips to and from work are not a major business issue, American business concerns are mostly related to responding to access problems or regulations as they arise and as situations to be coped with, e.g., Clean Air Act mandates. This responsive approach is in sharp contrast to the thoroughly analyzed, pro-active effort to reduce freight transportation costs and cycle time.

Industries require access to the skills and size of labor force needed for their business. A business typically doesn't pay for the journey to work of its employees, so these costs do not directly affect the cost of its products. However, companies consider the time, cost, congestion, and ease of access that its employees face when making a site selection. Business considers most carefully the size, educational background and skills of the labor force that it requires, and the availability of residential areas that already have such a labor pool, or that can be attractive and meet the residential location needs of its employees. Similarly, employees consider their commuting costs and travel time in making their decision to apply or accept employment with a company, and in considering their wage or salary requirements.

The labor force requirements of the various industries can then typically be characterized in terms of:

a) Size of the labor pool and mix of skills that can be tapped within a reasonable commuting distance from the industry location,
b) Cost of living and related pay scales in the area, and
c) Other life-style amenities that make an area attractive and can help keep a workforce productive.

The cost, time, and ease of commute is clearly one of the factors that makes an area attractive both for the individual employees as well as for a company. The commuting transportation requirements of America's businesses relate mainly to the availability of public transportation options, ease of intermodal connections, lack of highway congestion, bottlenecks and delays during peak periods, control of highway incidents, parking, etc.

In today's economic environment, growth has been centered in the service sector and the knowledge-intensive, high-technology based manufacturing industries, such as drugs, medical equipment and supplies, biotechnology, electronics, office and computer equipment,

etc. The high technology and knowledge-based manufacturing industries have more flexibility in site selection and place greater emphasis on **access to labor** in their location decisions rather than proximity to raw materials or consumers. Many of the high technology and knowledge-based industries are characterized by their need for high skilled professionals, engineers, researchers and managers. Their location decisions today are affected by such factors as climate, quality of life, and management preferences, all of which are influenced by the overall quality of transportation service. Similarly, the high skill and highly paid segment of the labor force today is more able to move, or to commute long distances (even by air) to be near attractive residential areas, recreational areas or due to family and other personal considerations.

Some of the high technology, knowledge-based industries also have a large requirement for low skill, or unskilled, assembly workers and/or low paid service workers. In many industries, firms require availability of housing for both the high and low paid segments of their work force. In other cases, firms are able to separate their corporate management, research, manufacturing, and service locations, based partly on the importance of housing and other amenities for the first two functions, and low cost labor and housing for the other functions.

For purposes of considering employee access requirements, the service industries can be categorized into three groups:

- High knowledge, information-based services, with high percentage of highly paid professionals (financial and legal services, health care, other professional services, etc.) which can be further subdivided into functions requiring customer face-to-face interaction, and those not requiring significant customer interaction;
- Labor-intensive, with high percentage of unskilled and low skill, low paid, customer-based services (retail, food service, tourism, etc.); and
- Capital-intensive services, also requiring higher skilled labor (e.g., transportation, wholesale trade, communications, etc.).

The need for and importance of employee transportation access of these three groups of service industries are directly related to the size, skill and pay of their workforce and their customer access requirements for face-to-face interaction. In many cases, the first group of services divides its business functions into those requiring face-to-face communication with the clients (front office), and those requiring repetitive tasks and low, or no, interface with clients (back office). The front office functions usually require more highly paid professionals, typically involving face-to-face interaction that also requires easy customer access. For these reasons, financial services, business services and professional services seek downtown, or central, locations in metropolitan areas. Most such business transactions would occur in or around the business centers of metropolitan areas. The end product, whether it is a legal contract or a new, marketing presentation, may require frequent face-to-face communications. The front office side of these service businesses is very sensitive to congestion costs and commuting times for its employees; however, these employees

typically choose suburban or exurban locations with a higher quality of life. Because of their time sensitivity characteristics, most of these workers, with the exception of some of the very large metropolitan areas like New York, find flexibility is synonymous with driving to work. A few of the very large metropolitan areas are unique for the high number of long-distance commuters that use transit to go to and from work.

Many of the functions of the financial service businesses, as well as those service businesses that do not require face-to-face interaction, require repetitive tasks and low interface with clients (back office). These businesses are taking advantage of the lower cost of operating in rural and suburban areas, as well as the advantages brought about by new telecommunication technologies. In most cases, the back office employees have lower wages than front office employees. Many of these employees are less willing to endure lengthy commutes to work. However, some firms also provide the back room employee with flexible schedules that are highly attractive to today's dual income families. Employer-provided benefits, such as free parking and child care amenities, may also compensate for the longer commute of the lower paid employees. The move of the back-room functions, and the growth of service jobs in the suburbs, is substantiated by the trend of increasing central, city-to-suburb commuting pattern on the journey-to-work census data.

Other service industries requiring a high level of highly paid, highly skilled employees have moved increasingly to suburban locations or small urban areas close to recreational areas, particularly in the sunbelt states. This is due to the fact that they do not require frequent local client interaction, but rather access to clients around the nation and the world. This group of service industries looks for quality of life, climate, access to universities and various other amenities in its location decisions. Its employees also prefer to have housing options near to their jobs to minimize commuting costs and time.

The second group of service industries (such as retail and hospitality businesses) requires a high percentage of low skill or unskilled employees. Their sites selection, however, are based primarily on customer access. For example, the retail industry and the tourism industry require quick access to their customer base and compete on the basis of price and location. The retail industry followed the population migration toward the suburbs earlier than most other services. It opened shopping malls in those areas, using cheaper land and gaining access to labor markets willing to trade off lower wages for lower commuting time (such as women with school age children). The employee access criteria of the tourism industry is very similar to that of the retail industry. The food service, hotels, entertainment and related businesses also require good geographical location and access to a large consumer market. In the case of retail and food services, where wages are typically low, they tend to recruit personnel from the same service area where their customers live, so as to minimize commuting costs and congestion-related employee delays.

The third group of service industries, those requiring large numbers of highly skilled, non-professional labor, is more dispersed throughout the nation. Its employee access requirements are not as important to its location decisions. However, these industries also

need access to a labor pool with the skills needed for their business. As is the case with all industries, their employee transportation requirements include low cost, low travel time, low congestion, parking availability and ease of commute. Employee tardiness is an example of a business cost associated with highway congestion or public transportation delays.

It is noteworthy that new communications and information technologies, and other business trends, are also affecting the requirements for journey-to-work trips. An increasingly large number of workers are working out of their homes, thereby eliminating their journey to work needs. Other workers are taking jobs at faraway locations, commuting on a weekly basis by air, while maintaining their main residence at a distant, or out-of-state location, either due to family-personal reasons, or due to preference for climate and other amenities.

In summary, competitiveness issues centered on journey-to-work trips are related to finding an adequate labor supply. The journey-to-work trip is typically not a competitive factor for companies despite the congestion problems faced by many employees, unless it affects the ability to attract qualified employees. Journey-to-work trips are the responsibility of employees; congestion, while unpleasant, is handled by each employee or eventually, he/she relocates or finds another job. Congestion and commute times then affect where people are able to work and the competitiveness of States and local areas to keep and/or attract jobs.

Customer Access Requirements

Customer access is an important competitive factor for consumer and business service industries, which represent an important part of the growing service sector. Access to customers is particularly important for the retail, food service, and other consumer businesses. They need cheap, fast, reliable, non-congested access by as many routes and modes as possible to attract the largest number of customers. Some of the transportation service requirements include:

- Frequent and inexpensive public transportation, with easy intermodal connections;
- Availability of easy, preferably free or low cost parking;
- No congestion in access routes at all hours, particularly easy access during peak periods, better control of highway incidents, and elimination of bottlenecks;
- High reliability of travel time between customers and service outlet locations;
- Direct interstate access or, at least, high, level of service freeway or highway access; and
- Large population and customer access within certain driving distance or travel time, with the size of viable markets for a consumer or business service outlet varying by industry.

Customer access plays a very significant role in locating large, service facilities such as shopping malls that are typically sited near major highway interchanges. However, once a facility is built, access is presumed to be a function of customer choice, unless congestion

affects customer demand levels. Large HMOs, major airports, and some sports/show facilities, address the problem of customer access with shuttle service to remote parking lots or transit stations. Virtually all other businesses end their involvement with customer access with the location decision. In some cases, businesses also provide free/subsidized parking.

The travel, tourism and hospitality industry not only serves local area customers, but also serves out-of-area visitors and international travelers, an increasingly growing and important market segment. To remain competitive with other tourist destinations, this industry depends on easy access from local and faraway regions, as well as from foreign locations. Therefore, in addition to the need for good local access, these businesses have additional customer transportation requirements, such as:

- Fast and inexpensive airport access;
- Fast and inexpensive cruise port access;
- Good access to inter-regional highway network;
- Fast and inexpensive access to Amtrak and other passenger rail services;
- Easy intermodal connections; and
- Easy domestic-international connections, including fast, efficient and streamlined customs processing/clearance, and fast gateway/inland connections, etc.

Visitors on pleasure trips and vacations are generally more sensitive to price considerations than business travelers, and availability of reasonable travel options that do not require excessive travel time is also one of the factors considered when tourists decide what destinations to visit.

Business Travel Requirements

The business travel requirements of American firms are significantly greater for some of the industry groups in the services sector. The agricultural, fisheries and forestry; mining; construction; manufacturing; wholesale and retail trade; utilities; and communications sectors do not generally have business travel requirements as significant as the rest of the services sector, except for the corporate, marketing, finance, advertising, research and other support services functions of those businesses. Typically, those functions are performed at headquarters or regional offices, that are different locations than the field, mine, construction, manufacturing, or retail site.

The service sector business travel requirements are particularly important for the high-knowledge, information-based business and personal services, with a high percentage of highly paid professionals (financial and legal services, other professional services, etc.) requiring customer face-to-face interaction. Large numbers of the employees of these companies are involved in frequent business travel. Companies with multiple manufacturing or service locations and those with international operations typically have large business travel needs.

Industry groups with significant business travel needs include those in heavy construction, international construction, legal services, international consulting, multinational manufacturing, or the international oil and gas business. Many of these companies spend large sums of money on business travel. For some of these companies, business travel is crucial to their competitiveness. However for others, their business scope is so large that the business travel cost is an insignificant component compared to the size of their operations.

All companies with business travel needs require reliability and speed of access to airports and intercity highways for their employee's frequent local and long distance business travel needs. Business travel requirements place emphasis on service and speed rather than cost. Business travel needs include access to:

- Customers for sales calls and marketing presentations;
- Customer locations to provide specialized services, and to finalize legal agreements and financial deals;
- Attend trade shows, seminars and conferences; and
- Meetings to agree on and review business plans, etc.

Business travel by employees to customers or suppliers that result in delays affect employee productivity, as not only is the company paying for the travel costs, but also for the employee's time. Businesses are clearly frustrated with conditions that use employee time unprofitably including roadway congestion, airport delays, poor quality of airline flight information, and customs delays. Speed and reliability of service are particular concerns with overseas flights. Businesses are willing to pay a premium for these services, as in using non-U.S. airlines. The major business travel requirements of businesses are summarized below.

Cost. Generally, the cost of employee business travel is less than 1-2 percent of gross revenues and often much less. For businesses whose primary stock-in-trade is personal service to customers nationwide and/or overseas, costs can be as high as 10 percent of gross revenues and yet, as a pass-through to clients, may not be a significant element of competitiveness. When companies are in competition with foreign service providers, travel cost can be an important competitive factor. In general, predictability of travel time, speed, and comfort are the most important considerations for these businesses.

Geographic Coverage. As noted above, access to highways and in some cases rail or public transportation, can be important in the urban-suburban fringe area. Access to air transportation is also important, requiring direct frequent service to all major markets domestically and internationally. Availability of high-speed rail service in shorter distance markets can also be an important requirement in congested corridors.

Contract Arrangements. Airline travel arrangements are often outsourced to corporate travel agents. Minimizing cost is seen mostly as a matter of getting best use of airline ticket pricing strategies.

Speed. Domestically, door-to-door travel time reliability is in most cases more important to business travelers than sheer speed. However, on long domestic or international trips, travel speed and comfort is most important because of the value of arriving rested and ready to work.

Mode Choice. Business travelers choose modes on a pragmatic basis, looking at available modes that meet their schedule requirements. Where faster rail service is offered, such as in the Northeast Corridor, they consider its use. Where such services are not available, they typically fly for trips over 100 miles and drive for shorter trips.

Customer Service. As noted above, the quality of customer service is important to business travel on longer trips where fatigue and recovery time may affect employee performance on arrival.

5.0 Transportation Industry Response to the Requirements of American Business

The transportation needs of American business described in the previous section emphasized cost as an important factor, but for some growing industries, reliable, fast freight transportation is as important or more important than cost. For passenger transport needs, the requirements include reliability, time and ease of access, cost, geographic coverage, and modal choice.

This section reviews how the transportation industry is responding to the changing needs of businesses. The transportation industry is broadly defined to include: Railroad Transportation; Local and Interurban Transit; Trucking and Warehousing; Water Transportation; Air Transportation; Pipelines; and Transportation Services.

It should be noted that modal distinctions are fast disappearing. Many of the services provided by all transportation companies now include multimodal movements and/or intermodal connections that cannot be identified separately or desegregated using the available national data. Industry trends affecting freight and passenger transportation carriers and services will be discussed first, followed by a review of trends affecting management of transportation functions by American businesses.

A. Freight Transportation Industry

As noted in the previous section, for freight transportation users, service in the form of high reliability, faster transit time and door-to-door deliveries is becoming more important than the fee charged by the carrier. This is particularly true for high-value/lower volume goods requiring more frequent shipments, such as electronic components and apparel, as opposed to lower value/bulkier goods like construction aggregates and waste materials. For the providers of transportation services, including carriers and facilitators such as freight forwarders and customhouse brokers, the pressure will be on delivering those services at a competitive cost and providing services flexible enough to meet their customer's needs now and in the future.

Transportation industry executives interviewed for this study offered the following perspective of what is most important to their clients. Three executives, each representing a different mode (maritime, rail, and truck) were interviewed for this study. These three executives agreed that the most important element of service for a shipper using their mode is a competitive rate. After cost, all three executives agreed that frequency of service (schedule) and reliability (in terms of meeting the schedule) are most important. All three agreed that customers wanted point-to-point service, thus relieving them of the burden to coordinate onward movement of shipments at mode transfer points, and fixing accountability and responsibility with a single transportation provider.

Regarding other factors important to their customers, the transportation industry executives noted that shippers expect goods to arrive undamaged and in correct quantities. All three concurred that this expectation is fundamental. Two things happen when inventory counts are incorrect or goods are damaged in transit. First, the carriers must pay for loss or damage. Second, customers will take their business to another transportation provider.

Transportation industry executives also noted that shippers expect to be provided with information about their shipment's status. Those shippers contracting with outside logistics managers to accomplish their distribution requirements want more information, more frequently than shippers not using third party logistics companies.

Largely in response to changing shipper needs, transportation providers offer bigger, faster and more economical modal and intermodal vehicles, including ships, trucks, railcars and containers, that are designed to improve the connectivity, continuity, and flexibility of the transportation and distribution process. Most of these improvements would not have been possible without some of the revolutionary advances in faster and more accurate communications and information systems, including electronic data interchange (EDI) that enables the shipper to make decisions faster, based on market needs and demands. At the same time, other third party providers—which will be referred as "providers of management services"—such as intermodal marketing companies (IMC), have carved out niches within the intermodal freight transportation business by providing door-to-door services that offer small and medium-sized shippers more personalized services that larger carriers find difficult to provide economically. The next section discusses trends in the relationships between the shippers, the carriers or transportation service providers, and the third parties, or management service providers.

1. Changing Definition and Role of Freight Transportation Industry Players

In any freight transportation move, there are typically at least two players, the shipper and the carrier. Depending on the size of the shipment, the type of cargo movement, the origin and destination, whether domestic or international, the receiver, and other factors, there might be several other players involved. These other participants include additional carriers, and what are typically referred to as "third party agents, brokers or middlemen." In addition, the shipper can also own a carrier, and in such situations, the department within the company in need of transportation service is typically required to use the company-owned or private carrier.

a. Shippers

The **shippers** are typically the originators of the freight, i.e., the business organizations that have a need, as part of their manufacturing or distribution process, to move freight between two locations. Most larger firms have a Traffic, Distribution or Logistics department that has the responsibility for the transportation function within the company. This internal department decides how the freight transportation needs of the firm are met, whether by operating its own private vehicles or by selecting outside carriers, middlemen, or other contractors to provide the transportation service. A recent trend is towards shippers outsourcing the transportation and logistics function to a Contract Logistics Services firm that performs the functions that have traditionally been the responsibility of the internal Traffic, Distribution or Logistics department.

b. Carriers

The **carriers** are typically companies that provide basic transportation service. Until the 1980s, most transportation carriers were modally oriented, i.e., they provided trucking, railroad, maritime, or air cargo services between various locations on their network or route system. Carriers now provide a variety of intermodal services (involving rail-truck, sea-truck, sea-rail-truck, sea-air, air-truck, and other combinations) through their own facilities and equipment, or through partnerships and alliances with other modal carriers.

c. Third Parties, Agents, Middlemen or Intermediaries

There are many different types of **middlemen or intermediaries** that arrange transportation and other "value added" services for a shipper (e.g., drayage, documentation, insurance, tracing, etc.) or market the services of a carrier. The number of third party categories and firms providing such middlemen services in each category has expanded rapidly since deregulation. There were many historical and legal distinctions between the various categories of middlemen that evolved from mode-specific regulation. Most of these distinctions have now disappeared. Today, there are basically two types of middlemen, those **marketing-oriented** acting as **sellers, agents, brokers or intermediaries**, and those **operations-oriented** acting legally as a **carrier**, who take legal responsibility for the cargo, assume liability for the transportation of a shipment, consolidate shipments, and typically contract with carriers for the transportation service. In some cases, middlemen firms have become carriers (such as the many air freight forwarders that became carriers after deregulation).

2. Freight Transportation Industry Trends

Recent trends and the status of carrier responses to shipper needs will be discussed in the following paragraphs first by mode and then for third party, intermediaries, facilitators or management service providers. There are a number of critical issues and challenges that shippers as well as carriers and transportation intermediaries are addressing to meet competitive pressures within the industry as well as to better serve the user.

a. Airlines

Most of the freight that moved by air during the early years of the airline industry was carried in aircraft designed to carry primarily passengers. There is still a significant amount of air cargo that moves in the bellies of wide-body passenger aircraft. Increasingly, though, passenger airlines have chosen to emphasize their core passenger business, leaving the cargo business to the air cargo carriers. There are essentially only a limited number of major air cargo transportation systems: air express or overnight, all-cargo and air/sea.

An example of a relatively new, fast growing, transportation service industry that did not exist until the mid 1970s is the package express and overnight delivery service, or what has also been referred to as the "integrated air carriers." This innovative industry was made possible by deregulation and new technology. Federal Express is now the largest freight carrying airline in the U.S. (as measured by ton-miles or revenues). However, its services are best described as guaranteed delivery transportation, since more than half of its freight moves only by truck. Led by Federal Express, this relatively new industry has expanded to include a growing share of domestic and international cargo. U.S. companies have a leading position in this industry worldwide, although they are facing increasing competition from European and other regional carriers. Overnight delivery by integrated air carriers, utilizing air and truck services, has revolutionized the distribution of legal and financial documents, materials and products. It has extended the market reach for service delivery and goods-producing industries and allows fast parts replacement and catalogue sales anywhere in the U.S. or even overseas (e.g., LL Bean to Japan) from one location.

Some of the best known examples of air express or overnight service providers include Federal Express, United Parcel Service (UPS), United States Postal Service (USPS), Emery, DHL, and Airborne Express. All of these carriers, except for UPS, use air and highway intermodal operations almost exclusively for these services. UPS, because of its extended distribution network, often uses rail on certain routes and for packages that can travel two or more days. These services not only offer fast transit time to most places in the world, but also reliable service in terms of schedule and security of final delivered product.

b. Railroads

In 1993, the railroad industry recorded a new high for freight traffic. Coal, grain, and chemicals are the major commodities shipped by rail. However, intermodal, railroad traffic has risen from 3.1 million trailers and containers in 1980 to 6.7 million in 1992. This rapid increase is due mainly to the introduction in 1984 of specialized railcars that carry double stacked containers. The double stack efficiencies have made it possible to move containers from the Far East through the West Coast ports to inland destinations and to the East coast, reducing delivery times compared to all-water routes and carrying export and domestic traffic on the backhaul. Double-stack cars now account for approximately 40 percent of total intermodal capacity.

Since 1975, shippers using the nation's railroad services have seen the industry decline from 67 to 10 Class I carriers today. From the perspective of the shipper, it can be said that reduced competition could result in oligopolies, and even one or two monopolies in certain regions of the country. On the other hand, a once-fragmented industry could be in a position to offer more unified regional services based on better-coordinated schedules and related services. For the customers of Intermodal Marketing Companies (IMCs; transportation coordinators for shippers who use rail as the primary mode), this will offer a single regional service, faster and more reliable transit times, more efficient use of routes, rail cars and cargo handling equipment, larger and faster throughput of intermodal rail yards, and improved communications between shippers and carrier.

On the other hand, it can be argued that if these rail mergers continue, there is the possibility that shippers could have only two or three large nationwide networks instead of the present two in the western states and the three large networks (soon to be two also if the Conrail-CSX-NS agreement is approved) in the east to choose from to meet their rail-related transportation needs. To prevent monopoly pricing situations that would affect the competitiveness of captive users of rail services, some shipper organizations are calling for safeguards or alternatively, some kind of *re-regulation* of the railroad industry.

The rail industry is considering other improvements to reduce its costs and improve services. One such initiative is the sharing of equipment between rail carriers to gain maximum utilization of those assets. These equipment-pooling agreements—sometimes referred to as improved asset management—are already in place involving Conrail, Norfolk Southern and the newly merged Burlington Northern-Santa Fe. For the shipper, this could mean more cost-effective placement, loading, transit, unloading and release of intermodal containers and trailers. For the carriers, it has the potential of improving equipment utilization, maintenance and purchasing/replacement programs for intermodal containers, trailers and transfer and storage yards.

Reliability of service by the rail industry is greatly dependent on the condition of the rail carriers' infrastructure. After decades of neglect, poor service by the railroads often led to loss of customers where customers had a choice of alternative services, or the businesses had moved or closed because of the lack of such alternatives. To win back customers, and possibly attract new ones, the railroads have in the past decade and a half spent billions of dollars to improve their infrastructure to provide faster and more efficient services, including intermodal. This includes improved tracks, crossings, faster intra-line and inter-line rail yards including intermodal, and equipment handling and inspection systems to spot equipment damage faster and more reliably.

c. Trucking

The U.S. trucking industry handled about 78 percent of the total freight market in 1993. Trucking services comprise several broad markets: truckload (TL); less-than-truckload (LTL); and small package. Until recently, long-haul LTL carriers competed only against other long-haul LTL carriers. Today, truckload carriers are cutting into the LTL market by accepting shipments as small as 6000 pounds, compared to the historical minimum of 10,000 pounds. On the other end, small package companies are raising their maximum weight limits to 150 pounds from 70 pounds. Air carriers also handle at least half of their heavy freight entirely by truck.

Trucking firms compete, to a limited extent, with barges and ocean carriers, but primarily amongst themselves and with railroads and airlines. As reported in 21st Century Trucking, trucks account for the largest share of the total domestic freight market (43 percent of tonnage and 83 percent of revenue in 1991). Trucks are expected to continue to handle the largest share of freight in the future, although losing some market share to air freight and intermodal.[3]

Short-haul and less-than-truck load highway carriers are perhaps, because of geography and lower volume types of shipments, often seen as the biggest obstacle to overcome when it comes to working with shippers and with other ocean, rail, over-the-road carriers, and transportation facilitators such as IMCs. Most of the problems lie with lack of more sophisticated communication systems between these smaller carriers and their larger modal and intermodal partners. To deal with this challenge, trade organizations like the Intermodal Association of North America are in the process of standardizing the EDI systems used by these carriers. As a result, a shipper should be able to know almost instantly where the cargo is and which carrier had it, has it now, or is next in line to receive it.

ATA Foundation, 21st Century Trucking, pII-3.

Another area for improvement is the motor carrier drayage industry. These are carriers that haul intermodal containers and trailers for generally short distances between the point of origin (factory, warehouse, storage yard, etc.) and a marine terminal or other intermodal yard. Because these carriers tend to be regional or local, their level of investment in modern equipment, especially communications, is often limited. Furthermore, many of the drayage movements have two or more different operators at each end of the move. To resolve the inconsistency of service that often results, it is reasonable to expect that many of the drayage carriers will form their own type of consortiums or partnerships to improve both communications and reliability of service for the shipper.

Ultimately, however, most truckers will have to enhance their vehicle and freight-tracking capabilities through satellite-based or other similar communications networks. This information will then have to be transmitted to shippers, IMCs and other carriers involved with the entire transportation process.

d. Steamship Lines

The U.S. water transportation industry consists of steamship lines involved in deep sea transportation, as well as services that move cargo through lakes and inland rivers. During 1990, the last full year for which data was available, the industry employed 177,000 persons and contributed $10 billion to GDP.

For deep sea transportation, rising trade volumes are expected to lead to a stronger performance and higher demand. U.S.-owned steamship lines face competitive pressures from foreign owned lines, and as a result have been involved in mergers or strategic alliances. For domestic shipping, long-term improvements will depend on the movement of additional tonnage that could result from the resolution of current agricultural subsidy disputes with U.S. trading partners and increased coal exports. NAFTA will have a positive impact on the inland waterways industry because North-South shipments of grains, oils, and steel will likely flow on the Mississippi River system. However, declining domestic petroleum production, and reliance on pipelines for petroleum movements would have a dampening effect on the growth of the domestic segment of the industry.

Shippers are always looking for the lowest rate and the most efficient method of transporting their cargo. The ocean containership industry has met that challenge by building larger and faster containerships. The shipper could be the winner, but only if the rest of the transportation and distribution chain is able to make equally impressive cost-effective changes, particularly at the intermodal connecting points where two or more modes meet.

Available data on vessels on order demonstrate the trend towards greater use of larger vessels. A total of 38 post-Panamax (larger than can use the Panama Canal) vessels

are in operation, 54 are on order and the construction of 27 additional vessels is under consideration. In addition, 60 Panamax size (maximum size that can transit the canal) containerships are on order, and 21 more will probably be ordered in the next few years.

Unless the entire transportation and distribution system enjoys equal economies of scale in its operations, the advantages gained from the larger ships will not be fully realized. For example, Maersk Lines' *Regina Maersk*, the first of this type of fifth generation containership, will carry the equivalent of enough containers, that, if lined end to end, would stretch the entire length of Manhattan Island. This volume of containers will place a great strain on marine terminal operations.

Furthermore, these vessels will require channel and berth areas that have depths in excess of 45 feet, about 10 feet deeper than is available at most of the world's larger container ports. Not only will the larger vessels affect port and carrier financial resources, but they will strain marine and other local intermodal handling facilities in terms of container processing, storage and throughput.

To accommodate the requirements brought on by bigger, faster ships, some of the largest carriers are building marine terminals that incorporate the latest in intermodal concepts and technologies. APL, for example, is constructing an on-dock rail operation designed to improve the cost efficiency and reliability of intermodal transfer operations. Other terminal operators, some of whom may or may not be connected directly to one of the carriers, are developing and operating what could be considered the so-called "seamless terminal." These terminals allow the container to move directly off the ship and out the front gate without stopping along the way in the terminal, based on pre-clearance of documentation via EDI. This form of just-in-time (JIT) type of movement parallels very closely what is already becoming the standard for cargo shipments in other parts of the logistics chain.

Conventional containerships can still take advantage of existing facilities. Niche carriers, with more traditional-sized vessels (2,000 to 4,000 TEUs), will continue to call at ports that are not capable of handling these very large containerships. This is especially true on trade routes that need to cater to customer requirements for more frequent and smaller-volume shipments. Meanwhile, the potential exists for faster, but smaller containerships, such as FASTSHIP, capable of crossing the North Atlantic in three and a half days. For the shipper, this could mean a reduction in inventory time and cost, especially important for high-value products such as apparel, electronic components, and automobiles.

Containership carriers are also looking at combining or sharing operations and other activities to reduce operating costs through mergers or the development of consortiums and partnerships. These working agreements include sharing vessel space, marine terminal facilities and equipment, and marketing staffs to reduce

duplication of assets and operational costs. In terms of price, however, they would still compete with each other. These consortiums and alliances are in direct competition with carriers that compete independently or are members of the now-threatened conference system, that was originally established to stabilize vessel-use and avoid ruinous competition. For the shipper, these agreements have very little effect on the actual movement of the cargo because the carrier and the bill of lading that it issues will control the level of service and reliability.

Some of the recent announced mergers include APL and NOL as well as Lykes and CP Ships. A prime example of a partnership or alliance agreement is the one between SeaLand Services and Maersk on some of the largest trade routes, such as the transpacific and transatlantic. Another example is the so-called global alliance of APL, MOL of Japan, Nedlloyd of the Netherlands, and OOCL of Hong Kong (which is being restructured in view of the APL/NOL merger and the P&0/Nedlloyd mergers). Through these agreements, partners coordinate vessel space, ship sailing—often in the form of increased frequency and direct port calls—and the use of port terminals. For the shipper, however, the only carrier they have to deal with is the carrier who issued the bill of lading or contract for services.

e. Intermodal Freight Transportation Facilitators (Intermediaries, Third Parties or Middlemen)

Modal and intermodal freight transportation services for domestic and international shipments are also sold by facilitators such as IMC, freight forwarders, Non Vessel Operators Common Carriers (NVOCC), brokers and agents. Depending on their customer base, these facilitators are entering expanded lines of services such as contract logistics or integrated transportation management or logistics functions of shippers. In some cases, they become an actual partner with their client or customer, replacing former traffic management functions with a new team of specialists.

Although logistics companies increasingly act as freight coordinators for major manufacturing firms, they usually do so for only specified lines of products. In such cases, the rationale is that the required services are so specialized that outside logistics management can provide the service better since the special skills are not readily available in-house. Therefore, the need is to step outside the corporate structure and hire a specialist.

3. Freight Transportation Technology, Information and Communications

The discussion thus far has focused essentially on what are some of the trends in how the transportation industry operates and relates to its customers. Two other trends are particularly revolutionizing the industry and creating opportunities for better customer service, i.e., technology and information/communications. New and innovative uses of

available technology are creating opportunities for new services that provide less costly, faster, and/or more reliable transportation.

The container revolution, the development of double stack technology and the new information handling and interchange systems are the most significant technological breakthroughs in freight transportation over the past few decades. Future technological developments are likely to produce:

- New state-of-the-art facilities with modern methods of cargo handling or container interchange that reduce intermodal transfer time and cost and facilitate "seamless" intermodal moves,
- Systems and equipment that increase the capacity and speed of line-haul moves, and
- Further developments to facilitate/expedite information exchange.

a. Cargo Handling and Intermodal Transfer Technology

Until the past decade, intermodal facilities were mostly old rail yards, not specifically designed for rail/truck transfers. Many were unpaved, located in inaccessible areas, and without adequate mechanized equipment for container handling. Over the past 10 years, railroads and ports have taken the lead in developing modern intermodal terminals, with state-of-the-art equipment for efficient intermodal transfers.

Improvements in container handling technology are also greatly facilitating intermodal movements. Planning, research and development are underway that could result in further improved facilities and technology for cargo handling and intermodal transfer.

To be able to handle the larger container vessels, steamship lines and ports are developing new container terminals with greater automation to be able to expedite the transfer of containers from the bulkhead to the container yard and the entrance/exit gate. Both Los Angeles/Long Beach and New York/New Jersey are planning projects to further facilitate vessel-rail transfers at their port complexes.

Work has also been underway on the use of automation and robotics in transportation for functions such as cargo loading and unloading, and vehicle maintenance and repair. Container cranes with semi-automation capability are in operation in Norfolk and Baltimore. Automatic Equipment Identification is being used for various applications, such as tracking rail equipment and transfers at terminal gates and yards, providing the ability to produce a paper less equipment interchange report. Barcode scanning technology also may have potential application in the automation of cargo handling and transfer.

b. Line-haul Systems and Equipment

Innovations in equipment and line-haul modal systems have the potential to increase the speed, reliability, capacity and productivity of the existing transportation system. The following are examples of the many technological innovations, or new systems, that have been under development, in early use or in the planning and discussion stage:

- Greater use of automatic train control systems,
- Intelligent Transportation Systems,
- Longer Combination Vehicles and/or separate truck highways,
- Innovative equipment, e.g., Roadrailers,
- New vehicle technologies (ship, railcar, truck and aircraft) with greater speed and/or increased size, and
- Automatic toll collection technologies.

Norfolk Southern has been operating Roadrailer equipment under its "Triple Crown" service, using a trailer with the capability to travel on road or rail for the past few years. The major users are the automobile manufacturers. NS sees this type of equipment as most advantageous on routes without adequate double stack clearances, or those with lower lane densities.

Some of the new technologies to achieve significant increases in productivity and capacity are readily available. However, some of these innovations require significant financial resources. For some of these options, many regulatory, market and institutional obstacles would have to be overcome.

For new and emerging technologies, development will most likely take place at different rates of change. Changes in the hardware (vessels, railroads and trucks, intermodal handling equipment and terminals, etc.) will be incremental. There will be exceptions, such as the Iron Highway and the Fastship. Container and other intermodal vessels, especially of the roll on-roll off (RoRo) type, will become larger and more numerous on trade routes where they could not have operated economically before. Navigation systems will become more accurate and cheaper, thus making them more widely available. Planes will be designed and operated to accommodate intermodal equipment more efficiently. Rail cars and trucks will be lighter, longer and stronger to carry a greater variety and volume of cargoes. What is most likely to happen is continued tinkering with existing equipment to make it more efficient in terms of both operations and cost. However, at the present time, nothing visible on the cargo equipment horizon could match or replace what the container has done to transportation and logistics management.

c. Information Exchange

Complementing the advances in cargo handling and line-haul modal systems,

advances in information technology have the potential to further improve the service levels carriers are able to offer shippers as well as continue to improve the operational efficiency of transportation companies. Carriers have been adopting Automatic Equipment Identification systems that permit the identification of individual rail cars and containers as they transit pre-established locations. Satellite positioning systems such as GPS are also being used or proposed, that will provide additional tools with which to monitor and manage transportation flows over long distances. Precise tracking of shipments will enable management to better utilize human resources and equipment as well as allow transportation companies to track shipments as they are handed off to other transportation modes or carriers. Automatic toll collection systems and automatic vehicle identification (AVI) systems also have potential application for toll highway operation and truck location monitoring.

Transportation providers are now able to monitor equipment and shipments on a real-time basis and at the same time share that information with shippers and logistics contractors. In addition, requests for equipment and shipment orders can be received faster and responses generated more to quickly provide accurate information about equipment or space availability. Shippers, carriers, and intermediaries can all be kept informed about booking and payments, scheduling and tracking terminal operations, in-transit monitoring (including change of destination and sometimes ownership of the cargo), and improving accountability of the entire transportation process from origin to destination. Technologies such as EDI (Electronic Data Interchange), satellite communication systems, facsimiles (fax), and, more recently, e-mail and the Internet have increased volume, quality and speed of information about transportation alternatives and capabilities, as well as inventory management.

4. Other Trends Affecting the Freight Transportation Industry

As the transportation industry responds to changing demand and service requirements, several other trends affect its services, e.g., the standardization of equipment, the implication of increased international trade on regulatory policies, and the demand for broader services and geographic coverage that one carrier alone can meet.

Standardization of equipment offers opportunities to eliminate empty backhauls. For example, rather than return an empty container to a port, a steamship line or railroad can fill it with domestic cargo and generate additional revenue. The integration of international and domestic equipment pools offers the opportunity to balance export/import moves with domestic cargo, and minimize any imbalances in various foreign trade routes and domestic lanes. One of the keys to carrier profitability is the ability to manage equipment to minimize empty backhauls and maximize the utilization of the equipment for revenue generation.

Even though international standards govern the transportation industry, there are many differences in regulations regarding allowable equipment, maximum weights, clearances,

etc., between various countries and regions of the world. As American companies increasingly ship their products to foreign markets, the transportation industry has attempted to utilize the same type of equipment that is used domestically.

However, the latest transportation technology, e.g., double stack railcars, high cube containers, long and wide truck trailers, are not as widely used in Mexico, Canada, and other foreign countries as in the U.S. Many of these types of equipment are not allowed in some countries, reducing flexibility for U.S. companies and carriers. Not only is the most efficient American equipment not widely used in the less developed nations of Africa, South America and Asia, but they are also not widely used in Europe, Japan, and other developed countries in Asia.

At the public policy level, governments--local, regional, and national--will need to take another look at existing transportation and commercial regulations and evaluate them in light of global demands for improved transportation and logistics operations, as well as multinational company operations. This includes new legislation that supports better accessibility and integration between the modes, and the recognition that whatever rules and regulations are implemented must take into account the global environment within which companies increasingly operate.

The growth of partnerships and alliances in the transportation and logistics industry, such as operating agreements and consortiums, is based on the idea that each partner should do what they do best as part of the transportation and logistics process, but also recognizes that one carrier cannot meet all the increasing needs of shippers. The objective of these alliances is to develop new approaches to doing business, improve services at a price that is both cost-effective and competitive, and create niches in an arena where customers demand broad services, global geographic coverage, and ability to handle small or large volumes as markets shift.

B. The Passenger Travel Industry

Airlines

Following deregulation in the late 1970s, the U.S. airlines, emphasized passenger services. Buffeted by major financial losses in the late 1980s, the major carriers have struggled recently to regain profitability and develop long range stability. This is being accomplished by limiting new aircraft orders; negotiating major labor agreements with unions to lower unit costs; and establishing more reasonable yields and a more stable fare level. New carriers have continued to enter the airline marketplace, offering low fares, and keeping competitive pressures on the more established, large carriers. Internationally, U.S. airlines continue to face increased competition from foreign flag carriers, that in many areas enjoy government protection and financial support. The trend towards privatization of airline services by foreign countries has continued, and eventually, should help increase the competitiveness of the U.S. airlines.

To remain competitive, the major airlines are using new, more efficient aircraft (such as the Boeing 777) in larger markets, or smaller aircraft (such as the Boeing 737 or commuter aircraft) in markets with low demand. Besides pursuing cost reduction strategies, the major airlines have been emphasizing marketing initiatives to attract higher paying business travelers, through frequent flier programs, on-board telephones, and other service enhancements. Some of the newer airlines also serve the business traveler, although most of them emphasize the more price-sensitive leisure market. In general, as the major airlines face increasing competition from lower fare carriers, amenities (e.g., meals) have been reduced.

Business travel is the most important market segment for the major airlines and most of the regional carriers. The availability of frequent non-stop service is an important factor that affects service companies in certain industries, such as broadcasting, financial services, consulting, etc. Some services, such as the US Air and Delta Shuttles between Washington National Airport, Boston Logan and La Guardia in New York, serve primarily business travelers.

Internationally, U.S. carriers have extensive routes, many of which are dependent on business travelers. In the North Atlantic, the world's most important long-distance travel market representing about 22 percent of international air passenger scheduled capacity in 1992, premium services oriented at the business traveler have been attracting a lower share of total passengers (the proportion fell from 19 percent to 16 percent from 1989 to 1992). In 1992, U.S. carriers handled 48 percent of total passengers in the Europe-USA routes, down from 50 percent in 1988. All U.S. major airlines have entered into alliances with European carriers to increase their global coverage (e.g., American-British Air, United-Lufthansa, Northwest-KLM, Continental-SAS-Air France, Delta-Swissair). Besides network coverage, the driving force behind these alliances is to provide mutual traffic feed.

U.S. policy has been to open more of its airports to foreign carriers and allowing more U.S. airlines to provide non-stop service to international markets, following up on the same policy of open market access to any U.S. carrier for domestic services. Some countries have agreed to the open-skies policy, while in other cases, bilateral disputes remain, and capacity constraints are in effect that limit non-stop services.

Amtrak

Amtrak operated over 25,000 miles of track with 220 trains per day in 1992. Although Amtrak operates nationwide, the bulk of its business both in terms of revenue and traffic volume, comes from the Northeast Corridor, the heavily populated area from Boston to New York to Washington. Almost half of Amtrak's passengers in 1992 traveled along the Eastern seaboard. Another heavily used service is along the Los Angeles to San Diego corridor.

Business travelers typically travel by air because they are most concerned with fast travel time. The only exception where rail attracts significant numbers of business travelers is along heavily congested relatively short-distance corridors, such as Washington-NY, where travel time by rail is competitive with air travel. Amtrak has captured 45 percent of the combined air-rail market in the NY-Washington corridor, offering its Metroliner service traveling at 125 mph, aimed primarily at

business travelers. The Amtrak Metroliner service allows employees to make maximum use of "downtime" travel time, while allowing companies to reduce their travel costs. Amtrak's Metroliner offers reserved seating, free newspapers, refreshments, and on-board telephones.

Highway Business Travel

Most business travel in the U.S. involves only highway travel on a company owned, taxi, rental car or private automobile, particularly for urban area and relatively short intercity trips. Although increasing congestion is a problem in major metropolitan areas, the lack of any practical alternatives means that business travelers will continue to travel primarily by car. Many large companies, with a requirement for a large fleet of vehicles outsource the management of their fleet to companies that specialize in these services (e.g., PHH which became part of HFS).

American business considers passenger transportation systems for employees and customers to be acceptable. There are frustrations, especially with roadway congestion, but they are not considered cause for switching passenger travel modes. Businesses would like to see a number of improvements in travel conditions to increase time-utilization of employees. They are also paying increasing attention to transportation access when locating facilities, especially in transition zones between downtown cores and suburban areas. This is particularly true of service organizations that need both clerical and professional staff.

Travel Management and Agencies

In 1992, there were 42,000 travel agencies in the U.S. The top 25 companies were estimated to account for 72 percent of the total travel market. For most agencies, airline ticket sales is the main source of revenue. Agencies are facing reduced commissions from airlines that are looking at ways to reduce their operating costs. At the same time, they face the threat that an increasing share of their business may bypass them, as airlines introduce new sales outlets. US Air has introduced ticketing machines at major airports and at grocery stores, and on-line travel information and reservations systems are accessible through business PCs (personal computers) and home computers. Some airlines have also introduced ticketless travel, so the passenger no longer needs a ticket, and can simply get a boarding pass based on a confirmed reservation. The airlines have also reduced commissions they pay to travel agencies recently, first instituting a cap for domestic tickets, and then also reducing the commission rate. Eventually, some observers believe the role of travel management companies will evolve, with service fees as the main basis of revenue.

In recent years, many mid-sized retail agencies have lost their most important corporate accounts to the industry's giants, which have obtained contracts with major corporations consolidating all their travel arrangements in one single agency. The travel agency business is then consolidating further (by mid-1995 there were 33,500 agency locations, 3,200 owned by American Express, the largest travel management company in terms of sales volume after its merger with Thomas Cook, and about 4,000 locations are owned by Carlson Wagonlit). As automation and volume become even more important factors in retaining business, consolidation of large travel agencies is continuing. To

protect themselves against the growing power of the large agencies, smaller independent agencies have formed consortia, cooperatives and other marketing partnerships.

By creating large mega-agencies or consortia, agencies can take advantage of volume purchasing, offer better prices to their customers, enter into preferred relationships with suppliers, and obtain negotiated commission overrides. As of 1994, 59 percent of independent agencies belonged to some retail marketing entity. In 1994, 92 percent of agency locations surveyed by the American Society of Travel Agents used an airline-owned Computer Reservation System (CRS) to process bookings.

Large corporations with significant business travel requirements have increased their demands for reporting capabilities, low rates through software that ensures that the company's travelers always get the best fares, guaranteed savings in the company's travel budget through travel management services, and convenient service, such as ticket delivery and airport transportation.

C. Trends in Management of Transportation Services

As the U.S. economy becomes more service-oriented and more integrated into the global economy, shipper requirements have increased. Shippers now require a greater variety of services to meet more specific needs. Typically, businesses have different groups responsible for passenger and freight transportation requirements.

Passenger transportation requirements are usually handled by administrative groups that have responsibility for employee and customer parking. Traditionally business travel needs have been handled by a separate department in many large companies. With deregulation, efforts to downsize administrative functions, the large number of travel options and the complexity of the fare structure, most companies are eliminating their in-house travel departments. These functions are now mostly outsourced.

Similarly, freight transportation requirements had been managed primarily by in-house logistics or transportation departments. With deregulation and the trend to downsize, most companies have reduced their in-house staffs and in some cases, their private fleets, and emphasis is shifting to outside, contract, logistics vendors.

Shippers have demanded higher service levels, including greater flexibility from carriers and other service providers, at lower prices. For many firms, transportation costs can define the economical reach of their products or services in the global marketplace. An efficient transportation, logistics and distribution system can increase the market for a product or a service, thereby achieving economies of scale that result in increased competitiveness and profitability. Careful management of inventory and distribution, with reliable delivery of in-transit goods reduces on-shelf inventory needs. When demand suddenly changes, businesses can adjust production resources faster. Logistics can then also have a significant influence on the national economy, reducing the length and severity of a recession.

The trend then has been towards outsourcing and changes in management's approach to the control of transportation costs and services. An increasing number of firms have contracted out these services, including arrangements with travel agencies for business travel needs, as well as contracting out freight transportation and logistics services. As documented by Armbruster (1995); Bingham (1994); Coyle (1994); Green (1995); Johnson (1995); and Shafran (1992) the major trends in management of the transportation requirements of American businesses in the U.S. include the following:

- Quality Management,
- Limited or Single Sourcing,
- Outsourcing Integrated and Innovative Logistics Management Services,
- Global Coverage and Management Capability,
- Equipment Condition and Availability, and
- Information Exchange Capability.

These requirements will be discussed in the following paragraphs.

Quality Management

Shippers and consignees who are suppliers of, or practitioners of, "lean manufacturing," or "just-in-time" concepts for inventory management are demanding a high quality, more customer-oriented management approach from the transportation service industries. In the past, a freight transportation move might involve several carriers and agents, making it sometimes difficult to manage the move and assure reliable delivery.

The widespread dissemination of Total Quality Management (TQM) principles in American business culture has encouraged businesses to expect and demand more from the freight transport provider. Higher shipper expectations and the demand for more consistent service are prevalent. The distribution pipeline has become a major focal point of the TQM programs because ultimately it is the customer's perception of quality that is most important. In many cases this has meant providing for customer demands within relatively narrow time frames. The rapid growth of the express package shipping services such as Federal Express, UPS, DHL, Roadway Package Service, and Customized Transportation, and their use of trucks, aircraft, and tracking systems and careful management of each move, are examples of the significance and importance of quality management of transportation moves to American business. A high quality transportation, logistics and distribution system offers the potential to increase economies of scale resulting in increased competitiveness and profitability.

Limited or Single Sourcing

Firms have sought to outsource their business travel and freight distribution activities in order to reallocate their resources toward their core business. They can make significant cuts from their cost stream, redeploy capital (by not financing truck fleets and buildings for warehousing and distribution purposes), and focus on core competency. The trend has also been for large companies to use one or two large travel agencies for their business travel needs.

For freight users, third-party transportation companies have emerged to fulfill a range of distribution and logistics functions including trucking, warehousing, billing, inventory management, and fleet maintenance. Some rail, truckload and LTL firms, in particular, have diversified to provide such services; newly created logistics firms have also formed to serve a market niche (e.g., Kleinschmidt Associates translates bill formats and checks their completeness) or tailor a service to a firm's specific needs.

Some shippers are seeking to diminish the number of carriers in favor of long-term agreements with single suppliers, or a limited number of such providers, for delivery of a requisite service level at a negotiated price. These long-term service relationships are frequently developed with carriers, logistics firms, and third party agents. For the shipping firm's logistics manager, the anticipated benefits of such arrangements include special services such as the ability to monitor traffic operations and rate incentives. Carrier firms are willing to make a commitment to deliver greater reliability and on-time performance in exchange for the shipper's commitment to concentrate its business. Where such relationships can be established, carrier firms have added advanced systems to provide real-time tracking for shippers such as GPS and land-based mobile communications. Such partnerships enable carriers to improve the utilization and productivity of their equipment.

Shippers are increasingly purchasing transportation service from companies that offer broad services, particularly door-to-door services and multimodal options. Even though in many cases the costs are higher, shippers recognize that it also costs something to manage the intermodal connections. Companies with time-sensitive or special products, that put a premium on service, typically see no other way to move their cargo than door-to-door.

Outsourcing Integrated and Innovative Logistics Management Services

Central to businesses' acceptance of outsourcing of services has been a drive toward greater productivity and closer examination of the entire production and supply chain, as well as the administrative functions. As companies face growing competition domestically and globally, efforts have increased to get total freight logistics and business travel costs down and achieve better returns on assets.

For business travel needs, as already noted, most functions are being outsourced. In cases where a company has large needs, in-house travel departments are being run by separate companies specializing in the travel business, such as travel agencies. The large travel agencies negotiate arrangements with businesses to set up specialized units within the client offices so as to provide the required quality and timely service tailored to each user.

For freight transportation, the emphasis is on total distribution costs and the reduction of inventory expenses, not on the cheapest transportation service. Reliability and fast transportation service are key elements to achieve these objectives.

Inventory is one of the largest assets held by many companies. If a company can expect consistent, fast, reliable transportation service, it can take steps to reduce inventory levels, redeploy assets and reduce costs.[4]

Partly as a result of transportation deregulation and the reduction in shipment delivery time as well as the increased reliability, American businesses reduced inventory levels from about 26 percent to about 20 percent of final sales from 1980 to 1989. It has been estimated that this reduction in inventory levels resulted in an annual savings of about $30 billion by the late 1980s. Inventory savings during the 1980s are actually estimated to have been close to the total freight transportation savings during the period, resulting from reductions in rates and increased competition.

One of the most important trends in manufacturing and trade is the emphasis by many businesses on "Just in Time" (JIT) delivery. Increasingly, manufacturers, retailers and service providers are carefully scheduling deliveries so that parts or supplies arrive when needed.

The proliferation of JIT practices by manufacturers and retailers has led to smaller and more frequent shipments emphasizing reliability. One consequence of JIT has been additional freight transport demand, particularly upon highway systems. Shippers/agents requiring reliable delivery times for their JIT systems have not widely accepted rail intermodal, despite rail intermodal's generally perceived cost advantages on long-haul freight.

Reducing total logistics costs involves a nearly continuous concern for the productivity of all the firms' assets involving transportation and warehousing. Analysis of the entire supply chain requires careful review of the warehouse function and how it is being operated externally and internally. External factors include global networks, third party sourcing, and technology. Internal factors include the firm's design and performance of basic roles: holding stock, material consolidation, order assembly, point of sale tracking, use of technology and automation, inventory control and shipping. The objective of both is reductions in service time and cost.

Logistics managers for multinational firms also widely accept the need for outsourcing of the transportation and logistics functions. The downsizing of firms that has occurred in many companies has resulted in fewer staff dedicated to logistics functions, including transportation, inventory management, warehousing, order processing, and billing. The logistics and transportation function has often been a primary area for cost reductions to be implemented with fewer staff. Logistics managers are feeling intensified pressure to constantly reconfigure their operations to squeeze every possible efficiency out of the international supply chain; in some instances the department is essentially eliminated and the function is outsourced to a third party in whole or in part. The following paragraphs describe the historical background for the rise of outside logistics management services and its implications.

[4] Trends in Logistics and U.S. World Competitiveness, Robert V. Delaney, Transportation Quarterly, Vol. 45, No. 1, pp. 19-41.

a. Definition of Logistics Management

Historically CEOs, CFOs, and other top-level corporate managers have paid little attention to the manner that raw materials arrived at their plant, or to the manner that they transported their finished products to the market place. The cost of transportation was seen as "a cost of doing business." Consequently these executives paid little attention to actions they might take that could reduce their costs and increase their bottom line. Instead they concentrated their drive for improvements on that part of the manufacturing process that they could directly influence, i.e., the production line.

Although efforts will continue to be made to improve manufacturing processes, such as lean or Just in Time Manufacturing, improvements to production lines are, for the most part, limited to those that come about due to some technological breakthrough, e.g., the use of robotics on automobile production lines. Companies have also increasingly turned to the supply and transportation side of their production and distribution processes to improve their competitiveness.

Examination of supply operations proved to be a fruitful area for savings. If a manufacturer can downsize, or even eliminate, warehousing operations for raw material and parts consumed on the production line and eliminate warehousing for finished products awaiting shipment to the market place, there are savings in infrastructure (buildings and furnishings), equipment (material handling equipment), personnel (who operate the warehouses), and inventory-on-hand required to feed the production line and the market place. However, reductions in such areas create a tremendous pressure on transportation to keep everything moving. The pressure to keep everything moving requires an enormously complex matching of information, transportation capacity, and production scheduling if everything is to work in synchronous harmony.

The result of this pressure to meld information with transportation capacity with production scheduling is the management of *logistics*, linking corporate strategy with operations to achieve maximum efficiency.[5] Logistics is no longer viewed by top-level executives as "a cost of doing business." If done properly, logistics management is a production multiplier that results in reduced cost and increased production.

Third party logistics companies practice *logistics management* which has been defined as the management of freight transportation as part of a total logistical

[5] The concept of logistics linking corporate strategy with operations found in *21st Century Trucking,* The American Trucking Association's Foundation, Alexandria, VA, 1994, pg VI-6.

strategy that includes inventory control, production schedules, distribution, warehousing, and transportation.[6]

b. Services Provided by Third Party Logistics Companies[7]

Companies providing Logistics Management services currently fit into one of four categories:

1. Asset-Based Logistics Providers offer dedicated logistics through the use of their own assets, such as trucks, warehouses or both.

2. Administrative-based Logistics Companies offer administrative management services for such things as freight billing, data management, and auditing.

3. Integrated Logistics Providers own their own assets such as warehouses, and trucks and use these to satisfy a client's distribution requirements. However, these companies also have arrangements with other vendors to provide whatever service or equipment might be required to meet a client's requirement.

4. Management-Based Logistics Providers offer consulting services and data base management. They must contract separately for transportation and/or warehouses as they do not own their own.

A.T. Kearney has studied the reasons why companies turn to outside logistic managers for assistance in maximizing the performance of their distribution systems for inbound or outbound logistics or both.[8] Reasons with associated percentages reflecting frequency are:

To Gain Advantage over Competitors	72%
To Reduce Operating Costs	68%
Logistics Management Identified the Need	60%
Take Part in Overall Corporate/Business-Unit Initiatives	51%
Required by Customers	31%
To Maintain Parity with Competitors	31%
To Respond to Major Service Failure in the Past	23%

It should be noted that the most frequent reason companies contract with logistics providers, to gain competitive advantage, is indicative of the fact that the decision-

[6] Ibid, pg VI-1, see footnote.

[7] Ibid, pg VI-4 provides this categorization of logistics management providers.

[8] AT Kearney, Inc., " Achieving Customer Satisfaction Breakthroughs", 1993.

making executives in companies are turning to outside logistics managers for innovations that will gain them a competitive advantage.

c. Implications for the Transportation Industry

The perspectives of the outside logistics manager and the transportation carrier are different. The logistics manager struggles with a requirement to deliver products to customers with ever increasing speed while cutting costs. The logistics manager decides which mode or carrier can best meet the delivery schedule. Cost is a secondary consideration in this decision. The transportation carrier competes with other carriers to provide the lowest rate. Once the mode operator is chosen on the basis of rate, the logistics manager will tolerate few, if any, service failures. Each executive interviewed indicated that low rates win the opportunity to move a company's freight. Schedule frequency, reliability, information flow, and quality keep a company's freight returning to a carrier.

Shippers in general want information on their shipment's status. For companies using a logistics provider to manage their distribution, the thirst for information is more intense. In the case of inbound logistics, production schedules have been set anticipating the timely arrival of raw materials or parts. For outbound logistics, the manufacturer failing to get the product to the market place in the agreed-upon quantities and in the agreed-upon time frames will loose sales and/or market share. Shippers, by spending money on outside logistics management expect to save money by reducing infrastructure, inventory, and personnel.

Manufacturers ultimately want to be able to count products on the production line and in-transit as inventory that can be counted on to be distributed reliably. Through an integrated production and logistics process, the manufacturer will be able to predict exactly when the item will roll off the end of the line, when it will be shipped, and when it will arrive at its destination. Likewise, the manufacturer's customer will want to know what is headed their way, how many, and when the shipment will arrive in order to count these items as part of their inventory.

Position-reporting technology will then become increasingly important to carriers and terminal operators who will be expected to provide logistics managers with precise information on a shipment's position. Use of the Internet or computer networks by mode operators to disseminate information on load availability, equipment availability, etc., will become important capacity multipliers.

Just-in-time business relationships consume more transportation assets than conventional shipping arrangements. Thus there may be more trucks on the road than ever before but they will not be moving more freight, just moving it quicker. Strong business partnerships will render capacity less flexible, as well. Capacity or, perhaps more correctly stated, the flexibility of the U.S. transportation's capacity,

may be constrained. As more businesses turn to the logistics process and form business partnerships with mode operators, getting information on shipments as soon as possible can help the carrier in maximizing the utilization of its capacity. The current state-of- the-art technology and use of EDI permits:

- Near real-time receipt of future shipment data;
- Reformatting of information from the manufacturer's format to the carrier's format using an EDI Value Added Network (VAN);
- Fault-tolerance parameters set in the EDI VAN to ensure accurate source data; and
- Microcomputer-based programs that can run simulations quickly; permit the carrier to alter parameters and rerun the simulation; and provide information on congestion points, direct and indirect costs, routing, alternative mode selection and cost and impact on delivery date, etc.

d. Integrated and Innovative Logistics Services

Companies are not only entering into agreements with outside firms to manage transportation service, but are demanding innovative logistics support and other value-added services. The trend has been for some companies to consider contract logistics management. In other cases, companies are not ready to totally turn over the logistics function to an outside vendor, but want very close coordination and integration with their logistics and transportation groups. They want customized packages that meet their specific requirements.

The ongoing nature of the relationship between third-party logistics companies and shipper/consignees leads to the potential extension and expansion into a broader range of desired services that the logistics firm may provide. Companies are using outside vendors for such value-added services as warehousing, special equipment, consolidation services, freight bill payment, auditing, carrier selection and evaluation, rate negotiations, tariff and contract administration, network design, automated decision support tools, claims administration, tag services, packaging, and distribution. Examples of the range of customized services that have been fashioned include:

- *Fleet replacement.* Many shippers have come to the conclusion that their firm should reduce the size, composition and routing of their private vehicular fleets, particularly in intercity movements, and concentrate on core business functions. Tank truck carriers, for example, are replacing the fleets of chemical companies because of their ability to provide better logistics services, provide drivers in a period of shortage, cut costs, and limit potential liability regarding the risk of transport of products. For example, Chemical Leaman Tank Lines, Inc., will handle the chemical

truck fleet of Allied-Signal, Inc., which involves approximately 25,000 annual truckloads.

- *Equipment design.* When General Electric needed additional cubic volume for its domestic intermodal rail container movements on the Southern Pacific, it worked with Southern Pacific and Rail Van Consolidated, Inc., to develop a 53-foot container.

- *Equipment management.* Menlo Logistics, under its agreement with Sears Logistics Services to manage LTL carriers for the Sears retail operations, also installed a trailer management system to load trailers in proper sequence as well as return empty ones, thereby managing the utilization of trailers.

Global Coverage and Management Capability

A growing number of companies are demanding global coverage from their transportation providers. They seek a partnership or alliance with a firm or firms that knows the best fares and can handle routings and carriers for business travel to all areas of the world. Similarly, companies are establishing alliances with a firm or firms that can deliver freight to all the markets they serve, as well as potential future markets. Such global coverage is expected to be provided either directly or through agreements with other carriers and modes. Some of the largest transportation carriers (e.g., CSX-SeaLand) have responded by diversification, partnerships and alliances (SeaLand-Maersk).

The global environment has encouraged the development of carrier partnerships, alliances, and third party relationships to extend coverage and provide specialized services abroad (e.g., United-Lufthansa in the airline business or SeaLand-Maersk in the steamship line business). Effective use of information technology is critical to the success of a global logistics operation. The outsourcing of logistics and transportation has created a niche for transportation companies to add services that will add value for their customers. Some transportation companies have established subsidiaries that offer broad-based logistical services for their customers, including warehousing, inventory control, order processing, and delivery in several continents.

The effect is that transportation companies have changed dramatically and will continue to do so as they establish alliances in all areas of the world, and consider opportunities for providing expanded global services.

Equipment Condition and Availability

Access to an adequate equipment pool to meet management requirements, particularly during peak periods, is increasingly important for shippers. Delays in obtaining containers or a damaged chassis can reduce transportation service reliability. General Electric obtained the

right of first refusal on a pool of 200 53-foot containers that are used to move appliances. If GE does not need the equipment, the third party handling GE business solicits cargo from other customers. But GE has assurances that it will have the right type of equipment, when it needs it. GE not only demands a trailer pool that can handle its peak shipping activity, but the equipment must also be in excellent condition.

Business acceptance of intermodal transport depends on the regular provision of a dedicated equipment pool, of appropriate size and type, that is in good condition and capable of handling peak periods. Historically, some shippers have experienced delivery delays or failures because of equipment shortages, or inadequate or aged equipment. While the industry may not actually be suffering from an absolute shortage of appropriate equipment, equipment utilization is at times imbalanced on particular line-hauls and the rail industry has yet to fully implement a system for the rapid redeployment of equipment.

During many of the interviews with shippers carried out as part of this study, concerns were raised regarding equipment shortages in the rail and steamship line industry. For example, adequate supply of equipment is critical at harvest time for grain producers. It was also noted that there has been a shortage of railcars and breakbulk vessel capacity needed to carry bulky, heavy and oddly shaped materials and intermediate products of the construction industry as well as power generation equipment for export.

Information Exchange Capability

Perhaps the most important trend as far as management requirements is the demand for customized information on a real-time basis. Business travel users require access to the latest schedules, air fares, space availability, etc., on a real-time basis. For freight transportation, many shippers want to have real-time access to the location and status of their shipments. They want to be able to enter bookings by computer directly from their many production, warehousing and office locations. They need access to shipment status, billing, payment and other information to manage and control their business and be responsive to their customers. Consequently, effective Electronic Data Interchange (EDI) with carriers and agents is an increasingly essential requirement for many companies.

Information exchange technologies have been essential tools in the advancement of more sophisticated transport service-levels and the delivery of more reliable, customer-oriented services by carriers. Businesses expect real-time information for management of their logistics needs, involving both products and assets.

The introduction of low-cost, user-friendly software and more powerful computing hardware has enabled the proliferation of new data processing and analytical tools in the logistics integration and analysis process. These tools have provided assistance in many functions including:

- *Inventory Management and Control* systems allow shippers to better examine their inventory-transportation requirements by developing a detailed database over time. Computer systems can enhance communication about product demand in complex business environments between manufacturer, distributor, supplier and point of sales. Inventory levels can be reduced as demand requirements at each link in the supply chain are better coordinated through forecasting and scheduling of acquisition of raw materials, production and distribution of intermediate and finished products.

- *Electronic Data Interchange (EDI)* systems manage the flow of materials from vendors. Carriers, agents and shippers want to have real-time access to the location, shipping, and billing status of shipments. This capability to manage and control the process includes the ability to enter bookings directly from office, production and warehousing locations. With high-speed data links and computer access, a company's inventory can be physically located and sized to take advantage of changing business requirements.

  While EDI is readily available for larger shippers and brokers and truck carriers, there are still obstacles to its widespread dissemination and the achievement of a "paper less" environment. Only 50 percent of all transactions at rail terminals utilize EDI; smaller drayage companies are also not equipped with EDI. Thus, large segments of the shipping business rely upon faxed bills of lading and require manual processing of shipment orders. Incompatible EDI systems have been promoted by individual carriers, further inhibiting EDI's full integration for all shippers. Industry acceptance of a more neutral, non-carrier specific standard may occur in the 1990s. Shippers and their agents currently incur time and costs acquiring and using duplicative software for each carrier.

- *Routing and Scheduling* has become much easier with desktop computers and specially designed optimization programs and expert systems. Deployment, vehicle load management and routing and scheduling systems facilitate the movement of vehicles from production to warehouses and customers, and reduce empty back hauls.

- *Automated Storage and Retrieval systems* as well as other sophisticated storage and conveyor systems have been used to assist in the warehousing and manufacturing process. Computer systems also support the flow of materials and products along the supply chain.

- *Global Positioning Systems* are satellite systems used by shippers and carriers to track the exact location, and schedule for delivery, of individual packages, navigation for vessels and trucks, and container tracking at terminals. These systems make possible real time tracking of shipments anywhere in the world.

- *Barcode Scanner Technologies* can improve logistical control and inventory management particularly in the distribution process. Greater coordination between

vendor system, customers and transportation companies can be expected in the future. Such technologies can also be applied to containers and equipment for better long-term control and deployment, as well as to describe contents.

- *Wireless Communications* offer another option for transmission of shipment data and tracking of vehicles. These developments will allow use of cellular transmission of shipment data and will track vehicles via the cellular phone network or through satellites.

Recent interviews with U.S. logistics executives have indicated that many firms struggle to implement truly integrated logistics systems. A key to leveraging a firm's logistics strengths is its ability to support logistics operations with a comprehensive computerized system.

D. Summary

The transportation industry, broadly defined to include travel management and freight logistics, has been rapidly evolving to meet the changing requirements of American business. Business travelers have an increasing number of options for their domestic and international travel needs, with expanded geographic coverage involving seamless connections between carriers that have established alliances or marketing agreements. Similarly, companies have an increasing number of alternatives for moving their freight to more destinations with improved reliability. The ability of the industry to further meet the increasing requirement for reliability is dependent on assuring adequate long-term capacity, improving intermodal connections, and reducing congestion, particularly in heavily used urban corridors, ports and airports.

It is interesting to note that better logistics processes, whether outsourced or not, do not only apply to an individual firm's competitive advantage. If enough U.S. manufacturers improve on their supply chain logistics efficiency, the whole economy is affected positively. This can be seen most clearly during an economic slowdown where a less severe downturn is expected than in the past due to more efficient manufacturers, as Allen Wastler explains in a recent article in *The Journal of Commerce:*

> Some analysts believe such hope [for a softer consequences in a slowing economy] exists because American business is becoming more sophisticated about logistics. [In the past,] a downturn in the country's general economic situation would still leave goods and materials in the inventory and distribution pipeline. Historically, in fact, many economic downturns have been preceded by an inventory buildup, as production stayed at previous levels while demand slackened. As a result, businesses have had to liquidate stockpiled goods, a process economists euphemistically refer to as inventory correction. (JOC, January 23, 1996. Pg. 1A, 10A)

This past inefficiency in the supply chain "worsens recessions" according to analyst Steve Lewins. However, if the supply chain is efficient, there are not many goods in the pipeline, and as demand falls, production will decrease accordingly, thereby saving business losses from over production and over inventory.

As such, the benefits of increased transportation reliability include contributing to U.S. competitiveness, business profitability, and overall economic stability.

6.0 Conclusions and Implications for Government Policy

Based on the review of American Business Transportation Requirements, planners should consider those state and metropolitan area transportation requirements that appear to have the greatest potential to increase the competitiveness of American business, e.g., those that would

- Benefit a large number or at least several economic sectors or industries that are most significant or are the fastest growing in their area, as well as those that are being targeted by the area's economic development program (e.g., those investments that can increase reliability and reduce congestion, such as incident management, congestion management, ITS, etc.);
- Appear to result in more significant reductions in transportation costs or increases in service level (e.g., improved highway access to rail yards, ports and airports so as to reduce time and cost of intermodal connections); and/or
- Address specific issues or obstacles that presently hinder industry competitiveness or address unique economic development opportunities (e.g., new highway corridors or intermodal connections that significantly reduce costs or increase service level along newly emerging corridors connecting to Canada and Mexico as a result of the NAFTA agreement or to major international sea and airport gateways).

To provide future opportunities for industries to improve their competitiveness by continuing to maintain lower inventories, increasing product delivery reliability, and improving speed of business travel, transportation plans should consider long-term and short-term strategies to:

- Assure adequate capacity for access to businesses during peak periods, e.g.,
  - eliminate bottlenecks
  - efficient control of incidents
  - reduce congestion
  - real-time tracking of congestion;

- Improve emerging corridors, border ports of entry, international gateways, and other infrastructure to meet the emerging needs of the changing economy;

- Facilitate intermodal connections (access to ports, rail stations, truck terminals, rail yards, and airports) and services, e.g.,
  - reduce congestion on roadways between airports/other terminals and manufacturers/retailers;

- Introduce new technology (vehicles, facilities and ITS) that can result in further significant reductions in travel time and reliability;

- Eliminate institutional roadblocks to more efficient, more reliable, and less costly services, e.g.,
  - increased international airline connections
  - laws and regulations, e.g., maritime deregulation and uniform truck size/weight regulations
  - customs and immigration clearance streamlining
  - equipment and other standards, e.g., EDI and uniform container standards for all modes; and

- Encourage international standards and regulations that make possible the use of the same equipment around the world and offer the opportunity to establish more integrated international and domestic transportation services and equipment pools to balance export/import moves with domestic cargo and minimize imbalances in various foreign trade routes and domestic lanes.

Appendix B includes some examples of transportation strategies that might be applicable to incorporate the changing needs of businesses in the transportation planning process.

APPENDIX B

Potential Strategies

APPENDIX B
POTENTIAL STRATEGIES

This appendix provides examples of potential strategies to address transportation constraints and problems that affect the competitiveness of industries and businesses in an area. As discussed in the report, the transportation planning process needs to more formally incorporate consideration of business needs. The process should specifically include consideration of transportation strategies that can help resolve the major problems faced by area businesses, as well as help achieve the economic development goals of the area. Strategies should then reflect solutions that can facilitate the efforts to attract new industries and retain existing industries.

Generally, the transportation planning process, as one of its first efforts, includes the articulation of an area's development goals. Depending on the area's development goals, emphasis may be placed on attracting targeted industries; increasing the competitiveness of certain industries that are particularly important to the area's economy; and/or limiting development in certain parts of the region. Businesses should be encouraged to participate in assuring that their perspective is understood when the area's goals are decided. Furthermore, their specific needs and any problems that affect their ability to continue operating and expand in the region should be formally a part of adopting an area's development goals.

If this process is carried out taking into consideration the needs of existing area businesses and the targeted industries in the area's economic development goals, it will provide the planner with a list of key problems and important service criteria for which strategies and/or specific solutions should be identified and recommended as part of the planning process. Examples of specific problems or needs important to an area's business might include:

- Increase reliability of travel time (consistent travel time);
- Reduce congestion and eliminate bottlenecks at key intersections or around commercial centers (time savings);
- Improve incident management (time savings and consistency);
- Reduce transport costs, i.e., more efficient direct intermodal connections, increased opportunities for competition);
- Improve transportation service (increased level of service at airports, ports, etc.); and
- Standardize technology, traffic signs, and other regulatory programs that reduce time, increase reliability and reduce costs (time savings/efficient throughput).

The best solution (e.g,. the one with the best return on investment) for meeting a specific requirement may have other negative impacts or take a large share of the available budget. Coming up with acceptable strategies will entail a combination of solutions that address as best as possible the various business problems and service criteria identified, while at the same time, meeting as many of the needs of other groups as possible.

As part of Step 3, in Chapter 3, *Identify the Resulting Problems or Issues and Propose Solutions* to meet business needs in a particular area/category, the planner should examine one or more strategies, like the examples described below to identify those that best meet the requirements.

The following discussion defines key features of some strategies that an area could pursue to improve its business environment and become more attractive to increase business activity. These strategies represent examples and are not intended to be either a complete listing or the most relevant ones that address a particular business need. Clearly, specific strategies must be tailored to the particular circumstances and problems that businesses face in an area.. The examples of strategies are grouped according to the six categories proposed to address major business needs. The strategies are briefly described considering the scope, key objectives, results, implementation and/or policy issues.

Category I: Reduce Congestion and Bottlenecks

Example: *Congestion Pricing*. Addresses the needs of overnight delivery packages of growing service sector and technology based companies relying on JIT inventories, requirements of business services industry sector, tourism, etc. Congestion pricing offers a mechanism through variable toll schedules to relieve traffic congestion. This strategy also affects road funding and/or disperses peak traffic. The overall benefit of congestion pricing is to provide consistent travel time by improving reliability and dispersing traffic throughout the area and during the peak. This scheme is particularly relevant if there is severe traffic congestion without the option to expand nearby parallel facilities.

Key Objectives: Relieve bottlenecks, disperse and reduce peak traffic, reduce travel time, facilitate consistent travel time and reliability.

Relationship and Result of Strategy Application: The toll system costs are covered by user revenues that should be able to generate additional income to improve other roads in the corridor. Given sufficient demand on a given toll segment, the revenues generally produce 10 times the cost of electronic toll collection infrastructure. However, other methods of congestion pricing may be more appropriate. Congestion pricing schemes can be as inexpensive as the Singapore licensing system, where drivers purchase a permit to pass a cordon. The paper permit is simply displayed in the windshield of the driver to facilitate enforcement through observation.

The purpose of this strategy is to reduce the demand level by pricing travel by the time of day, or according to traffic levels. If properly designed, the motorist has a choice between priced travel and an alternative free roadway. The choice allows people to judge whether time savings is more important than monetary savings for a particular trip. This strategy has certain benefits to tourism as well because tourists may feel they have leisure time to choose another mode or time to avoid the peak price, effectively reducing demand on the toll road. In addition, this scheme enhances competitiveness among business owners dependent on consistent travel time, since recent evidence indicates that pricing schemes level demand. Level demand is valuable to anyone ranging from the average commuter to the repair technician who earns money per the number of trips made in one day

or to business travelers headed to the airport. Individual travelers benefit from being able to judge approximate trip time.

Consistent travel time also aids shippers and carriers (such as Federal Express, United Parcel Service, and other overnight and local express couriers) to estimate delivery schedules with greater accuracy. Congestion pricing impacts will range according to the size of the priced facility and connection to non-priced facilities. Generally, congestion pricing will impact a region, by moving demand onto other facilities and by increasing access to others. In the case of the latter, a dispersed peak can increase access to previously highly congested areas, in addition to moving through traffic more efficiently into and out of a priced area.

This strategy may only have a marginal affect on foreign trade, but it improves area congestion to the point of potentially having a beneficial impact on overall economic growth, such as in Riverside and Orange Counties in California after the development of the 91 Express Lanes project along the median of the State Route 91.

Implementing Requirements: A congestion pricing scheme must meet legal statutes within a particular state for charging a variable toll system. The planning authorities or facility concessionaire need to conduct outreach to gain an understanding of particular problems that the scheme can generate and, later on, to measure community acceptance. Financing must be secured. Affected parties and associated agencies must cooperate with the concessionaire and/or implementing/planning authorities; for example, bond covenants and bondholders of an existing toll facility need to consent to a variable toll schedule.

Policy Issues: Conform to existing plans, or modify plans to conform to the congestion pricing scheme. Congestion pricing typically is consistent with air quality plan requirements and also may reduce financial requirements for infrastructure requirements.

Other examples of strategies that support category key objectives: Real-time tracking of congestion through variable message signs, effective control of incidents, computerized synchronized traffic signals, freeway metering, etc.

Category II: Border-crossing/Gateway Development and Promotion

Example: *Automated Border Clearance Systems and International Electronic Databases.* Addresses the data requirements from shippers/carriers crossing international borders to streamline border clearance. Some systems have been implemented by U.S. Customs for cargo arriving by vessel or air. Currently in the development and testing phase for border crossings, the creation of standardized data reporting, collecting, and processing with the overall goal of electronic data interchange (EDI) will eventually speed international trade.

Under the North American Trade Automation Prototype (NATAP)[1], a transponder on a truck electronically identifies it and its cargo as the vehicle passes through a border facility, creating the potential for trucks to move through inspection stations in seconds instead of hours. The system also allows for a driver's photograph to automatically display on a Customs inspector's computer screen as a truck passes through a gate.

Key Objectives: Work with U.S. Department of Treasury, the U.S. Customs Clearance System, and the International Trade Data System (ITDS) to assure that international cargo is processed as efficiently as possible through airports, seaports, and border crossings in the region, and work with the area's transportation industry to develop a system compatible with the standard federal and/or international systems and facilitate their use, thereby giving the area a competitive advantage for the movement of international cargo.

Relationship and Result of Strategy Application: Today, separate trade and transportation data systems are maintained by federal agencies involved in the international trade and cargo clearance processes. Exporters and importers deal with numerous paper and electronic systems and are often confounded by duplicating, incompatible, and non-uniform data reporting and record-keeping requirements.

Federal agencies have been working, in cooperation with the industry and ports, airports, and border crossing ports of entry to expedite and streamline cargo clearance. Customs clearance systems have been functioning at major ports and airports and now an ambitious cargo clearance prototype system is being tested at border crossings. Using NATAP, when a truck equipped with a transponder arrives at Customs and passes an electronic reader at a constant speed, data on the truck, cargo and driver show up on the Customs agent's screen. With as many as 10,500 trucks crossing daily at Detroit, and half that number in Buffalo, speed becomes a critical issue. For any company that has a computer with a Microsoft Windows operation system and an Internet connection, little monetary investment is required to participate.

The possibility of faster border clearances is so attractive that already 400 companies have signed up to test the system. In addition, the very low cost of conducting business over the Internet has made it easier to justify participating in an experiment where long-term success is not guaranteed.

Local areas can benefit from the system also as they reduce congestion for vehicles crossing the border and reduce the need for holding areas for waiting trucks. Truck traffic has risen 10 percent annually for the past few years, causing the General Manager of the Detroit International Bridge to build an overflow area for trucks waiting to clear customs.

Implementation: Currently NATAP is being tested at six international border crossings connecting the U.S. to Canada and to Mexico. After successful evaluation of the system, the U.S. Department of Treasury will be preparing to move into full implementation. The planning process in metropolitan areas that are international gateways or major border crossing points should address

[1]International Trade Data System (ITDS), U.S. Department of Treasury, Room 3130 ICC, 1301 Constitution Ave, N.W., Washington, D.C. 20229.

how this system affects area businesses and the area's role as a gateway, including consideration of institutional hurdles, needed technology and infrastructure deployment to help improve the area's competitive position for this business.

The NATAP tests have uncovered some operational problems (e.g., the system doesn't work as well for trucks carrying a variety of goods). In addition, by demanding a considerable amount of information up front before a shipment leaves a country, NATAP may place too great a burden on exporters. A detailed registry of drivers *(requiring coordination with the state registration system; see Category V)* is also essential to allow trucks to cross a border without stopping for inspection.

State and metropolitan planning authorities can participate directly in the NATAP through the Internet. The Treasury Department's ITDS web page allows a planner to track recent events, comment on system improvements, and test Beta versions of the NATAP (by downloading free software).

Policy Issues: An area whose economy is closely tied to international gateway traffic can use this type of program to assure that its competitive position is improved for through cargo business, at a reduced cost compared to building more lanes at border crossings or expanding ports and seaports to handle growing volumes of foreign trade.

Other examples of strategies that support category key objectives: Airport and port expansion, special access lanes for trucks leading to border crossings, dedicated facilities for airport or port access (such as Dulles Access Road, etc.).

Category III: Improve Capacity and Efficiency

Example: *Intermodal Connectivity.* Improve intermodal connections to facilitate movement of people and goods from one mode to another, by providing better connections between two modes of transportation. Lack of direct access connecting Interstate highways with airports, ports and rail yards can affect traffic and freight movement.

Key Objectives: Adequate capacity along major corridors serving developed and developing industrial and commercial areas and their connections to major transportation facilities, and efficient movements between major highways and other modes for the transfer of people and goods between modes.

Relationship and Result of Strategy Application: A good example of the need to increase capacity to handle business needs is the Chicago area. Chicago is a major hub for national and international freight movement and business travel. With respect to freight, Chicago represents the connection of the eastern and western rail carriers. Nearly half of the nation's intermodal rail shipments

originations, destinations and connections take place in Chicago[2]. As a result, freight drayage is a substantial part of local and regional traffic, particularly along some corridors. The resulting congestion has been identified as potentially impeding national and international freight movement. To address these problems in the short term, the Chicago MPO sought funding for improved connections between intermodal facilities and highways. As a long-term strategy, the GAO has identified the potential need for a multi-user intermodal terminal located near or in the city that would permit rail-to-rail connections, thereby eliminating crosstown drayage[3]. The rail mergers that have taken place or are in the approval stage may also help facilitate a solution to this problem.

In the case of the airport, Chicago O'Hare is the largest hub in the U.S.. Chicago has been considering plans for a new major airport, since without a new facility, other hubs are likely to attract part of the business that otherwise would serve Chicago.

Implementation: The cost of adding capacity—whether to facilitate intermodal connections or to build new highways, expand existing facilities, and/or build new airports or port terminals—is usually the most expensive option, requiring large investments that are typically difficult to finance. New large facilities also have large impacts. Capacity increases and related large efficiency increases are sometimes difficult or impossible to achieve without a major expansion program.

Policy Issues: An area whose economy is closely tied to high-tech manufacturing, distribution, or services will need to consider increasing the efficiency of its transportation system to serve its dominant industries.

Other examples of strategies that support category key objectives: Airport and port expansion, new highway corridors, new public transportation facilities, special dedicated truck lanes, ITS, etc.

Category IV: Introduce New Technologies

Example: *Electronic Toll Collection (ETC)/Electronic Preclearance.* Reduces traffic congestion and improves safety by eliminating the need for vehicles to stop at toll booths or at truck inspection stations to check truck operator credentials, permits or truck weights. ETC allows a toll authority to charge motorists for toll fees without having vehicles stop or reduce speed, as with a manual toll collection operation.

[2]General Accounting Office, *Intermodal Freight Transportation: Projects and Planning Issues*, GAO/NSIAD-96-159.

[3]Ibid.

Key Objectives: Reduce time by eliminating vehicle stopping/slowing down for regulatory inspection or toll collection. Additional objectives include: maintain constant traffic speeds, reduce bottlenecks, and improve passenger and truck safety.

Relationship and Result of Strategy Application: Toll road customers have the option of paying with a credit card, and commercial customers have the added benefit of not needing to send the drivers out with cash, eliminating the potential for misuse. The method most commonly used for vehicle-roadside communication is a telecommunications link that operates at radio or microwave frequencies. Each vehicle is equipped with a transponder, which recognizes a signal transmitted by a roadside antenna. Information carried in the transponder (an identification code) is exchanged with an off-vehicle processing computer. The computer uses the code to identify the account from which to deduct the toll. When the toll is distance-based, the computer stores the vehicle's point of entry, for the toll deduction to be commensurate with distance traveled. Otherwise, the entire transaction is performed while the vehicle is within the antenna's reach (usually 40 meters).

An electronic preclearance (EP) allows safety officers to check operating credentials and weights electronically. Both technologies assume that the information—tolls, credentials, and weights—could be gathered at mainline speeds, eliminating the need for vehicles to slow down for inspection.

An ETC requires three major in-lane/roadway components as follows:

1) Automatic Vehicle Identification
2) Automatic Vehicle Classification
3) Video Enforcement Systems

Automatic Vehicle Identification (AVI) uses a radio frequency device located in the vehicle to uniquely identify the vehicle to the toll system. Automatic Vehicle Classification (AVC) uses various sensors in and around the lanes to determine the type of vehicle so that the proper toll is charged. Video Enforcement Systems (VES) capture license plate images to identify and cite the vehicle owners of vehicles that use the facility without a valid tag. All of these systems are tied together by what is commonly referred to as a "lane controller." The lane controller computer system receives the inputs form the AVI, AVC, and VES equipment.

In addition to this in-lane equipment, each toll plaza usually has a host computer which collects transaction information for the lane controllers and communicates with the central computer system linked to all the respective toll plazas. The plaza's host computer is also used to transmit to each lane controller the list of valid tags used for AVI validation. Finally, ETC requires a Customer Service Center which enrolls customers, manages the toll accounts and issues tags to customers, processes violation images, and handles customer inquiries.

Electronic toll collection typically results in reduced operating costs because labor cost savings usually are more than the costs associated with installation and operations. The average price to operate an automated lane is $15,800 compared to that of an attended lane, $176,500, approximately nine percent of the manual collection operating costs.

This strategy greatly improves competitiveness by assuring a consistent travel time and reduced bottlenecks, thereby reducing congestion and accidents. Throughput on a manual lane can accommodate 350 to 400 vehicles per hour, whereas ETC can accommodate 1,000 vehicles per hour. This strategy only provides minor improvements in accessibility to an area by reducing travel time; however, this strategy greatly improves productivity for both passenger and commercial traffic, by increasing vehicle throughput and time savings. Overall time savings and traffic congestion benefits for carriers and individuals, as well as for some industries depending on location, can be significant from either type of technology. ETC/Electronic preclearance can be used in spot applications, cordon settings, or along a ring-road.

Electronic preclearance provides several benefits to industries. Unproductive time is defined as the time spent by legal and compliant carriers on safety and weight enforcement activities. The electronic preclearance process reduces the amount of unproductive motor carrier time. EP reduces the number of illegal carriers by automatically identifying every illegal carrier, in contrast to the spot check process which is time intensive and only captures a fraction of illegal carriers.

Implementing Requirements: To be effective, ETC requires a large percentage of the traffic using a facility on a regular basis in order to achieve maximum throughput and customer acceptance.

Policy Issues: Benefits in terms of both regional economic growth and streamlined foreign trade can be high. The impacts can also be beneficial to both a local area in terms of air quality improvements and to a region by improving throughput. Motor carrier companies in compliance stand to gain the most from EP; every motor vehicle will benefit from ETC.

Other examples of strategies that support category key objectives: ITS, new more efficient vehicle technologies, electronic vehicle control, ground based or satellite positioning systems, automation systems for cargo handling, etc.

Category V: Address Institutional Roadblocks

Example: *Streamline Permitting Process/Electronic Data Interchange (EDI) of commercial vehicle operations (CVO).* All commercial vehicles must register their vehicles and pay appropriate vehicle registration fuel taxes to cover the costs of highway damage inflicted by these multi-axle vehicles. Through various types of permitting systems, accompanied by electronic data interchange (EDI), the commercial vehicle operator may register more efficiently and is less likely to have expired permits.

Two main possible permitting improvements might include: 1) "one-stop shopping" and 2) electronic data interchange (EDI). One-stop shopping is a concept for streamlining the process of applying for credentials and permits required to operate legally within a state or region, so that all the necessary paperwork can be processed and completed in one geographic location. The means to do so can range from establishing a single agency to handle all functions to providing coordinated multi-agency information and services at one location. At least, a coordinated service with

information on where and how to apply for all the necessary credentials can be available. Under one-stop shopping, the operator may benefit from one of three possible alternatives:

1) *One department model.* The departments handling credentials would relinquish their authority over motor carriers and one (possibly new) state department would be given full power to administer all motor carrier laws and issue all permits.

2) *Distributed model.* The model would not alter the present authorities; however, each department would be required to share information via computer systems. To obtain credentials, each carrier would send all application information and fees to a single contact. This contact would handle all registration and reporting with other agencies.

3) *Brochure model.* The various agencies produce an informational brochure.

EDI systems can be divided into two types: The carrier-to-agency interchange eliminates the need for application forms and allows for electronic transfer of funds for payment of fees; The agency-to-carrier interchange would eliminate physical products associated with credentials. Credentials, such as license plates and fuel tax decals, would exist in electronic form, activated when a carrier is paid up and legal.

Key Objectives: Streamline CVO application process, reduce the number of expired or illegal commercial vehicle operators, and enforce payment/registration fee collections.

Relationship and Result of Strategy Application: Quantifying the benefits of improved service quality and value to the taxpayer is difficult. However, reducing the compliance burden on private industry, as well as improving enforcement effectiveness, would be beneficial to industry and society. In surveys conducted in Ohio, by Ohio State University researchers, the majority of 400 motor carrier respondents preferred innovations facilitating application processes to those reducing en route time. Motor carrier management valued the time savings in processing their trucks. The one-stop operation, whether implemented under any one of the three models indicated above, allows management to concentrate on other business concerns. The user-friendly registration process also reduces registration evasion and the number of expired permits, and generates higher registration revenues. The change in the registration system will enable the average motor carrier to manage greater sized fleets with less effort.

The cost to implement will vary among states and agencies, and greatly depends on the extent to which an agency will restructure their existing system. The "one-stop shopping" may enhance the competitive position of a state, because a motor carrier is likely to register in a state known for its registration system efficiency. However, this change is not likely to have a large impact on regional growth.

EDI will result in additional time savings and efficiencies. Time savings from regulatory processes improves motor carrier productivity levels. The Ohio survey indicated that motor carrier company managers preferred carrier-to-agency over agency-to-carrier EDI options, i.e., favoring time savings from the application and payment process but preferring to be given physical possession of credentials.

Implementation Requirements: Implementation of this strategy requires the will and interest of multiple agencies to work together to establish a streamlined system that can benefit the carriers as well as eventually reduce public sector costs.

Policy Issues: Benefits in terms of efficiency of public sector operations as well as reduced costs to carriers that in turn should translate into reduced rates to shippers should result from this type of strategy. This type of strategy requires changes in public policy and agency procedures that are sometimes very difficult to implement.

Other examples of strategies that support category key objectives: Uniform truck size and weight regulations, open skies for airline service, streamlined immigration processing at airports, standard work rules and labor provisions among all modes, uniform tax provisions and reporting, standard permit processes for overweight trucks, etc.

Category VI: Standardization of Equipment and Processes

Example: *Standardize Equipment and vehicles* Truck and container size and weight requirements differ among states and foreign countries, making it difficult for shippers and carriers to assure that their shipments meet all government limitations along the entire trip of the vehicle or container.

Key Objectives: Standardize truck sizes, weights, types and measurement systems to the largest extent possible to be in effect nationally and internationally so that Vehicle Size and Weight Regulations would be consistent, and a legal vehicle in one state would be legal in other states and foreign countries.

Relationship and Result of Strategy Application: A standardized vehicle or equipment regulation could be used for addressing a number of issues including heavy-vehicle and weight regulatory policy, enforcement of heavy-vehicle size and weight regulations, management of highway infrastructure, resolution of issues of inter-jurisdictional vehicle size and weight conflicts, efficient management of fleet and truck movement, road-user taxation, and support consistent regulation.

For example, the advantages of such a system would include use of higher cube containers that are mostly in use in the U.S. (45 ft. and 48 ft. long) for international shipments, thereby making that equipment interchangeable for domestic and foreign trade. The integration of domestic and international equipment offers the opportunity to balance export/import moves with domestic cargo, and thereby minimize imbalances that frequently occur between foreign trade routes and domestic lanes. One of the keys to carrier profitability and efficiency is the ability to manage equipment minimizing empty backhauls and maximizing equipment utilization.

Implementing Requirements: It would be nearly impossible to achieve complete consistency among all states and foreign countries in the maximum weight and size regulations, due to the differences in laws and infrastructure. However, achieving a greater consistency than exists today would benefit carriers and shippers and would simplify the existing situation.

Policy Issues: Standardizing vehicle and equipment standards can increase safety, efficiency, and capacity, but can also result in reductions of capacity, safety and efficiency, depending on what it takes to achieve standardization. Although the goal is laudable, the need is to consider how to simplify the myriad of standards and requirements rather than to achieve complete standardization.

Other examples of strategies that support category key objectives: Standards for communications equipment and cargo tracking information, uniform standards for freight handling documentation and liability rules, standard insurance requirements, etc.

APPENDIX C

Interview Questionnaires

Shipper Questionnaire

The purpose of this study, sponsored by the Transportation Research Board, is to consider how recent economic trends are affecting the transportation requirements of American business. This information is important to understand how to improve the transportation system to most effectively increase American firms' competitiveness in the global economy. This questionnaire is designed to solicit shippers' views on their future domestic and international transportation needs and their suggestions on how to best fulfill these needs. A similar questionnaire is being used to also obtain the views of transportation carriers.

A. **General Information**

Name of the Interviewee's Company or Organization: _____
Name of the Interviewee: _____
Name of the Interviewer: _____
Date: _____ Location of Interview: _____

Economic Sector: Agriculture, Forestry and Fisheries
Subsector_____
Mining
Subsector_____
Construction
Subsector_____
Manufacturing
Subsector_____
Public Utilities
Subsector_____
Wholesale and Retail Trade
Subsector_____
Government
Subsector_____
Other Services
Subsector_____

If Manufacturing _____
Industry

If Services (please circle)
Distributive or Producer Services
Other Business Services
Consumer Services
Non-profit or government services

_____
Industry

Size of industry: (revenues) _____
(employees)_____

Size of company: (revenues) _____
(employees)_____

Share of Business: Domestic:_____%
International:_____%

What is your role and/or position in your company?_____

Do you deal with transportation issues daily? Yes___ No___ If yes, what area of transportation are you involved with in your company?

_____

What are the primary transportation mode(s) typically used in your industry for both passenger and freight movements (please check all that apply)?

Mode	Freight	Passenger
Rail		
Water		
Air		
Road		
Multimodal (please specify which modes used in multimodal)		

B. **Overview of Transportation Requirements**

How significant is transportation services to your industry/business?

_____
_____
_____

Does the product or service you provide have an important transportation cost (more than 2-3%) component? Yes_____ No_____.
If yes, approximately what % does transportation costs represent out of your product or service costs? (Please indicate if not applicable)

A. Total transportation component percentage: _____%.
Of the total % number in part A of this question, what % of this cost is:
B. Business travel _____%
C. Freight transportation _____%

If you don't know %'s, in your view how important are person transportation services (business trips) compared to freight transportation services?

_____
_____
_____

How does person and/or freight transportation influence your industry's competitiveness?

_____
_____
_____

For manufacturing industries, what percentage does distribution represent out of your product cost or sale price? Please indicate what you have included as part of distribution (i.e. transportation, warehousing and inventory costs). _____%
Distribution made up of:_____
_____

Do transportation costs represent a higher or lower % of costs than in the past (Please circle one)?

More than 5% Higher
About the same
More than 5% Lower

How important are overnight package and document delivery services to your business?

_____
_____
_____

For overnight package and document delivery services, what trend do you see occurring in your industry over the next five years (please circle one)?

Increased usage
Same usage
Decreased usage

Why?_____

C. **Freight Transportation**

Rank in order of importance (number 1 is most important, 2 second, etc.) the main freight transportation service characteristics that are important to your industry (try to respond for industry- if not possible, answer for your own company).?

Rank:

_____ Cost
_____ Speed - Delivery Time
_____ Just in Time Delivery
_____ Reliability
_____ Geographic coverage
_____ Loss Damage Rate
_____ Real time status Information
_____ Container/Equipment/Shipment characteristics (temperature, availability, maximum weight, maximum volume)
_____ Other_____

For the table on the following page, indicate your main freight transportation requirements (if not applicable put "N/A"). Then, for each of your choices, indicate the following information (if available):

- % of total product/service costs that they typically represent
- whether cost or service level more important for these categories of movements
- how would you characterize the type of materials or products moved and the service requirements? Please use as many of the categories listed at the top of the following page that apply.

Materials and service requirements categories: High value, Low value, Bulky--voluminous, Heavy, Perishable, Time-sensitive, Just-in-time, Hazardous Materials, Emergency shipments, Overnight shipments, Other (please describe).

Movement Description	% of Product/ service costs	Cost or service more important?	Type of product/ Service requirements
raw materials to plants			
intermediate products to final assembly or production locations			
production from final production to wholesalers or distribution centers			
production from distribution centers to retailers/consumer outlets			
products from final production locations to retailers			
products from final production locations to consumers			
products from final production locations to other business			
products from final production locations to subsidiaries			
products from suppliers to distribution centers			
products from distribution centers to consumers			
products from retailers to consumers			

What are the most important recent trends affecting your industry's freight transportation requirements and how do they affect total product or service costs?

Has the industry faced significant restructuring of its operations recently?

Has industry inventory turnover increased significantly recently?

Does industry rely on multinational production? Yes____ No____

Does it use Just in Time for all or a major portion of its freight transportation requirements? Yes____ No____. If yes, how?

What % of freight transportation requirements are international?

Raw materials Exports_____%Imports_____%
Partially finished or assembled products Exports_____%Imports_____%
Finished products Exports_____%Imports_____%

Would faster and more reliable service reduce your order cycle time? Yes____ No____
Is that a significant competitive factor? Yes____ No____ If yes, Why?

What % of your freight moves by:

Air _____
Rail _____
Truck _____
Water (domestic) _____
Water (internationally) _____

What % of your freight moves intermodally? _____

Do you use a logistics or third party contractor to manage your distribution and/or freight transportation requirements?
Yes_____ No_____ If yes, what functions do you contract out (check all those applicable)?

All distribution functions _____
Warehousing _____
Inventory Control _____
Transportation moves _____
Bill processing and auditing _____
Others (please specify) _____

Do you operate your own truck fleet? Yes____ No____ If yes, for what purposes do you use the fleet?

What percentage of your product's cost does the fleet cost represent? _____%
What percentage of your freight volume involve long-term and/or short-term contracts?
Long-term _____% Short-term_____%

What are the typical minimum annual volume commitments that these contracts require?
Long-term_____ Short-term_____

How do volume or contract rates compare to published tariff rates (give the volume discounted tariff as a percentage of the full rate tariff)? Long-term_____% Short-term_____%

Is the percentage of your freight volume moving by contract increasing or decreasing? _____

D. **Passenger Transportation**

Does your industry (or company) have a problem obtaining qualified employees due to difficult transportation access to your worksite(s)? Yes_____ No____ If yes, which employee category (below) has access difficulties (please circle all that apply)?

Professional/managerial/executive employees
Large skilled labor force
Low cost unskilled employees
Employees with unique talents/qualifications (short term contracts)

On a scale of 1-5 (1 being important, 5 unimportant) what are the most important person transportation requirements of your industry (or company)?
Rank:

_____ Journey to work trips for Employees
_____ Access to your locations by consumers
_____ Access to your locations by clients/other businesses
_____ Employees Travel to other businesses/clients
_____ Business Travel for your employees

Does your company provide free parking for employees as a general policy? Yes_____ No_____

Does your company provide incentives for employees to use alternative ways to get to work–versus driving alone in their cars--as a general policy? Yes____ No_____

What are your main business travel requirements (Please circle all that apply)?

Meetings with: suppliers; customers

Meetings or visits: in local area; outside local area but within State; out of State travel but within US; international travel

E. **Final Comments**

Are you aware of how congestion and delays affect your shipments or client/employees travel, and if so, do you have suggestions as to the types of transportation initiatives that would help improve your industry competitiveness? Yes____ No____
Suggestions:_____

Do highway incidents have an effect on your business performance? If so, how significantly and in which ways? Yes_____ No____

What are some of the recent changes that you have instituted or are considering that affect your use of transportation services in your business? Does it result in increase or decrease of transportation costs?

(Please Circle one)
A._____ Increase / Decrease
B._____ Increase / Decrease
C._____ Increase / Decrease
D._____ Increase / Decrease

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What do you believe are the main freight transportation problems or potential areas for improvement that would help improve your industry competitiveness:
domestically?

internationally?

What short-term improvements in transportation services do you think would help increase US competitiveness in the global economy over the next 2-4 years for :
Your company and/or industry?
A_____ Why?_____
B_____ Why?_____
C_____ Why?_____

What long-term improvements in transportation services do you think would help increase US competitiveness in the global economy over the next 5-10 years for :
Your company and/or industry?
A_____ Why?_____
B_____ Why?_____
C_____ Why?_____

What new or improved transportation policies by government could most effectively improve the competitiveness of US business?
National_____
State or Regional_____
Local_____

If you have any industry analysis, publications or reports that discuss transportation requirements, we would appreciate getting a copy.

Thank you for your cooperation.

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TRANSPORTATION REQUIREMENTS OF AMERICAN BUSINESS

Carrier Questionnaire

The purpose of this study, sponsored by the Transportation Research Board, is to consider how recent economic trends are affecting the transportation requirements of American business. This information is important to understand how to improve the transportation system to most effectively increase American firms' competitiveness in the global economy. This questionnaire is designed to solicit carriers' views on the future needs of our domestic and international transportation system and their suggestions on how to best fulfill these needs. A similar questionnaire is being used to also obtain the views of shippers in various industries.

A. **General Information**

Name of the Interviewee's Company or Organization:_____
Name of the Interviewee:_____ Name of the Interviewer:_____
Date:_____ Location of Interview:_____

Economic Sector Transportation

Type of Transportation Services:
Passenger movement
Freight Movement
Both Passenger and Freight Movement

Size of industry (revenues) _____
(employees)_____

Size of company (revenues) _____
(employees)_____

Share of Business: Domestic:_____%
International:_____%

% of total freight carried:
Domestic:_____%
International_____%

Mode(s) used in your service:

Rail	____%
Water, Domestic or International	____%
Road	____%
Air	____%
Multimodal (if multimodal, please specify which modes)	____%

B. **Freight Transportation Carriers** (NOTE: THIS SECTION IS ONLY RELEVANT FOR FREIGHT CARRIERS)

What are the primary industries you serve (please include a more specific subsector if possible)?

Agriculture, Forestry and Fisheries Subsector_____	____%
Mining Subsector_____	____%
Construction Subsector_____	____%
Manufacturing Subsector_____	____%
Public Utilities Subsector_____	____%
Wholesale and Retail Trade Subsector_____	____%
Government Subsector_____	____%
Other Services Subsector_____	____%

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TRANSPORTATION REQUIREMENTS OF AMERICAN BUSINESS

What type of shipments do you carry?

Containerized	____%
Palletized	____%
Less than truckload	____%
Truckload	____%
Bulk: solid	____%
liquid	____%
Other	____%

What types of service and average range of distance does your transportation service provide?

Local hauls	____% Average length of haul_____
Specify if drayage	____% Average length of haul_____
Regional hauls	____% Average length of haul_____
Long-distance US domestic routes	____% Average length of haul_____
International service	____% Average length of haul_____

What types of goods do you handle on a regular basis?

High value	____%
Low value	____%
Bulk	____%
Heavy	____%
Perishable	____%
Time-sensitive	____%
Just in Time	____%
Hazardous Materials	____%
Emergency shipments	____%
Other	____%

For your customers, what type of service is more important (please rank each choice from 1-5, with 1 being very important and 5 unimportant):

	Rank
Ability to serve broad range of routes, destinations	____
Schedule	____
Cost	____
Reliability	____
Frequency	____
Experience	____
Flexibility	____
Other (Please specify)	____

Have the service requirements of your customers changed in the last few years? Yes____ No____. If so, how?

_____
_____

If you use multiple modes, does this improve the service level you offer your customers? Yes____ No____
If yes, how?

_____
_____

Do you see the importance of transportation costs and services for your customers increasing or decreasing in relation to other cost factors that affect their competitiveness? Yes____ No____ Why?

_____
_____

Rank in order of importance the things that *you* feel are most important to increase your industry's market share and the competitiveness of your customers (number 1 is most important, 2 second, etc.)?
Rank:

_____ Cost
_____ Speed - Delivery Time
_____ Just-in-Time Delivery
_____ Flexibility of routes, services, etc.
_____ Reliability
_____ Frequency
_____ Geographic coverage
_____ Loss Damage Rate
_____ Real time status information (shipment tracking)
_____ Container/Equipment/Shipment characteristics (temperature, availability, maximum weight, maximum volume)
_____ Long term relationships
_____ Short term relationships
_____ Other _____

Do you help your customers plan their logistics needs? Yes____ No____ If yes, how?

_____

_____

What percentage of your industry's revenues involve long-term and/or short-term contracts?
Long-term_____% Short-term_____% (note: Long-term equals 1 year or more)

What are the typical minimum annual volume commitments with these contract customers?
Long-term_____ Short-term_____ (note: Long-term equals 1 year or more)

How do the tariffs your industry charges them compare to published tariff rates (give the percent of discount off regular tariffs)?
Long-term_____% Short-term_____% (note: Long-term equals 1 year or more)

Is the percentage of volume or contract customers increasing or decreasing? _____
What is the average length of a short-term contract?_____months
What is the average length of a long-term contract?_____years

What technologies or innovations do you believe have the most potential to improve the service or cost competitiveness of the transportation industry?
A_____Why?_____
B_____Why?_____
C_____Why?_____

What transportation infrastructure problems do you face as a carrier that, if solved, would enable you to deliver your services more effectively and efficiently?
A_____Why?_____
B_____Why?_____
C_____Why?_____

What short-term improvements in transportation services (policies, infrastructure, etc.) do you think would help increase US competitiveness in the global economy over the next 2-4 years for :
Your company and/or the transportation industry?
A_____Why?_____
B_____Why?_____
C_____Why?_____

The industry's customers?
A_____Why?_____
B_____Why?_____
C_____Why?_____

What long-term improvements in transportation services (policies, infrastructure, etc.) do you think would help increase US competitiveness in the global economy over the next 5-10 years for :
Your company and/or the transportation industry?
A_____Why?_____
B_____Why?_____
C_____Why?_____

The Industry's customers?
A_____Why?_____
B_____Why?_____
C_____Why?_____

What new or improved transportation policies by government could most effectively improve the competitiveness of US business?
National_____
State or Regional_____
Local_____

C. **Passenger Transportation** (NOTE: THIS SECTION ONLY APPLIES TO PASSENGER CARRIERS)

What average distances (in miles) do customers travel on your service?

Local area: _____
Outside of local area but within state/region: _____
Out of state but within US: _____
International travel: _____

For what reasons important to American business (and in what percentages) do passengers use your service?

Business travel _____%
Commute to work _____%
Access to businesses, shopping, health services, etc. _____%
Other (Personal travel - residential oriented) _____%

Have you been gaining or losing ridership? Why do you think this is the case?

_____

_____

In terms of the following activities, to what extent have they increased, stayed the same, or decreased.

1. Number of passengers: Increased_____Same____Decreased_____Why?_____
2. Frequency of trips: Increased_____Same____Decreased_____Why?_____
3. Peak Hours: Increased_____Same____Decreased_____Why?_____
4. Off-peak hours: Increased_____Same____Decreased_____Why?_____
5. Other (please specify): Increased_____Same____Decreased_____Why?_____

What are the main problems that affect your transportation service in meeting the travel requirements of American businesses (rank in order of importance, 1 for very important, 5 not very important, or n/a if not applicable)?
Answer separately for the three categories below that are relevant to your service:
Journey to work
Access to businesses
Business travel

	Rank	
Access to your system	_____	Why?_____
Congestion, on your system and/or route	_____	Why?_____
Familiarity with your system	_____	Why?_____
Infrastructure	_____	Why?_____
Others?_____	_____	Why?_____

Do you believe that improvements in your service could significantly increase American business competitiveness? Yes____ No____
If so, how?

_____
_____
_____

What investments (financial, infrastructure, policy, etc.)--both governmental and/or within your company--do you believe could most effectively improve your transportation service and the competitiveness of US business?
A_____Why?_____
B_____Why?_____
C_____Why?_____

What new or improved services implemented in your industry could most effectively improve the competitiveness of US business versus other countries?
A_____Why?_____
B_____Why?_____
C_____Why?_____

What technologies (vehicles, passenger accommodations, communication and information, etc.) do you believe have the most potential to improve the services of your segment of the transportation industry?
A_____Why?_____
B_____Why?_____
C_____Why?_____

What new or improved transportation policies by government could most effectively improve the competitiveness of US business?
National_____
A_____Why?_____
B_____Why?_____

State or Regional_____
A_____Why?_____
B_____Why?_____

Local_____
A_____Why?_____
B_____Why?_____

What do you see as the greatest opportunity which will increase level of service in the next:
A. 2-4 years_____Why?_____
B. 5-10 years_____Why?_____

What do you see as the greatest threat which will affect the level of service in the next:
A. 2-4 years_____Why?_____
B. 5-10 years_____Why?_____

D. **Final Comments**

Are you aware of how congestion on your routes or modes and delays affect your shipments or clients/employees travel? Yes____ No____
Do you have suggestions as to the types of transportation initiatives (public and/or private) that would help improve your industry competitiveness?
A_____Why?_____
B_____Why?_____
C_____Why?_____

What regulation/deregulation changes do you think are important to improve competitiveness of American business?
A._____Why?_____
B._____Why?_____

How does or will the North American Free Trade Agreement (NAFTA) and other trade agreements affect your industry and/or the competitiveness of American business?
A._____Why?_____
B._____Why?_____

Do highway incidents have an effect on your business performance? Yes____ No____ If yes, how important (from 1-5 with 1 being very important and 5 being unimportant) and in which ways?

A_____Rank (1-5)____Why?_____
B_____Rank (1-5)____Why?_____
C_____Rank (1-5)____Why?_____

What are some of the recent changes that you or others in your industry have instituted or are considering that affect the use of transportation services by various industries? Does it result in increase or decrease of transportation costs?
A.Change_____Affect_____Why?_____
B.Change_____Affect_____Why?_____
C.Change_____Affect_____Why?_____

What are the major transportation infrastructure problems and their alternatives (public/private) that need to be addressed to improve the competitiveness of American industry?

Public Problems:

Problem	Importance (1-5)	Alternative	Why?
A.			
B.			
C.			

Private Problems:

Problem	Importance (1-5)	Alternative	Why?
A.			
B.			
C.			

If you have any industry analysis, publications or reports that discuss transportation requirements, we would appreciate getting a copy.

Where do you see your company/agency/industry going in the next:

A. 2-4 years_____Why?_____
B. 5-10 years_____Why?_____

Thank you for your cooperation.

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3rd Party Logistics and Terminal Operator Questionnaire

The purpose of this study, sponsored by the Transportation Research Board, is to consider how recent economic trends are affecting the transportation requirements of American business. This information is important to understand how to improve the transportation system to most effectively increase American firms' competitiveness in the global economy. This questionnaire is designed to solicit logistics providers' and terminal operators' views on the future needs of our domestic and international transportation system and their suggestions on how to best fulfill these needs. A similar questionnaire is being used to also obtain the views of shippers in various industries.

A. **General Information**

Name of the Interviewee's Company or Organization: _____
Name of the Interviewee: _____
Name of the Interviewer: _____
Date: _____ Location of Interview: _____

Economic Sector Transportation

Type of Transportation Services:
Logistics Services
Terminal Operations

Size of industry (revenues) _____
(employees) _____

Size of company (revenues) _____
(employees) _____

Mode(s) used by your service or in your terminal:

Rail	____%
Water, Domestic or International	____%
Road	____%
Air	____%
Multimodal (if multimodal, please specify which modes)	____%

What are the primary industries you serve (please include a more specific subsector if possible)?

Agriculture, Forestry and Fisheries	____%
Subsector_____	
Mining	____%
Subsector_____	
Construction	____%
Subsector_____	
Manufacturing	____%
Subsector_____	
Public Utilities	____%
Subsector_____	
Wholesale and Retail Trade	____%
Subsector_____	
Government	____%
Subsector_____	
Other Services	____%
Subsector_____	

What type of shipments do you coordinate in your logistics service or serve at your terminal?

Containerized	____%
Palletized	____%
Less than truckload	____%
Truckload	____%
Bulk: solid	____%
liquid	____%
Other	____%

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B. **Terminal Operators** (Logistics Providers should skip this section and move to the next one.)

What types of goods do you handle at your terminal on a regular basis?

High value	____%
Low value	____%
Bulk	____%
Heavy	____%
Perishable	____%
Time-sensitive	____%
Just in Time	____%
Hazardous Materials	____%
Emergency shipments	____%
Other	____%

For your customers, what port attributes are more important (please rank each choice from 1-5, with 1 being very important and 5 unimportant)?:

	Rank
Customs ease	____
Congestion relief	____
Cost	____
Location	____
Ability to handle hazardous materials	____
Storage Capabilities	____
Ability to handle large vessels	____

C. **Logistic Providers Section** (Terminal Providers should skip this section and move on to the next one)

For your customers, what type of service is more important (please rank each choice from 1-5, with 1 being very important and 5 unimportant)?:

	Rank
Ability to serve broad range of routes, destinations	____
Schedule	____
Cost	____
Reliability	____
Frequency	____
Experience	____
Flexibility	____
Other (Please specify)	____

Have the service requirements of your customers changed in the last few years? Yes____ No____ If so, how?

_____
_____

If you use intermodal transport, does this improve the service level you offer your customers? Yes____ No____ If yes, how?

_____
_____

Do you see the importance of transportation costs and services for your customers increasing or decreasing in relation to other cost factors that affect their competitiveness? Yes____ No____ Why?

_____
_____

Rank in order of importance the things that *you* feel are most important to increase your industry's market share and the competitiveness of your customers (number 1 is most important, 2 second, etc.)?

Rank:

____ Cost
____ Speed - Delivery Time
____ Just-in-Time Delivery
____ Flexibility of routes, services, etc.
____ Reliability
____ Frequency
____ Geographic coverage
____ Loss Damage Rate
____ Real time status information (shipment tracking)
____ Container/Equipment/Shipment characteristics (temperature, availability, maximum weight, maximum volume)
____ Long term relationships
____ Short term relationships
____ Other _____

How do you help your customers plan their logistics needs?

_____
_____
_____

What functions do you provide as a logistics provider and what percentage of these services represent your revenues (check all those applicable)?

All distribution functions _____
Warehousing _____
Inventory Control _____
Transportation moves _____
Bill processing and auditing _____
Others (please specify) _____

_____

D. Final Comments

What technologies or innovations do you believe have the most potential to improve the service or cost competitiveness of the transportation industry?

A_____ Why?_____
B_____ Why?_____
C_____ Why?_____

What short-term improvements in transportation services (policies, infrastructure, etc.) do you think would help increase US competitiveness in the global economy over the next 2-4 years for :

Your company or Terminal?

A_____ Why?_____
B_____ Why?_____
C_____ Why?_____

Your customers?

A_____ Why?_____
B_____ Why?_____
C_____ Why?_____

What long-term improvements in transportation services (policies, infrastructure, etc.) do you think would help increase US competitiveness in the global economy over the next 5-10 years for:

Your company or Terminal?

A_____ Why?_____
B_____ Why?_____
C_____ Why?_____

Your customers?

A_____ Why?_____
B_____ Why?_____
C_____ Why?_____

What new or improved transportation policies by government could most effectively improve the competitiveness of US business?

National_____
State or Regional_____
Local_____

Are you aware of how congestion on your routes or modes and delays affect your shipments?

Yes____ No____ Do you have suggestions as to the types of transportation initiatives (public and/or private) that would help improve your industry competitiveness?

A_____ Why?_____
B_____ Why?_____

What regulation/deregulation changes do you think are important to improve competitiveness of American business?

A_____ Why?_____
B_____ Why?_____
C_____ Why?_____
D_____ Why?_____

How does or will the North American Free Trade Agreement (NAFTA) and other trade agreements affect your industry and/or the competitiveness of American business?

A._____ Why?_____
B._____ Why?_____

Do highway incidents have an effect on your business performance? Yes____ No____ If yes, how important (from 1-5 with 1 being very important and 5 being unimportant) and in which ways?

A_____ Rank (1-5)____ Why?_____
B_____ Rank (1-5)____ Why?_____

What are some of the recent changes that you or others in your industry have instituted or are considering that affect the use of transportation services by various industries? Does it result in increase or decrease of transportation costs?

A.Change_____ Affect_____ Why?_____
B.Change_____ Affect_____ Why?_____
C.Change_____ Affect_____ Why?_____

What are the major transportation infrastructure problems and their alternatives (public/private) that need to be addressed to improve the competitiveness of American industry?

Public Problems:

Problem	Importance (1-5)	Alternative	Why?
A.			
B.			
C.			

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Private Problems:

Problem	Importance (1-5)	Alternative	Why?
A.			
B.			
C.			

If you have any industry analysis, publications or reports that discuss transportation requirements, we would appreciate getting a copy.

Where do you see your company/industry going in the next:

A. 2-4 years_____Why?_____
B. 5-10 years_____Why?_____

Thank you for your cooperation.

APPENDIX D

Bibliography and Glossary

APPENDIX D

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GLOSSARY

AASHTO:	American Association of State Highway Transportation Officials
AM:	Aftermarket
APEC:	Asian Pacific Economic Cooperation
APL:	American President Lines
ATA:	American Trucking Association
AVC:	Automatic Vehicle Classification
AVI:	Automatic Vehicle Identification
BEA:	Bureau of Economic Analysis
BNSF:	Burlington Northern Santa Fe
CAAA:	Clean Air Acts Amendments of 1990
CEO:	Chief Executive Officer
CFO:	Chief Financial Officer
CFS:	Commodity Flow Survey
CLM:	Council of Logistics Management
CRS:	Computer Reservation System
CVO:	Commercial Vehicle Operations
DOC:	Department of Commerce
DOT:	Department of Transportation
EC:	European Community
EDI:	Electronic Data Interchange
EMU:	Economic and Monetary Union
EP:	Electronic Preclearance
EPA:	Environmental Protection Agency
ETC:	Electronic Toll Collection
EU:	European Union
FDA:	Federal Drug Administration
FHWA:	Federal Highway Administration
FOB:	Freight On Board
FTA:	Federal Transit Administration
FTAA:	Free Trade Area of the Americas
GAO:	General Accounting Office
GATT:	General Agreement on Trade and Tariffs
GDP:	Gross Domestic Product
GE:	General Electric Company
GMSPO:	General Motors Service Parts Operations
GNP:	Gross National Product
GRP:	Gross Regional Product
GSP:	Gross State Product.
HDTV:	High Definition Television
HMO:	Health Maintenance Organization
HSC:	Hughes Space and Communication

ICC:	Interstate Commerce Commission
IMC:	Intermodal Marketing Company
ISTEA:	Intermodal Surface Transportation Efficiency Act
ITDS:	International Trade Data System
ITS:	Intelligent Transportation Systems
JIT:	Just-In-Time
JOC:	Journal of Commerce
LTL:	Less-Than-Truck-Load
MIS:	Major Investment Studies
MPO:	Metropolitan Planning Organization
NAAQS:	National Ambient Air Quality Standards
NAFTA:	North America Free Trade Agreement
NATAP:	North American Trade Automation Prototype
NCHRP:	National Cooperative Highway Research Program
NEXTEA:	National Economic Crossroads Transportation Efficiency Act
NOL:	Neptune Orient Lines
NVOCC:	Non Vessel Operating Common Carriers
OE:	Original Equipment
OEM:	Original Equipment Manufacturers
OOCL:	Orient Overseas Container Lines
OPA:	Oil Pollution Act
OPEC:	Organization of Petroleum Exporting Countries.
R&D:	Research and Development
SIC:	Standard Industry Classification
SIP:	State Implementation Plan
SLS:	Sears Logistic Services
STIP:	State Transportation Improvement Program
TEU:	Twenty Foot Equivalent Units (Container)
TIP:	Transportation Improvement Program
TL:	Truck Load
TQM:	Total Quality Management
TTI:	Texas Transportation Institute
UMW:	United Mine Workers
UPSP:	Union Pacific Southern Pacific
USDOT:	United States Department of Transportation
USTTA:	United States Travel and Tourism Administration
VAN:	Value Added Network
VES:	Video Enforcement Systems
WTO:	World Trade Organization
XOT:	Exactly On Time

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Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation

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