2010 and Beyond: A Vision of America's Transportation Future

21st Century Freight Mobility

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Final Report

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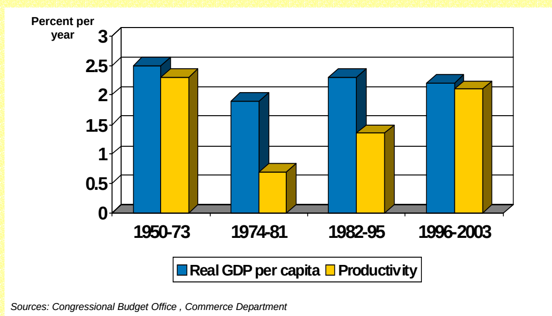
E. Executive Summary

E.1 Freight Transportation and the U.S. Economy

The U.S. economy is dependent on an efficient and reliable freight transportation system. Our highways, ports, waterways, railways, airports, warehouses, distribution centers, and intermodal and other facilities make up a complex system that shippers rely on to move products to markets. The performance of that system has direct implications for the productivity of the U.S. economy, the costs of goods and services, and the global competitiveness of our industries.

In particular, if we think of freight transportation as a necessary input for the production of goods and services (e.g., manufacturers must move their product from a production site to a consumption site or market) then the benefits of improvements to our freight transportation system become clearer. Efforts to enhance the efficiency and reliability of our freight system drive reductions in the cost of transporting goods and services to markets. As the cost of transportation falls, shippers substitute more transportation for other inputs (specifically, inventory and warehousing), and firms are able to produce more output for the same overall amount of inputs (or cost). The end result is an increase in economic productivity.

Exhibit ES-1: Productivity and Economic Performance



Productivity growth is important because it is the main determinant of changes in our standard of living. An increase in productivity reflects more efficient use of the labor, capital, materials, and so forth that are available to society at any given time. Production can always be increased if more resources can be found, but the supply of resources at any particular time is always limited. Productivity gains allow us to enjoy more or better goods and services with the resources we have. As depicted in Exhibit ES-1, growth in our Gross Domestic Product (GDP) per capita tends to rise and fall in conjunction with growth in labor productivity.

In addition to affecting our standard of living, the freight transportation sector itself is an important component of our economy.

- ***Share of the U.S. economy.*** Transportation accounts for a significant share of the GDP in the U.S. In 2002, the total value of for-hire freight was approximately $560 billion, almost 5.4 percent of GDP.[1] If we add in an estimated $100 billion for private carriage of freight (a low estimate), the total dollar figure is around $660 billion and the share of GDP is almost 6.4 percent.

[1] Cass/ProLogis, 14th Annual State of Logistics Report, June 2, 2003.

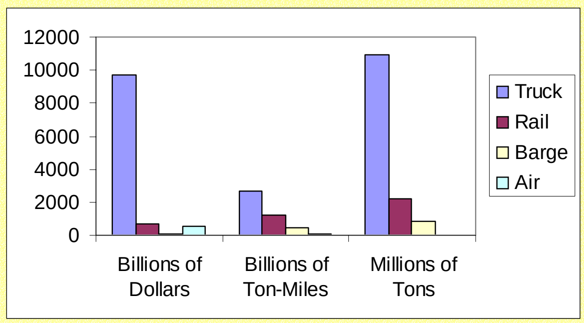
- ➢ ***Employment.*** The transportation sector is a major U.S. employer. In 2000, over 11 million people (nearly 9 percent of the U.S. non-farm labor force) were employed in transportation-related industries, including for-hire services, vehicle manufacturing, and parts suppliers. Of that total, 3.7 million people were employed in the for-hire transportation industry in the areas of air, rail, water, pipeline, and trucking (including warehousing).[2] Millions more held jobs in freight transportation within non-transportation companies.

Given these important direct and indirect contributions to our economy, it is imperative that public policies recognize the benefits of an efficient and reliable freight system and help to ensure high levels of performance. At the end of the day, performance is determined by the interaction between the demand for freight transportation and its supply, as well as by the unintended consequences of freight transportation itself (such as air pollution, degrading public safety, etc.) that affect our society's welfare. Consequently, understanding the factors that 1) drive the demand for freight transport, 2) affect supply, and 3) lead to unintended effects is imperative to shaping public policy.

E.2 A Gathering Storm

As shown in Exhibit ES-2, our freight system (not including pipelines) moved well over 14 billion tons of goods worth roughly 11 trillion dollars. However, there is significant and growing concern on the part of both the private and public sectors about the future performance of our freight transportation system. Consider the following:[3]

Exhibit ES-2: U.S. Domestic Freight Movement (2000)



Source: AASHTO, Freight-Rail Bottom Line Report

- ➢ ***Growing congestion on our highway system.*** As of 2002, our nation's road network consisted of over 8 million lane miles. Local roads comprised roughly 66 percent of these lane miles leaving approximately 3 million lane-miles of interstate, arterial and collector roads to carry intercity truck freight traffic. While the overall total number of lane-miles is impressive, growth in lane-miles has been scant over the last 20 years.

  The demand for highway travel, however, has been growing at a fast rate. This has led to a significant increase in congestion over the past few decades. It has been estimated that the annual cost of congestion and delay in the 75 largest urban areas is

[2] U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics 2002.
[3] The focus of this report is on the truck, rail, water, and air modes of freight transportation. We recognize that pipelines play an important role as well. Appendix A provides information on pipelines, but efficiency and reliability issues relevant to pipelines are not assessed in the body of this study.

approximately $70 billion. Congestion is even spreading to major rural roadways. Just over 7,000 miles of rural arterial roads are classified as significantly or severely congested. Furthermore, according to a recently released report from the General Accounting Office (GAO), peak-period highway congestion for passenger and commercial vehicles doubled from 1982 through 2000. From 1993 through 2001, truck traffic on urban highways increased more than twice as much as passenger traffic. This means that freight traffic is contributing to worsening congestion at a faster rate than passenger traffic, and as we will discuss later, there is no end in sight to the growth in freight traffic.[4]

Today, freight movements by trucks are increasingly time sensitive. The ability of the trucking industry to delivery goods in a reliable and time efficient manner is a key component to the mode's overall competitive position. Congestion, therefore, increases transit times and logistics costs leading to inefficiencies, loss of productivity, and higher prices. Congestion, however, also decreases the reliability of shipments. Even in areas of persistent congestion, the extent of that congestion may vary widely from day to day depending on weather, accidents, or other events. Recent trends such as just-in-time delivery require reliability, and unanticipated congestion comes at a great cost. For example, some recent evidence suggests that unexpected delays may cost shippers as much as $371 per hour depending on the type of cargo being shipped.

- ***Our shrinking railway system.*** Before deregulation and the Staggers Rail Act of 1980, the rail industry was widely considered to have significant levels of excess capacity. From 1980 to 2001, however, Class I railroads consolidated from 22 carriers to 7 (four of which have 95 percent of Class-I revenue), the number of locomotives decreased by 29.7 percent, the number of freight cars decreased by 23 percent, and railroad employment decreased by 55.5 percent.[5] The amount of rail line has also contracted substantially since 1980, from 164,822 to only 142,633 in 2001, a decrease of 13.5 percent.

  Although the reduction in capacity experienced since 1980 has led to increased productivity for the rail freight industry, there are signs of strain. Growth in Class I rail traffic density, defined as revenue ton-miles per mile of track owned, has almost tripled since 1980 and there are no signs of abatement. This trend cannot be increased indefinitely since moving greater volumes of goods over a shrinking network is unsustainable. Additionally, as traffic on the nation's rail system becomes more saturated, the system will be even more sensitive to shocks, such as unanticipated levels of demand, infrastructure failures, or operational issues.

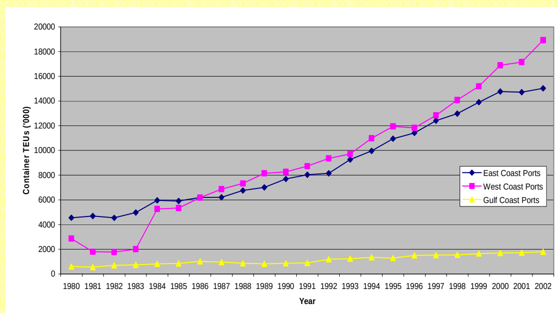
  AASHTO's recent Freight-Rail Bottom Line report forecasts various scenarios for the rail industry based on levels of investment. Of the four scenarios described in the report, the "Constrained" scenario represents the most likely future since it is based on what the Class I railroads can afford today from their revenues plus borrowing. In

[4] General Accounting Office, Freight Transportation: Strategies Needed to Address Planning and Financing Limitations, December 2003.
[5] Association of American Railroads; Railroad Facts, 2002 Edition.

the "Constrained" case, rail capacity is under great stress and the industry is not able to handle the proportion of goods movements that it carries today, although the absolute level of freight carried by the railroads would continue to increase. The rail industry would lose market share to trucking. The loss in market share would be equivalent to approximately 450 million tons of freight, adding 15 billion truck VMT to the nation's highways.

- ***Our constrained and inefficient port system.*** Globalization and growth in international trade are placing more demands on our ports. Between 1970 and 1999, trade's share of GDP increased from 10.7 percent to 26.9 percent. As a result, our nation's ports and channels are becoming increasingly congested as ever greater amounts of freight are moved through a system with limited means for physical capacity expansion. From 1990 to 2000, tonnage at U.S. ports increased by 13.8 percent[6] (see Exhibit ES-3), while capacity expanded only marginally. In fact, considerable resources were required merely to maintain physical capacity through efforts such as dredging.

Exhibit ES-3: Trends in U.S. Ports Container Traffic



Source: American Association of Port Authorities www.aapa-ports.org

Note that Wal-Mart estimates it spent $15 billion on Chinese-made products in 2003. If Wal-Mart were a nation, it would be the fifth largest export market for China, ahead of Germany and Britain.

Moreover, landside access is a problem of increasing importance to our ports and is becoming one of the primary bottlenecks for the movement of goods from vessels to the rest of the transportation system. Once vessels arrive at a port it makes little difference how productive the rest of the port is if goods cannot be unloaded off a vessel efficiently. In 2001, 20 to 25 percent of the top 15 U.S. deepwater ports reported unacceptable flow conditions on landside elements of the intermodal access system.[7] Compounding this problem is the fact that many ports do not even have sufficient room to expand landside access nor do they have the funds required to maintain this additional capacity even if it was acquired.

With capacity becoming more constrained, disturbances can create larger and larger shocks. For example, the recent collision of an offshore supply boat and a container

[6] U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics, 2002.
[7] U.S. Department of Transportation Maritime Administration, 2002 Intermodal Access to US Ports Report on Survey Findings, August 2002.

vessel at the mouth of the Mississippi River created major bottlenecks delaying tankers and cargo ships at costs as high as $35,000 to $40,000 per vessel per day.[8]

Adding to the problem, many U.S. ports charge users fees below their costs. This is partly due to subsidies from various levels of government, but also due to competition among ports where raising user fees would lead to losses of business. This creates an environment where individual ports may have excess capacity much of the time, but are characterized by severe congestion during peak periods.

- ***Our aging inland waterways.*** The U.S. inland waterways are an important component of the nation's transportation system. These waterways transport approximately 20 percent of the nation's coal and 60 percent of the nation's grain movements.[9] Investment in the infrastructure required to support these waterways (e.g., locks), has not been adequate to maintain the system. In 1997, the U.S. Army Corps of Engineers reported that the median age of all lock chambers was 35 years.[10] This survey also concluded that lock specific delays have been increasing throughout the inland waterway system and that delays averaged around six hours at the most congested locks and sometimes lasted for much longer. Additionally, capacity of inland water channels has remained basically flat since 1970 while tonnage has increased by 33 percent.[11]

- ***Incredible growth in air cargo.*** At an annual growth rate of 5.1 percent from 1990 to 2000, air freight is by far the fastest growing mode of freight transportation. (The exception would be intermodal rail if it were regarded as a separate mode.) Available forecasts predict air freight will continue to grow at rates of 4.0 percent to 5.2 percent through 2020. Growth at these rates will put considerable strain on an aviation system already characterized by frequent delays, traffic control safety concerns, and heightened security measures. To date, however, this growth in air freight has yet to severely constrain the system as a whole, although certain hubs are beginning to experience chronic problems. At LaGuardia airport, for example, 16 percent of flight takeoffs and landings experience delays.[12]

  The conditions at heavily trafficked airports such as LaGuardia suggest that a return to the growth rates in air travel prior to 9/11 likely will strain our airport system. There are a number of interrelated issues affecting the performance of our airports, from the need for terminal and runway expansions to the need for additional landside connections to accommodate air cargo movements. Freight and passenger conflicts, safety and security concerns, and the adequacy of the air traffic control system also

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[8] *Collision Brings Chaos: Main Mississippi Channel Blocked*; The Advocate; Baton Rouge, Louisiana; February 23, 2004.
[9] The American Waterways Operators: http://www.americanwaterways.com/.
[10] Reported in: Freight Capacity for the 21st Century, Special Report 271; National Academies of Sciences; Transportation Research Board.
[11] U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics, 2002.
[12] Reported in: Freight Capacity for the 21st Century, Special Report 271; National Academies of Sciences; Transportation Research Board.

are pressing issues that must be addressed to accommodate continued growth in the demand for air freight.

E.2.1 Some Vulnerable Points in the System

In addition to the numerous highway bottlenecks that currently exist, there are other important examples of potential weak points in the national freight system.

- ***Congestion in the Southern California Ports and Chicago.*** Enormous volumes of container traffic (almost 11 million ton equivalent units - TEUs) move through the ports of Los Angeles and Long Beach. Containers destined for the major consumption centers of the Midwest and the East largely move from Los Angeles to Chicago by intermodal rail, an efficient and low-cost movement. But congestion around the docks and along the roads from the docks to the rail terminals constantly threatens efficiency of the dock-to-rail move. Similarly in Chicago, the transfer of eastbound containers from western railroads to eastern carriers is made by drayage moves through highly congested urban roads. Congestion and inefficiency in urban drayage degrade the efficiency of the 2,000-mile move at either end of the trip.

  A starker example of the vulnerability of the Los Angeles and Long Beach ports was the West-coast dock dispute of 2002. After a ten-day lockout of dockworkers, it took the system 23 days to get back to normal flows and eliminate the backlog. Goods in the value of $6.3 billion were held up. Some major importers had to take drastic steps to keep freight moving to their customers. Hewlett-Packard, for example, resorted to air freight to keep its commitments, whereas Mattel worked around the problem by having its containers placed where they would be unloaded first from ships.

- ***Inland waterways—The Mississippi.*** The lock-and-dam system on the Mississippi River and its major tributaries is aging, and many observers believe its capacity is no longer sufficient for the traffic moving on the river. Some locks are heavily congested with delays of well over six hours during peak-flow periods. The Mississippi and its principal tributaries, the Illinois and Ohio Rivers, are major highways for bulk traffic, especially coal and grain. The river system is the lowest-cost carrier of these commodities. Excessive delays on the river can add to shippers' costs, especially if they are forced to use more costly rail service. The river system is also a major factor in international competitiveness, as a large proportion of our grain exports goes down the Mississippi to New Orleans.

- ***Border-crossing delays.*** The great preponderance of NAFTA trade moves over our northern and southern borders in trucks. Partly because of customs procedures, and partly because of limited infrastructure at key crossing points, there is a significant potential for congestion and delay. Very long back-ups on the Ambassador Bridge are an ordinary occurrence for traffic inbound from Canada to Detroit. Since major auto-production facilities are clustered in both Michigan and western Ontario, congestion at the Detroit crossing can be a major source of inefficiency in the logistics systems of the automakers. This is the kind of cost that spreads quickly through the whole economic system, affecting both producers and consumers.

The same issues arise at the southern border, especially at the Laredo crossing point. A combination of customs procedures, limited infrastructure, and periods of very heavy traffic flows leads to inefficiencies that ripple through the production and distribution of all traded goods. Laredo and Detroit are leading examples, but congestion and delay are issues at several other crossing points as well.

The Bureau of Customs and Border Protection (CBP) has recently published new rules requiring advance electronic filing for inbound truck (and rail) traffic over both borders and for outbound traffic over the Mexican border. CBP is making efforts to streamline processes so heightened security requirements will not impede traffic flow, but this is a concern, nonetheless.

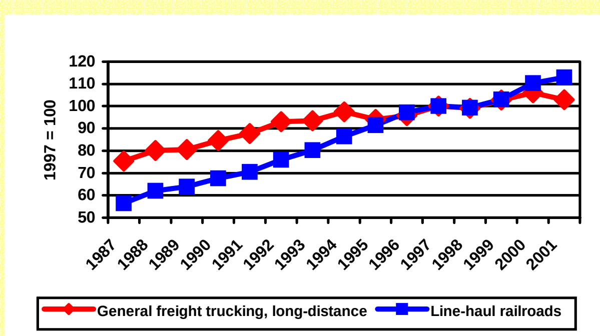
E.2.2 Can Carrier Productivity Save Us?

The impact of increasing traffic levels on the quality and reliability of freight transportation can be magnified if concomitant investments in our highways, ports, railroads, and intermodal facilities do not keep pace—in economics jargon, if the supply of infrastructure does not keep pace with increases in demand, the cost of moving freight will increase. However, the ability to balance demand and supply is also influenced by increases (or decreases) in carrier productivity.

For example, intermodal freight transport has generated benefits that have further fostered productivity growth in manufacturing and the overall economy. For instance, the benefits of low-cost double-stack service were fully realized because the trans-Pacific container lines were able to contract with rail carriers for fast and reliable service—service that adheres to the precise schedules set by the steamship companies. Because of this, and because of competition between railroads, large volumes of imported consumer goods move speedily and reliably from West-coast ports to the Midwest at low rates (e.g., railroads are hauling containers from Los Angeles to Chicago at rates in the vicinity of 43 to 48 cents a mile (around 55 cents for premium, high-speed service), while the average truckload rate is currently somewhat in excess of $1.40 a mile). Freight service of this quality and price allows major distributors and retailers to keep a tight rein on their logistics costs to the benefit of their customers and the overall economy.

Intermodal transportation services exemplify the types of changes that have led to improvements in the reliability and quality of this nation's freight system. As shippers have changed their logistics practices to take advantage of a more flexible and demand-responsive freight system, carriers have also improved their operations. In this manner, improvements in carrier productivity are important to ensure that

Exhibit ES-4: Productivity Trends in the Trucking and Railroad Industries



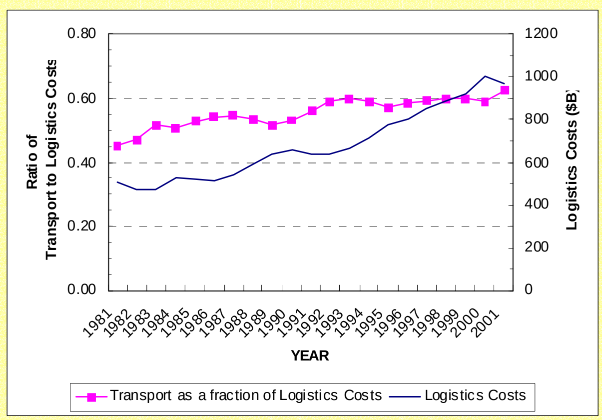
efficiency gains in the freight system are sustainable.

As depicted in Exhibit ES-4, both trucking and rail productivity have improved significantly since the mid-1980s (largely because of deregulation). However, the recent decline in trucking productivity suggests that the trucking industry may have difficulty in meeting short-term transportation demands from the manufacturing, service, and trade sectors over the next several years. Furthermore, due to intense competition the railroads have passed most of the productivity gains on to their customers in lower rates.

Overall, productivity losses in the transportation sector can lead to higher costs to the manufacturing, service, and trade sectors in the form of increased operating costs. This, in turn, can exert downward pressure on economic productivity, as transportation and warehousing costs rise relative to output. Coupled with the significant strains that currently exist in the capacity of our freight system, decreasing carrier productivity will result in an overall weakening of the U.S. economy as fewer products and services can be generated with the same amount of resources.

At the most general level, degradation of freight-system performance would be felt all along supply and distribution chains and, accordingly, by all producers and importers of goods and all consumers of goods. In today's highly competitive business world, many manufacturers, distributors, and retailers maintain their profit margins by means of ultra-sophisticated logistics systems. Using advanced software and algorithms to calculate optimal quantities in the supply chain, in warehouses, and in stores, these systems strike a fine balance between holding down inventories and keeping enough goods in the forward end of the chain to meet customer demand. Part of the design of these systems is the size and spacing of warehouses and distribution centers. Fewer distribution centers can mean lower inventory costs, but fewer distribution centers also mean longer distances between supply sources and distribution centers and from distribution centers to stores. It takes speed and a high level of reliability in freight deliveries to make the system work with longer distances. Exhibit ES-5 depicts how shippers have increased their use of transportation and reduced their reliance on other logistics components (specifically, inventory and warehousing). This has led to the phenomenon commonly referred to as "warehouses on wheels."

Exhibit ES-5: Substitution of Transportation for Other Logistics Components



Source: Cass State of Logistics Report, 2002

Any degradation of the goods-movement system will seriously erode the profits firms now gain from successful inventory management. The success of these logistics operations depends on deliveries, mostly truck deliveries, hitting time windows, sometimes as narrow as 15 minutes, day in and day out. With any sustained decay in schedule reliability, the efficiency in these carefully designed systems would quickly disappear. In past interviews with both carriers and shippers, a recurrent theme heard by ICF analysts was the damage that could be done by system failure or degradation. Any such loss of efficiency would have an impact on the economy well beyond lower profit margins for the companies directly affected. There would be a negative effect on productivity that would ripple through the whole economy, lowering our competitiveness and our standard of living.

E.3 Growth in the Demand for Freight Transportation

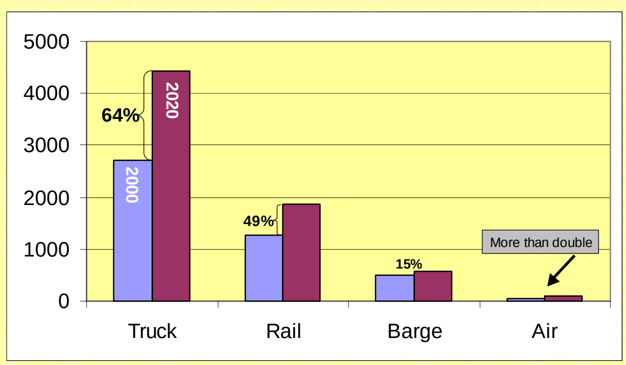
To more clearly understand the severity of the trends that are discussed in the section above, it is helpful to review how the demand for freight transportation is expected to change in the future. Numerous studies have been conducted to forecast growth in freight transportation demand. Although the results of those studies may differ, they all point to explosive increases in demand—increases that are sure to further erode the performance of our current freight system unless something is done.

Based on an evaluation of multiple studies, a plausible demand growth scenario for each mode was developed for this analysis. Under our scenario, the annual growth rates in ton-miles for the period between 2000 and 2020 are as follows:

- Trucking = 2.5% per year,
- Rail = 2.0% per year,
- Barge = 0.70% per year, and
- Air freight = 4.0% per year.

As depicted in Exhibit ES-6, even under what some may argue to be conservative demand forecasts, these growth rates mean that by the year 2020 our freight system will have experienced a 64 percent increase in trucking ton-miles, a 49 percent increase in rail ton-miles, and a 15 percent increase in barge traffic—all while the demand for air freight will have more than doubled. To put these growth rates in context, consider the following.

Exhibit ES-6: What do these forecasts mean? (Billions of Ton-Miles)



- **Trucking**: At the national level, a 64 percent increase in truck ton-miles between 2000 and 2020 means 79 million more intercity truck shipments per year by 2020. As an example, at a regional level, this growth would mean 5 million more intercity truck shipments per year out of the Houston region by 2020, or nearly 7 million more truck VMT per year on Houston area roadways.

- **Rail**: At the national level, a 49 percent increase in railroad ton-miles between 2000 and 2020 means that 7.8 million more rail carloads will be originated per year by 2020, or 90,000 more freight train movements will be originated per year by 2020. At the regional level, such growth implies 360,000 more rail carloads originated per year in Chicago by 2020, or more than 4,000 more yearly freight train movements in the Chicago area by 2020.

- **Barge**: A 15 percent increase in barge ton-miles between 2000 and 2020 means that 37,000 more barge movements will occur on the Ohio River per year by 2020 and 25,000 more barge movements will occur on the Lower Mississippi River per year by 2020.

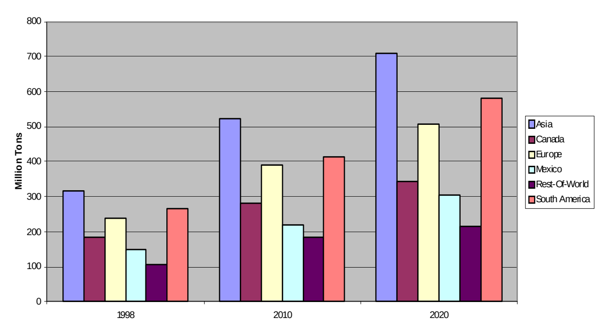
- **Air**: A 120 percent increase in air cargo ton-miles between 2000 and 2020 means 9,600 more annual air cargo plane departures at LAX by 2020 and 3,500 more annual air cargo plane departures at Dallas-Fort Worth Airport by 2020.

The ramifications on our freight system's ability to accommodate this growth in demand are severe, especially given little or no change in government policies and programs designed to enhance the system's effective capacity.

The factors driving the growth in the demand for freight transportation are as follows.

- ***Growth in economic output and increased dependence on imports.*** Specifically, growth in the production of goods in the U.S. destined for both domestic and international markets and growth in imports directly affects the demand for freight transportation. Those two metrics in effect define the number of goods that must be transported within the U.S. From 1987 to 2000, the annual growth (value based) in U.S. manufacturing plus imports was 4.26 percent, greater than the overall growth in GDP (3.19 percent). Our increased dependence on imports means that more finished goods move directly from our ports to distribution and consumption centers across the country, increasing the emphasis on carrier service flexibility and reliability and influencing the need for a leaner supply chain. As depicted in Exhibit ES-7, the role of international trade in our economy is not expected to subside in the future.[13]

Exhibit ES-7: Growth in Trade



Source: FHWA, Trade: From National Markets to Global Markets (Theme Paper #1) – Global Insight Data

[13] The advent of nanotechnology, however, could alter this picture since it would lead to a revolution in the way that we make and consume products. There is a significant amount of resources being dedicated to nanotechnology research in the U.S. For example, the President's 2005 proposed budget includes $1 billion for research and development in this area, while a number of private and publicly-

Two specific developments relevant to international trade are likely to occur or continue that will further affect our freight system. First, it is very likely that, in the medium term, the Panama Canal will be widened to accommodate post-Panamax ships. The effects on trade patterns and domestic freight flows could be significant, especially if our ports system is not modernized.[14] Second, continued explosive economic growth in China can be expected to continue into the future. This continued growth can be expected to influence: 1) U.S.-Mexico trade (maquilas) and, more broadly, U.S.-Latin America trade, 2) the prices of consumer goods and, by extension, the demand for imports, and 3) the performance of our West-coast ports and associated inland freight system.

- ***Technology.*** Innovation in information technology facilitates development of new products in robotics, just-in-time inventory control programs, networked dispatching, real-time schedule management, and other manifestations of intelligent production and transportation logistics. When manufacturers and transportation firms invest in such products, their labor productivity improves and peoples' real wages improve accordingly. And, since capital investment itself triggers faster technological advance, a circle is established which drives the rate of growth higher still.[15]

  In the past, technological innovation has enabled: 1) the shift from push to pull logistics which led to a focus on supply-chain management and the advent of 3-PLs and 4-PLs (i.e., specialists in total logistics management) and 2) significant decreases in logistics costs as shippers have consolidated distribution centers and substituted more transportation for costly inventory. Today, technology is enabling shifts to coordinated logistics based on new carrier business models to meet time-definite and door-to-door needs of shippers (e.g., mode-neutral service products).

  In the not-too-distant future, technology is likely to once again influence our freight system. For instance, a "second wave" of the information technology (IT) revolution is on the horizon, as advances in computer technology and communication networks (e.g., band width) are realized. This "second wave" could lead to new and improved logistics systems and industry arrangements that enable the development of freight villages and city-logistics practices that, in turn, greatly affect how our freight system is structured spatially and institutionally.

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held companies are also investing to develop this technology. The timing of the development of cost-effective manufacturing processes based on nanotechnology is uncertain, however. Significant technical and societal challenges lie ahead, but progress is being made quickly.

[14] Industry consolidation and the ever-present drive for increased efficiency are leading to greater use of mega-containerships and traffic consolidation (hub-ports). This additional traffic necessitates wider and deeper channels. For example, the newest class of mega-containerships requires channels 50 to 53 feet deep compared to historic standards in the 36 to 40 foot range. Although expansion dredging is an important issue, many of the nation's ports have not even been able to fulfill their maintenance dredging needs. For example, a 2001 U.S. DOT survey found that nearly 30 percent of all U.S. container ports reported unacceptable channel depths (U.S. Department of Transportation Maritime Administration, 2002 Intermodal Access to US Ports Report on Survey Finings, August 2002).

[15] David Lewis, The Role of Public Infrastructure in the 21st Century, Special Report 220, Transportation Research Board, National Research Council, 1988.

The linkages between technology, advanced logistics, and economic productivity can be weakened, even severed, by congestion and delay on our freight system. It is one thing for new robotics and intelligent logistics products to come on the market; it is quite another for manufacturing and transportation firms to invest in them. Such investment is costly. Threats to the effectiveness of such products are threats to the business case for investing in them. Widespread testimonials are not at hand, but analytic and anecdotal evidence indicates that congestion and delay is viewed in some sectors as a barrier to obtaining satisfactory payback from investment in just-in-time logistical products. Take-up of advanced logistics may be waning already, in part due to the economic slowdown, but also to mounting congestion in some strategic corridors around the country.

E.4 The Role of Government

The discussion thus far tells us that there are likely to be significant strains on the capacity of the national freight system over the next ten to 20 years, given little or no change in government programs. "Little or no change" means a continuation of past trends in funding levels and patterns of practice in programs and policies affecting freight-system performance. It does not mean a world in which there is no further investment in freight-transportation infrastructure and facilities. It means a world in which Federal-aid highway funds continue to flow, states and local governments continue to spend on roads, railroad firms continue to invest in track and equipment, and so forth. But the current level of effort, allowing for some uptrend in funding in light of historical trends, is insufficient to maintain the current performance of the freight system, let alone enhance it.

The question then becomes whether the expected future strains on the freight system merit a response from government. "Response" means some significant change; it could be a change in funding levels, changes in the structure of existing programs or creation of new programs, changes in regulatory practice, or some combination of these. The clear message is that some significant response definitely is needed. The cost to the economy of a poorly performing freight system is too great to ignore.

E.4.1 Possible Types of Government Responses[16]

The basis of effective public policy should start with a national vision for our freight system. The programs and projects that are implemented by states and localities in turn need to support that vision, as well as the goals, objectives, and strategies that

Exhibit ES-8: Where do we want to be 10 or 20 years from now?

- An efficient, reliable, and integrated freight system, enabled by technology, that
  - Optimizes generalized logistics costs
  - Helps to maximize manufacturing productivity
  - Helps to minimize the prices of imports
  - Enhances efforts to make our homeland more secure
  - Enhances our ability to deal with congestion in urban areas
  - Is energy and environmentally efficient
  - Limits effects on community livability and cohesiveness
  - Minimizes the probability of accidents and associated fatalities and injuries

[16] Note that this report focuses on the demand for freight transportation services and the capacity issues that define the performance of our freight systems. Energy, environmental, homeland security, and other social issues associated with the movement of freight are not explored in detail.

flow from it.

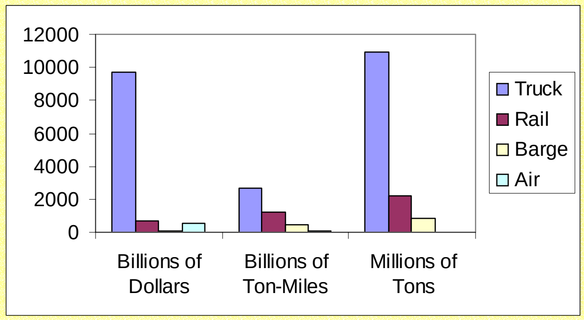
Exhibit ES-8 (above) articulates a vision for our freight transportation system, one that is predicated on economic efficiency and societal goals. Recognizing the numerous medium-term and long-term system performance challenges that are described in this report, and drawing from the input received from the expert panel that participated during the course of this study, achieving this vision likely will require programmatic approaches. For example, national-level programs designed to select and help fund freight projects of national significance can help to address major capacity bottlenecks and accelerate the development of projects that enhance the performance of the nation's freight system. Such programs could be based on detailed and strict guidelines for project selection, monitoring, and evaluation. Likewise, national-level programs for funding, evaluating, and disseminating the results of innovative multimodal freight planning and programming at the state and local levels can help to address the need for meaningful freight planning at the state and local levels. Such programs could help to push the envelope on issues related to collaborative institutional arrangements, public/private partnerships, freight-passenger interferences, regional freight networks (e.g., freight villages, city logistics), land use needs, freight analysis data and tools, and operations-oriented strategies.[17] Similarly, national-level programs designed to improve the efficiency and productivity of our nation's harbors can help to address the current lack of national and/or regional focus for port planning, as well as address needs related to changing trade patterns and post-Panamax vessels. Such programs could help fund channel dredging projects according to the national interest and include an efficient user fee that adheres to trade treaties.

[17] Given the importance of intercity freight movements to our economy, effective freight policy and planning will require a high degree of coordination between state-level agencies (such as between neighboring state DOTs) and between state- and local-level agencies (e.g., between a state DOT and a city government).

1. CONTEXT AND PROJECT OVERVIEW

As shown in Exhibit 1, trucking is the dominant mode of domestic freight transportation in the U.S. In 2000, trucking accounted for 78 percent of the nation's intra- and intercity freight tonnage, 60 percent of total ton-mileage, and 88 percent of our total freight bill (all exclusive of pipelines).[18] The picture changes, however, when one focuses on just intercity freight movements. According to BTS, in 1990, rail accounted for almost 40 percent of intercity ton-mileage. By 2000, rail's share had grown to 47 percent. During that same period, the trucking share of intercity ton-mileage also grew from 28 to 33 percent, while water's share fell from about 32 percent to 19 percent.[19]

Exhibit 1: U.S. Domestic Freight Movement (2000)



Source: AASHTO, Freight-Rail Bottom Line Report

In the past, policy-makers, government agency practitioners, carriers, and even shippers viewed our freight system from this type of modal perspective, and focused analyses and decisions on mode-specific considerations. The advent of intermodalism, which has been enabled by technology, has changed this perspective to a more holistic viewpoint that is blurring the lines between specific modes. Today, shippers, carriers, forwarders, and integrators are reshaping freight networks. The modal industries are evolving from "carriers" to "supply-chain managers." Shippers are delegating carrier selection to third-party logistics (3-PLs) firms. Government is focusing on system performance, rather than facility design and mode-specific capacity issues. Overall, the trend is toward market integration, and efficiency and reliability are defined by the performance of the overall system.

There are a number of drivers that are generating this change. The most significant are changes in the structure of our economy and technological innovation.

- ***Changing economic structure.*** Between 1970 and 1999, the share of our Gross Domestic Product (GDP) that is attributable to international trade increased from approximately 11 to 30 percent. During this period, the services sector of our economy increased significantly and manufacturing became relatively less of a driver in our economy. These changes have had a profound effect on our freight system. First, relatively more finished products are being transported, meaning that carrier flexibility and reliability are becoming more and more important. Second, the connectivity between our trade gateways (ports and border crossings) and inland highways and rail systems has become critical to the performance of the freight system. Modes depend more on one another to meet the demands of customers.

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[18] American Association of State Highway and Transportation Officials (AASHTO), Freight-Rail Bottom Line Report, 2002.
[19] In this context, "water" includes river barge and coastal and lake shipments.

- ***Technology.*** Technological innovation has enabled: 1) the shift from push to pull logistics which led to a focus on supply-chain management and the advent of 3-PLs and 4-PLs (i.e., specialists in total logistics management) and 2) significant decreases in logistics costs as shippers have consolidated distribution centers and substituted more transportation for costly inventory. Today, technology is enabling shifts to consolidated logistics based on new carrier business models to meet time-definite and door-to-door needs of shippers (e.g., mode-neutral service products). In the future, technology may enable the development of freight villages and city logistics practices; further reshaping networks and service paradigms.

Exhibit 2: Freight Transportation Externalities

Air quality

- Diesel exhaust is a primary source of PM and air toxic contaminants, which are deemed as major health threats especially to children
- Diesel exhaust is a primary source of NOx emissions, a precursor to ozone

Community livability and environmental justice

- Location of many freight facilities may lead to a disproportionate impact on minority and economically disadvantaged communities

Transportation safety

- In 2002, 434,000 large trucks were involved in traffic crashes in the U.S.; 4,542 were involved in fatal crashes. A total of 4,897 people died and 130,000 were injured.

Homeland security

- The vulnerability of the freight system, especially given globalization, is a major cause for concern when it comes to terrorism

Even though our freight system has proven to be highly adaptable, there is growing concern on the part of government and industry about the future performance of our freight transportation system, its ability to foster continued economic growth, and its effects on the environment, public safety, and other social issues (see Exhibit 2). Growing congestion on critical highway segments, increases in delay at freight terminals and border crossings, rail infrastructure downsizing, insufficient dock or near-dock loading facilities at our ports, and the effects of potential new security requirements are examples of the types of factors that affect the productivity of our freight system. When coupled with our inability to quickly increase the capacity of the system, these factors could have significant adverse effects on our future standard of living.

This report provides information on the issues that determine the balance between the demand for freight transportation and its supply (as characterized by capacity), so that decision-makers can answer the following question:

> *What can government (at all levels) do to ensure an efficient and reliable freight system that fosters economic productivity and growth, while minimizing unwanted externalities?*

First, a review of the role of freight transportation in our economy is presented. Second, an assessment of the capacity challenges facing users of the freight system is provided. Third, a future demand scenario is constructed against which future supply considerations can be evaluated. Fourth, past and current policy initiatives to improve the performance of our freight system are reviewed. Finally, approaches for mitigating the imbalance between supply and demand are investigated from a policy perspective.

2. FREIGHT AND THE ECONOMY

Carriage of goods is the movement of the inputs and outputs of all the production and distribution processes—manufacturing, farming, mining, and the wholesale and retail trades. Freight carriage is important in the economy in two ways. Taken by itself as an economic activity, goods movement is a major industrial sector. But the carriage of the inputs and outputs of the other sectors is a critical input to all the production and distribution processes in the economy. As such, the cost and quality of freight movement affect the productivity of the entire economy.

The importance of freight movement as an industrial sector is seen in Exhibit 3, which shows total value of for-hire freight at about $560 billion, almost 5.4 percent of GDP. If we add in an estimated $100 billion for private carriage of freight (a low estimate), the total dollar figure is around $660 billion and the share of GDP is almost 6.4 percent.

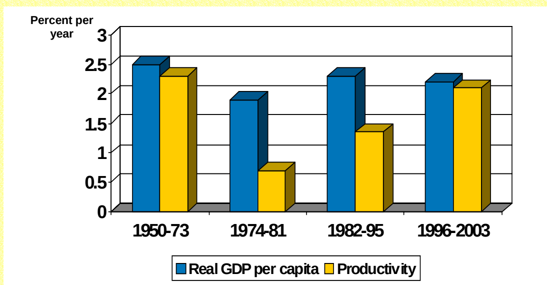
Exhibit 3: U.S. Business Logistics System Costs, 2002

2002	Billions of Current US$	% of GDP
Trucking (intercity & local)	462	4.41%
Rail	37	0.35%
Water (domestic & int'l.)	27	0.26%
Air (domestic & int'l.)	27	0.26%
Oil Pipelines	9	0.09%
Total	562	5.37%
2002 Nominal GDP	*10,470*	

Source: Cass/ProLogis 14th Annual State of Logistics Report, 6/2/03

As these numbers show, movement of goods is a non-trivial share of the national economy. For American consumers, however, the significant impact of freight carriage is felt through its effect on productivity and, hence, on the standard of living. An increase in productivity reflects more efficient use of the labor, capital, materials, and so forth that are available to society at any given time. Production can always be increased if more resources can be found, but the supply of resources at any particular time is always limited. Productivity gains allow us to enjoy more or better goods and services with the resources we have available. As depicted in Exhibit 4, growth in our per capita GDP tends to rise and fall in conjunction with growth in labor productivity.

Exhibit 4: Productivity and Economic Performance

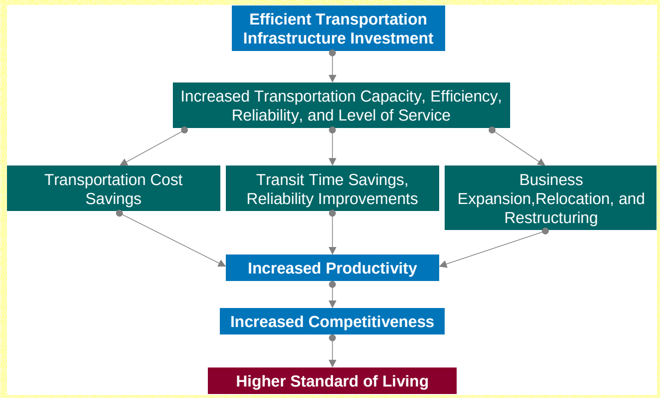


Sources: Congressional Budget Office , Commerce Department

2.1 Freight Transportation and Economic Productivity

The performance of the goods-movement system affects economic productivity in several ways. Changes in the cost of freight movement and the quality of freight movement both affect the amount of freight transport that firms buy and the ways in which they use freight transport. At the most basic level, a drop in the cost of goods movement means firms will buy more goods movement. This will most likely take the form of shipping products longer distances and obtaining inputs, materials and intermediate products, from longer distances. This increases the market that can be served from a given facility and gives access to lower-cost inputs and, perhaps, to a wider spectrum of choices of inputs. Exhibit 5 traces the links from an improvement in freight-transport to a higher standard of living.

Exhibit 5: Transportation and the Economy



Improvements in the quality of transportation take the form of reduced transit times and greater reliability of delivery times. Both of these effects, and especially the second, affect the way in which firms design their logistics systems. Lower transit times increase the "reach" of facilities such as factories and distribution centers; if these facilities can be more widely spaced, placed farther apart from each other, a given market area can be served with fewer facilities. Since fewer facilities for a given flow of goods means more volume per facility, operating costs as well as investment costs may be reduced. Thus, when firms consider their logistics arrangements and the design of their distribution systems, they will take account of improved freight transport to develop lower-cost systems.

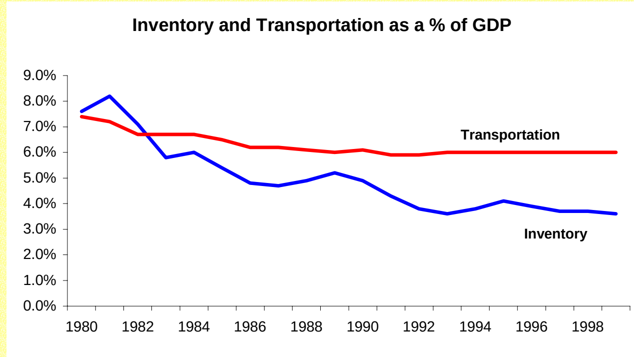
As described in Exhibit 6, increased reliability has a further effect. It allows firms to reduce the total investment in inventory required to support a given volume of sales. The greater the reliability of the system, the less the requirement for buffer stocks to guard against delivery failures. Again, firms will take advantage of this factor when they redesign or build new logistics systems, leading to overall reduction in logistics costs even while they buy

Exhibit 6: How do firms react to improvements in freight transportation?

- Firms reduce stocking points, increase JIT processes, and increase shipping distances
- Firms react to reduced late-shipping-delays, valued highly by shippers, by investing more in logistics
- Inter-industry trading patterns are affected

more transport services to ship longer distances. Substitution of transportation for the other elements of logistics costs—principally inventory and warehouses—has been a marked feature of the U.S. economy over the last two decades as shown in Exhibit 7.[20]

Exhibit 7: For example, shippers substitute inventory for transportation.



2.1.1 Examples of Specific Firms' Responses to High-quality Freight Transport

If we think of freight transport as a necessary input in the production of goods and services (e.g., manufacturers must move their product from a production site to a consumption site or market), then the benefits of freight improvements become clearer. First, as the cost of transportation falls, firms substitute more transportation for other inputs. Second, the result is that producers can now generate more output at the same level of cost. By definition this effect is an increase in economic productivity. The end results from the decrease in transportation cost are 1) an increase in the demand for transportation from the drop in the cost of transportation and 2) a long-term change in the structure of that demand as firms rely more on the efficiency and reliability of the freight system and less on the other components of logistics.

Below are three specific examples of how firms have restructured their logistics systems to take advantage of high-quality transportation and reduce costs.[21]

1. **Polaroid** – In the late 1980s, Polaroid decided to centralize its European inventories by substituting transportation for warehousing; a large number of warehouses were closed. Estimated annual gross savings were $6.9 million, broken down as follows:

    - ✓ Warehousing personnel - $2.5 million;
    - ✓ Inventory carrying costs - $2.2 million;
    - ✓ Warehouse rental costs - $1.0 million;

[20] Strictly speaking, shippers, (i.e., the owners of the cargo) when deciding on how to best get their products from production centers to markets, look at generalized logistics costs. Simplistically, the elements of logistics costs are 1) transportation costs, 2) the costs of carrying inventory, and 3) the costs associated with product storage facilities (such as warehouses or distribution centers). Generalized logistics costs are what shippers strive to minimize given other production inputs and total logistics costs comprise transportation, inventory, and storage (costs of warehouses, insurance, etc.). Historical data on transportation and total logistics costs (see Exhibit 5 in the Executive Summary) show that transportation has steadily increased as a share of total logistics spending over the period since 1980—a period in which truckload trucking and rail rates were steadily falling in real terms. This illustrates the "reorganization effect" in which logistics set-ups are revamped; transportation spending is substituted for inventory cost with reduced logistics costs per unit as a result.

[21] FHWA, Economic Effects of Transportation: The Freight Story, January 2002. Prepared by ICF Consulting and HLB Decision-Economics.

- ✓ Facilities and offices - $0.6 million;
- ✓ Internal transportation between dealers and subsidiaries - $0.5 million; and
- ✓ Insurance premiums - $0.1 million.

Net annual savings were $6.3 million after subtracting $0.6 million per year for increased costs resulting from computer system maintenance and increased warehouse personnel at headquarters. A capital investment of $3.0 million for new computer equipment was required.

Besides these savings that Polaroid could quantify, there were other gains that were not measured. Prior to centralizing inventory, 69 percent of orders could not be filled at the location that received them, so that items were backordered until they could be filled from other locations. This required significant internal transportation among dealers and subsidiaries to reposition inventory. Polaroid also achieved unspecified freight cost savings based on volume discounts for consolidated (truckload) shipments to centralized warehouses as well as reduced freight rates that reflected truck cost savings from reduction of border crossing inefficiencies.

2. **Dell Computer** – In 1996, Dell Computer launched its “online” store. Customers were able to choose their own computer configurations and receive 24-hour support online. When an online order is received, the configuration of the desired computer is immediately transmitted to the manufacturing group. Using a specification sheet the order is broken down to individual components. Components are either ordered for just-in-time (JIT) delivery on very short notice or drawn from relatively small stocks that are replenished on a JIT basis. The computer is assembled by a production team and then shifted to software loading where it is tested for between four to eight hours. The entire process from receipt of order to shipping requires about 36 hours. Dell would not be able to achieve this combination of rapid response and low level of inventory without a very high level of freight service from United Parcel Service (UPS) under a comprehensive contract covering all inbound movements of parts, in addition to a sophisticated, computer-based communications system.

   The online store concept was a revolutionary precedent for the computer industry that had been dominated by manufacturers with complex supply chains and relatively large inventories of parts and computers. By building to order and outsourcing most components, Dell gained a major cost advantage by greatly reducing parts inventories and virtually eliminating stocks of finished machines. Dell effectively became little more than an assembly and shipping company.

   The JIT system for parts delivery allows Dell to reduce inventory of components from an industry norm of 75 to 100 days to 13 days. Suppliers are integrated into Dell’s online ordering and procurement system resulting in a span of fifteen minutes for most suppliers between receipt of order and shipment to Dell’s assembly plant. Shippers of monitors, for example, receive an e-mail giving the day a customer’s order is to be shipped, and the monitor is delivered on that day. Dell estimates that they save $30 per monitor by virtually eliminating inventory.

Dell's build-to-order approach is of particular significance in an industry characterized by continuous innovation and introduction of new products. Since prices of components decline rapidly in response to continuous innovation, Dell derives a cost advantage from the fact that most components are not bought until an order is received.

The Dell JIT system of procurement and online ordering typifies the virtual substitution of transportation and communications for inventory. It would not be possible without the availability of very high-quality freight transportation services.

3. **Ford Motor Company** – Ford presents another example of using communication and transportation improvements to establish closer links to the customer and eliminate inventory. The transportation-improvement stimulus came from cost and service gains realized from sharply increased use of rail service. Railroads went from moving very few new vehicles from assembly plants to a dominant share (over 80 percent) of this market. For example, in 1980 railroads handled 342,000 carloads of vehicles compared to 609,000 carloads in 1990. Since 1990 annual movements of finished vehicles have increased to nearly 900,000. This is a case in which shippers reorganized their logistics to exploit fully the financial advantages of a low-cost mode while improving service to customers.

   Several trends have favored increased use of rail movements of finished automobiles and light trucks in the U.S.:

   - Domestic vehicle production has grown largely as a result of foreign transplants and resulting decreases in imports with a more recent shift to exports.
   - The mixture of new vehicles shipped has changed in the direction of more light trucks, which tends to favor rail for shipments from factories because the cubic-space requirements of light trucks and sport utility recreational vehicles are better met by rail cars.
   - North American assembly plants, with the exception of recent rail served expansions in Mexico, have remained relatively concentrated in the Midwest and southern Ontario at rail-competitive distances from major coastal markets.

   The Big Three did not respond to the service characteristics of rail shipment in any substantial way until 1997. Commencing in 1997, both Ford and GM announced sweeping changes in how new vehicles were to be distributed from assembly plants to domestic markets. Ford moved to implement a "regional mixing center" concept.

   Ford created four national mixing centers in Chicago; Shelbyville, Kentucky; Kansas City, Missouri; and Fostoria, Ohio. Ford has an exclusive contract with Norfolk Southern (NS) Railway under which NS constructs and operates these sites. Each mixing center performs the function of a logistics distribution center by creating an assortment of vehicles that can be shipped in response to dealer orders in full rail cars or trucks to destination markets.

The mixing centers replace a distribution system in which dealer orders for different lines of vehicles were accumulated at individual assembly plants until a sufficient quantity existed to fill an entire rail car (ten to twenty vehicles, depending on size) or truck (five to ten vehicles, depending on size) for shipment to the local market. Instead of waiting for sufficient dealer orders to fill rail cars and trucks with vehicles made at a particular plant, each assembly plant now makes daily shipments to the mixing centers. Each mixing center receives shipments from different assembly plants. Rail cars and trucks from assembly plants are unloaded at a mixing center and reloaded with a specific set of vehicles for destination markets, responding to orders by local area dealers. Vehicles will normally be held at the mixing center only as long as necessary for transloading. It is estimated that vehicles will be received at the mixing centers, unloaded, reloaded, and shipped within eight to 24 hours.

The Ford distribution center concept has been adopted to achieve economies of transportation time by maximizing trainload and truckload movements of vehicles from all plants to the centers and from centers to local markets. The four Ford mixing centers handle over 3.2 million new vehicles per year. The mixing center concept also appears to have achieved substantial transportation cost savings for Ford.

Through a major restructuring of its logistics operations and facilities, Ford was able both to reduce transportation costs and inventory costs while improving service to its customers.

The gains in logistics that are exemplified by the experiences of Polaroid, Dell Computers, and Ford are examples of how an efficient and reliable freight transportation system can lead to increases in economic productivity. In general, such gains may occur when a firm responds to a freight improvement, or, for whatever reason, analyzes its logistics arrangements and discovers that it is not taking full advantage of the freight transportation system's capabilities.

Exhibit 8: Some Findings from Interviews with Shippers and Carriers—As part of FHWA's Freight Benefit-Cost Analysis Study, ICF Consulting conducted interviews with shippers and carriers. This is some of what those interviews showed.

Current service is good

- On-time rates often over 95%

Firms frequently revisit their logistics arrangements

- Of 13 shippers, 5 changed or were about to change logistics

Firms concerned if highway conditions get worse

Businesses revisit logistics under a variety of business pressures (cost and customer service)

- Freight-transport improvements affect the outcome of industry re-organizations
- Shippers revisit logistics in response to business pressures

Either way, these productivity gains will not occur unless a firm's management perceives that the freight system is robust and reliable enough to support its plans. These gains certainly will not occur if a firm's managers perceive that the quality of the freight system (as defined by speed and reliability) is deteriorating or will deteriorate in the near future (see Exhibit 8 on the previous page). In a nutshell, any degradation of the goods-movement system will seriously erode the profits firms now gain from successful inventory management. The success of these logistics operations depends on deliveries, mostly truck deliveries, hitting time windows, sometimes as narrow as 15 minutes, day in and day out. With any sustained decay in schedule reliability, the efficiency in these carefully designed systems would quickly disappear. In past interviews with both carriers and shippers, a recurrent theme heard by ICF was the damage that could be done by system failure or degradation. Any such loss of efficiency would have an impact on the economy well beyond lower profit margins for the companies directly affected. There would be a negative effect on productivity that would ripple through the whole economy, lowering our competitiveness and our standard of living. This is the importance of the link between the quality of the freight system and national productivity gains.

2.2 Examples of System Strain and Potential Degradation

At the most general level, degradation of freight-system performance would be felt all along supply and distribution chains and, accordingly, by all producers and importers of goods and all consumers of goods. It is useful to identify some specific parts and segments of the freight system where declines in performance would have especially strong effects and some characteristics of the logistics systems where those effects would be felt. Examples of some specific segments that are now showing some signs of strain from pressure on capacity are provided below.

- **Congestion in the Southern California Ports and Chicago** – Enormous volumes of inbound container traffic (almost 11 million Ton Equivalent Units, TEUs, in 2002) move through the ports of Los Angeles and Long Beach. Containers destined for the major consumption centers of the Midwest and the East largely move from Los Angeles to Chicago by intermodal rail, an efficient and low-cost movement. But congestion around the docks and along the roads from the docks to the rail terminals constantly threatens efficiency of the dock-to-rail move. Similarly in Chicago, the transfer of eastbound containers from western railroads to eastern carriers is made by drayage moves through highly congested urban roads. Congestion and inefficiency in urban drayage degrade the efficiency of the 2,000-mile move at either end of the trip.

  A starker example of the vulnerability of the Los Angeles and Long Beach ports was the West-coast dock dispute in 2002. After a ten-day lockout of dockworkers, it took the system 23 days to get back to normal flows and eliminate the backlog. Goods with a cumulative value of $6.3 billion were held up. Some major importers had to take drastic steps to keep freight moving to their customers. Hewlett-Packard (HP), for example, resorted to air cargo to keep its commitments to customers. The fact that HP was able to turn to another mode (although a more costly one) highlights the flexibility of our freight system. But should the lockout have lasted longer, the increases in shipping costs likely would have limited HP’s ability to turn to air cargo and maintain desired profit margins over the longer term.

Exhibit 9: Top West Coast Ports by TEUs (in thousands), 2002

Los Angeles (CA)	6,105
Long Beach (CA)	4,524
Oakland (CA)	1,707
Tacoma (WA)	1,470
Vancouver (BC)	1,458
Seattle (WA)	1,438
Manzanillo (COL)	634
Anchorage (AK)	463
Portland (OR)	256
Fraser River (BC)	101
Ensenada (BCAL)	53

Source: AAPA

Another important consideration that is brought to light by the ten-day lockout is the potential effect of a terrorist attack (or other major event) on one of our major ports. Should such an event lead to longer disruptions in port operations, the effects on shippers and our economy could be far reaching. As depicted in Exhibit 9, the Ports of Los Angeles and Long Beach, for example, handle the lion share of container traffic into and out of the West Coast of North America. If one of those ports becomes incapacitated for an extended period, the stress on the freight system (including other West-Coast ports, as well as the rail and highway facilities that connect to them) most likely would significantly reduce our West-coast freight system capacity, with concomitant effects on shippers and the U.S. economy.

- **Inland Waterways: The Mississippi** – The lock-and-dam system on the Mississippi River and its major tributaries is aging, and many observers believe its capacity is no longer sufficient for the traffic moving on the river. Some locks are heavily congested with delays of well over six hours during peak-flow periods. The Mississippi and its principal tributaries, the Illinois and Ohio Rivers, are major highways for bulk traffic, especially coal and grain. The river system is the lowest-cost carrier of these commodities. Excessive delays on the river can add to shippers' costs, especially if they are forced to use more costly rail service. The river system is also a major factor in international competitiveness, as a large proportion of our grain exports goes down the Mississippi to New Orleans.

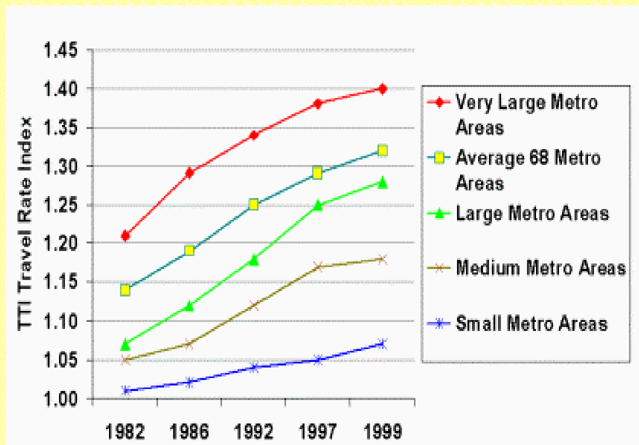
- **Border-crossing Delays** – The great preponderance of NAFTA trade moves over our northern and southern borders in trucks. Partly because of customs procedures, and partly because of limited infrastructure at key crossing points, there is a significant potential for congestion and delay. Very long back-ups on the Ambassador Bridge are an ordinary occurrence for traffic inbound from Canada to Detroit. Since major auto-production facilities are clustered in both Michigan and western Ontario, congestion at the Detroit crossing can be a major source of inefficiency in the logistics systems of the automakers. This is the kind of cost that spreads quickly through the whole economic system, affecting both producers and consumers.

  The same issues arise at the southern border, especially at the Laredo crossing point. A combination of customs procedures, limited infrastructure, and periods of very heavy traffic flows leads to inefficiencies that ripple through the production and distribution of all traded goods. Laredo and Detroit are leading examples, but congestion and delay are issues at several other crossing points as well.

A 2001 sample of seven U.S. ports of entry found average travel time for inbound crossings at 26.8 minutes, with a 95th percentile time of over 70 minutes.[22] Efforts have been underway to help alleviate this problem. For example, the Bureau of Customs and Border Protection (CBP) has recently published new rules requiring advance electronic filing for inbound truck (and rail) traffic over both borders and for outbound traffic over the Mexican border. CBP is making efforts to streamline processes so heightened security requirements will not impede traffic flow, but this is a concern, nonetheless.

- **System-wide Highway Issues** – There is serious road congestion in our large metropolitan areas, and as depicted in Exhibit 10 congestion is getting worse. It has been estimated that the annual cost of congestion and delay in the 75 largest urban areas is about $70 billion.[23] Congestion is even spreading to major rural roadways. Just over 7,000 miles of rural arterial roads are classified as significantly or severely congested.[24] No change in policy will eliminate all highway congestion; that is impossible. But these data on congestion tell us that our economy is bearing costs that could be significantly reduced with effective policy responses.

Exhibit 10: Highway traffic congestion has been getting worse in urban areas of all sizes.



Source: FHWA

- **Rail Capacity and Intermodal Movements** – A recent article from the Journal of Commerce states the following.

> ***Box shortage crisis coming, says Pacer exec.***
> *By BILL MONGELLUZZO - THE JOURNAL OF COMMERCE ONLINE.*
> *7 April 2004*
> *Journal of Commerce Online*

[22] "Commercial Vehicle Travel Time and Delay at U.S. Border Crossings;" Federal Highway Administration; June 2002.
[23] Texas Transportation Institute, 2003 Urban Mobility Study.
[24] Calculated by the ICF Team using FHWA's Highway Statistics, 2002. The data come from volume-to-service flow ratios published in table HM-61.

LOS ANGELES - The president of a leading intermodal service provider warned that rail congestion in North America is squeezing the supply of containers, a situation that could reach crisis proportions during the peak shipping season.

"We will have the mother of all box shortages this fall," Jeff Brashares, president of Pacer Global Logistics' transportation division, told the Los Angeles Transportation Club Tuesday.

Congestion on the intermodal rail network stretches from Vancouver, Canada, to Los Angeles, Chicago and all the way to the East Coast. This development is especially troubling because it began in the winter, traditionally the slowest period of the year for intermodal shipments.

Brashares noted that the Union Pacific Railroad is struggling with a crew and power shortage; Norfolk Southern Railway's ramps in the East are busier than they were during the peak season last October, and CSX Transportation is dealing with operational problems in the East.

Canadian shippers on Tuesday asked the government to help resolve growing congestion problems on the Canadian Pacific Railway that has left 10,000 TEUs sitting on the docks at the Port of Vancouver.

An unexpected flood of imports from Asia this winter caught the intermodal transportation industry by surprise. Ron Widdows, chief executive of APL Ltd. in Singapore, reported last month that vessels were leaving Asia fully loaded, something that normally doesn't happen until late summer.

Construction of new containers has also been hit by a shortage of steel caused in part by China's voracious appetite for raw materials. The intermodal congestion problem in the U.S. is compounded by operational deficiencies on the rail networks.

The UP, for example, began to experience crew shortages one year ago when hundreds of crew took early retirement. The result: slower average train speeds and delays in returning rail cars and equipment to West Coast ports.

Industry figures indicate that a decrease of just one mile per hour in the average network speed creates a need for an additional 250 double-stack rail cars and 300 locomotives to move the same volume of cargo. The UP this week is reporting delays of 24 to 48 hours out of Los Angeles and Chicago.

The UP hired 2,000 workers last year and is hiring 4,000 this year, with the first wave of trainees scheduled for certification in the spring. TTX, the U.S. railcar lessor, placed orders for 18,700 new intermodal platforms this year, the second consecutive year of substantial growth in equipment orders. TTX last year increased the double-stack rail car fleet by 14 percent.

The network congestion appears to be worsening, Brashares said, and soaring imports from Asia could push the system into crisis mode by the late summer peak shipping season.

Brashares called on shippers to demand a realistic assessment from their carriers of what they can and cannot do during the peak season.

The examples above highlight a number of important facts about our nation's freight transportation system. First and foremost, the multitude of transportation modes that comprise our freight system rely on each other. From the perspective of many shippers, the days of single-mode decision-making probably ended in the 1980s, in response to the effects of deregulation (such as the growth in intermodalism and truckload carriers). Consequently, a truly holistic, multimodal perspective must be brought to bear to decision-making on the policies, programs, and projects that affect the efficiency and reliability of our freight system. Second, and related to this, important capacity bottlenecks can affect efficiency and reliability, often times with potentially significant effects on our nation's economic welfare. Third, and as will be discussed in the following sections of this report, each of the modes is confronting capacity constraints that will be difficult to resolve without vision, leadership, and coordinated decision-making from the public sector (at all levels).

3. Capacity and Performance Challenges

In 2000, our freight system (not including pipelines) moved well over 12 billion tons of goods worth roughly 10 trillion dollars. However, there is significant and growing concern on the part of both the private and public sectors about the future performance of our freight transportation system. Consider the following:

- ***Growing congestion on our highway system.*** The demand for highway travel has been growing at a fast rate. According to a recently released report from the General Accounting Office (GAO), peak-period highway congestion for passenger and commercial vehicles doubled from 1982 through 2000. From 1993 through 2001, truck traffic on urban highways increased more than twice as much as passenger traffic. This means that freight traffic is contributing to worsening congestion at a faster rate than passenger traffic, and as discussed in Section 4 of this report there is no end in sight to the growth in freight traffic.[25]

- ***Our shrinking railway system.*** Before deregulation and the Staggers Rail Act of 1980, the rail industry was widely considered to have significant levels of excess capacity. From 1980 to 2001, however, Class I railroads consolidated from 22 carriers to 7 (four of which have 95 percent of Class-I revenue), the number of locomotives decreased by 29.7 percent, the number of freight cars decreased by 23 percent, and railroad employment decreased by 55.5 percent.[26] The amount of rail line has also contracted substantially since 1980, from 164,822 to only 142,633 in 2001, a decrease of 13.5 percent.

- ***Our constrained and inefficient port system.*** Globalization and growth in international trade are placing more demands on our ports. Between 1970 and 1999, trade's share of GDP increased from 10.7 percent to 26.9 percent. As a result, our nation's ports and channels are becoming increasingly congested as ever greater amounts of freight are moved through a system with limited means for physical capacity expansion. From 1990 to 2000, tonnage at U.S. ports increased by 13.8 percent,[27] while capacity expanded only marginally. In fact, considerable resources were required merely to maintain physical capacity through efforts such as dredging.

- ***Our aging inland waterways.*** The U.S. inland waterways are critical for certain bulk commodities such as coal and grain. Investment in the infrastructure required to support these waterways, however, has not been adequate to maintain the system, and the median age of all lock chambers has been estimated at was 35 years. Moreover, capacity of inland water channels has remained basically flat since 1970.

- ***Incredible growth in air cargo.*** At an annual growth rate of 5.1 percent from 1990 to 2000, air cargo is by far the fastest growing mode of freight transportation. (The

[25] General Accounting Office, Freight Transportation: Strategies Needed to Address Planning and Financing Limitations, December 2003.
[26] Association of American Railroads; Railroad Facts, 2002 Edition.
[27] U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics, 2002.

exception would be intermodal rail if it were regarded as a separate mode.) Our aviation system already is characterized by frequent delays, traffic control safety concerns, and heightened security measures, and certain hubs are beginning to experience chronic problems.

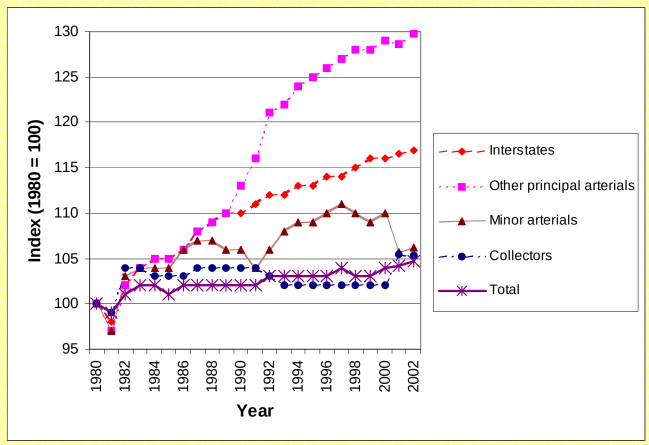
As these points highlight, trends in freight movements cannot be understood outside of the context of capacity constraints. While these constraints are primarily infrastructure related (e.g., highways), they also include operational concerns, regulatory issues, and financial considerations. This section describes the capacity of the current freight system and likely trends over the next 20 years.

3.1 Highway Capacity Issues

3.1.1 Infrastructure

As of 2002, our nation's road network consisted of 8.3 million lane-miles. Local roads comprise around 66 percent of these lane-miles leaving approximately 2.8 million lane-miles of interstates, arterials and collectors to carry intercity freight traffic. While the overall number of lane-miles is impressive, growth in lane-miles has been scant the last 20 years.

Exhibit 11: Trends in Lane-Miles of Roadway by Functional Class (1980–2002)



Source: FHWA

Exhibit 11 illustrates lane-mile growth from 1980 to 2002. Lane-miles of principal arterials grew by 30 percent while interstate lane-miles grew 17 percent. Total lane-miles across all roads, however, grew by a mere 5 percent over these 22 years, an annual growth rate of only 0.22 percent.

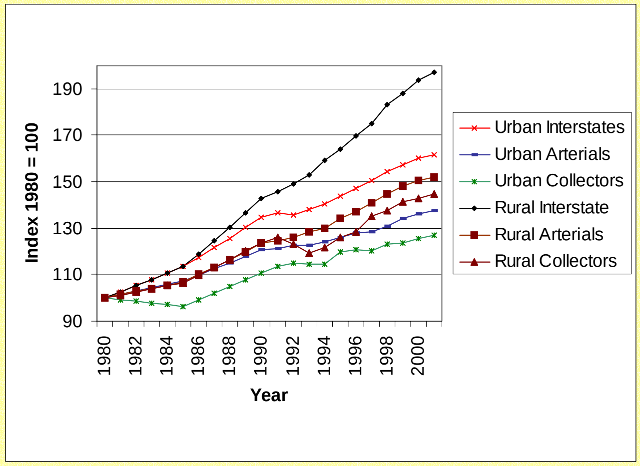
Traffic on this infrastructure, however, has been growing at a much faster rate. Some of this growth comes from freight movements but a large proportion is derived from a general increase in travel due to population and income growth. This has lead to a significant increase in congestion over the past few decades.

Exhibit 12 (below) depicts trends in intensity of usage as measured by the ratio of Vehicle Miles Traveled (VMT) to lane miles for various types of roads from 1980 to 2001. Usage has increased across all roads with the most dramatic increases on rural interstates (97 percent), followed by urban interstates (61 percent), rural arterials (52 percent), rural collectors (45 percent), urban arterials (38 percent), and urban collectors (27 percent).

These trends suggest that the ratio of volume to capacity is increasing at the greatest rate on interstates, the most important road segments for intercity trucking. While these metrics indicate trends that are useful when thinking about congestion, they are not direct measures of congestion in themselves. Volume-to-service flow ratios[28], however, indicate that there is considerable congestion on even the nation's rural interstates. For example, in 2001 7,225 miles of rural highways were classified as severely or significantly congested[29].

Even greater levels of congestion, naturally, characterize urban areas. Data from the Texas Transportation Institute (see Exhibit 10 in Section 2) show increasing trends in congestion from 1982 to 2001 for different sized metropolitan areas. While all metro areas exhibit increasing congestion, the larger metro areas have the worst congestion. TTI estimates that in 2001, congestion in the top 75 U.S. urban areas cost the nation 69.5 billion dollars in terms of delay and fuel. This cost, however, does not adequately describe the full burden of congestion on highway freight movement.

Exhibit 12: Highway Traffic Density 1980 to 2001 (Vehicle Miles Traveled/Lane Miles)



Source: FHWA

Freight movements by trucks today are increasingly time sensitive. The ability of the trucking industry to delivery goods in a reliable and time efficient manner is a key component to the mode's overall competitive position. Congestion increases transit times and decreases schedule reliability.[30] Even in areas of persistent congestion, the extent of that congestion may vary widely from day to day depending on weather, accidents, or other events. Recent trends such as just-in-time delivery require reliability and performance and unanticipated congestion comes at a great cost. For example, some recent evident suggests that unscheduled delays may cost shippers as much as $371 per hour depending on cargo.

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[28] For multilane facilities, volume-service flow ratio is determined by dividing the peak traffic in the peak direction by the capacity. For all other facilities, the ratio is determined by dividing the peak traffic by the capacity. Peak traffic is estimated as AADT *K, where K is the design hour volume (30th highest hour) as a percent of AADT.

[29] Highway Statistics, 2002; Federal Highway Administration (FHWA). Highways classified as severely or significantly congested if volume-to-service flow ratios are 0.80 or higher.

[30] Note that it is often not practical for carriers to shift their operating schedules to "off-peak" periods near and/or in a city center. This is because carriers are constrained by the delivery and pick-up schedules of their customers. Where possible, carriers do take advantage of available capacity during "off-peak" periods for the line-haul portion of their trips. For example, virtually all line-haul less-than-truckload (LTL) runs are made overnight. In general, to save time and money, carriers will use uncongested roads and off-peak periods whenever possible.

Significant swings in the travel times of international trucking movements caused by border delays makes logistics planning difficult for shippers, intermediaries, and carriers. Such traffic bottlenecks could force costly redesigns to logistics systems leading to decreases in productivity. Other findings from the recent border crossing study conducted by FHWA (referenced in Section 2 as well) include:[31]

- Time required for processing inbound commercial vehicles is significantly longer than for outbound vehicles;
- There was no single trend that accounted for the extent of delays across all ports-of-entry. Reasons varied by particular port-of-entry;
- Crossings varied greatly in their abilities to handle traffic volumes; and
- Studies of urban mobility reveal that delays on roadways are generally more predictable than at ports-of-entry.

3.1.2 Non-Infrastructure Related Highway Capacity and Trucking Productivity Issues

The effective capacity of the freight transportation system is also affected by operational and regulatory issues. Truck size and weight, hours of service, highway/road access restrictions, environmental regulations, and numerous other policy-driven considerations directly affect cargo payloads, trucking operation cycles, and route selection, for example. In addition, environmental laws and requirements and the amount of money available to public transportation agencies affect the ability to build needed facilities. Examples of some non-infrastructure based capacity issues relevant to the trucking industry follow.[32]

- *Truck Size/Weight Regulations:* Congress, by statute, limits the allowable size and weight of trucks on the Federal-aid highway system. Safety is the driving force behind these regulations as many feel larger trucks, especially those known as Longer Combination Vehicles (LCVs), are potentially dangerous to the traveling public. Increased infrastructure costs are also a concern. The regulations, however, do act as a capacity constraint as they reduce the amount of goods that can be moved by trucks. The U.S. Department of Transportation's most recent Truck Size and Weight study

[31] Federal Highway Administration, Commercial Vehicle Travel Time and Delay at U.S. Border Crossings, June 2002.

[32] It is important to note that motor carrier policy decisions should be based on numerous criteria that reflect the range of our relevant societal values—from economic efficiency to the public safety. For instance, in the case of size and weight and hours of service restrictions, any explicit financial burdens on the industry may be counter-balanced by long-term improvements in safety. Likewise, improvements in safety performance can lead to lower insurance rates, reduced cargo damage, and better service reliability. In general, regulatory measures that effectively remedy market failures ultimately can improve social welfare.

concluded that use of LCVs would lead to productivity gains ranging from $10 billion to $40 billion per year.[33]

- *Hours of Service (HOS) Regulations:* The HOS regulations apply to motor carriers (operators of commercial motor vehicles, or CMVs) and CMV drivers, and regulate the number of hours that CMV drivers may drive, and the number of hours that CMV drivers may remain on duty before a period of rest is required. This has a palpable effect on how carriers operate.

- *Regulations slowing project delivery/capacity improvements:* Environmental review processes for major Federal-aid highway projects take an average of 5 years 2 months, up from only 2 years in the 1970s.[34]

- *NAFTA Harmonization:* Differences in truck size and weight, emissions standards, insurance and liability rules still differ among the U.S., Mexico, and Canada, thus reducing efficiency of truck freight movements. Other complications are due to anomalies, such as the U.S.'s unilateral move to block the provision in NAFTA allowing Mexican truckers to carry freight into and out of the United States.

- *Project Financing:* The pay-as-you-go financing strategies typically employed by State DOTs for highway projects are one reason that projects require 5 to 15 years to plan and 20 years to complete is not uncommon.[35] State Infrastructure Banks (SIBs), which are essentially revolving loan funds, are one financial mechanism designed to accelerate projects.

- *Homeland Security:* The events of September 11, 2001 elevated transportation security to an issue of critical importance. Industry experts and policymakers have highlighted the vulnerability of the nation's freight system to terrorist attack and proposed a variety of responses. Concerns have focused in particular on border crossings, freight moving through seaports, hazardous materials transport, potential contamination of food shipments, and the potential use of a truck trailer to deliver a weapon.

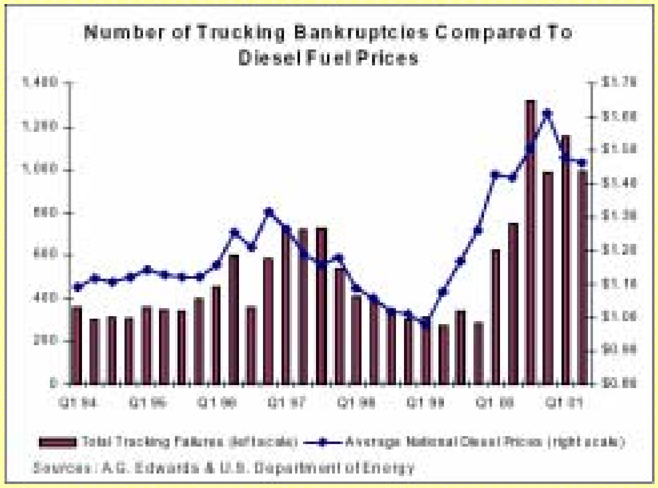
  The heightened focus on security since 9/11 has changed the operating environment for motor carriers. Long-haul truckers have reported difficulty in locating parking at night because informal roadside truck parking areas are now off-limits. Some have responded by stopping earlier for the night. The president of one of the major LTL carriers noted that his firm was feeling the cost effects of 9/11 in a variety of ways. For example, truck inspections, and the associated time lost, had increased by 150 percent.

[33] U.S. Department of Transportation, Federal Highway Administration, Comprehensive Truck Size and Weight Study, August 2000.
[34] Reported in: Freight Capacity for the 21st Century, Special Report 271; National Academies of Sciences; Transportation Research Board.
[35] U.S. General Accounting Office, Surface Infrastructure: Costs, Financing and Schedules for Large-Dollar Transportation Projects, 1998.

As with the issues listed above, a number of market-driven factors affect the operating capacity and productivity of the trucking industry.[36] For example, with average operating profit margins of five percent, the industry has little ability to absorb changes in fuel costs. While predictable and long-term price increases can be passed onto customers, where firms face unanticipated price increases and have long-term contract obligations to deliver freight, they may be unable to adjust their prices quickly enough to recapture these costs. It is not surprising that trucking firm bankruptcies are correlated with fuel price increases, as illustrated in Exhibit 13.

Likewise, insurance rates for the motor carrier industry have risen steeply over the last several years. The conditions causing rates to rise do not appear likely to be mitigated in the near future. Indeed, the low investment returns, increased risk of terrorism, and increased damage awards could cause further rate increases in the future. Additionally, competition in the trucking industry makes it difficult for carriers to pass these costs along to their customers in the form of higher prices. Insurance rate increases reduce the profitability and productivity of the motor carrier industry, and may force marginal companies out of business. Rising insurance rates were one of the factors cited by Consolidated Freightways as a cause of their recent bankruptcy.

Exhibit 13: Correlation of Trucking Firm Bankruptcies and Changes in the Price of Fuel

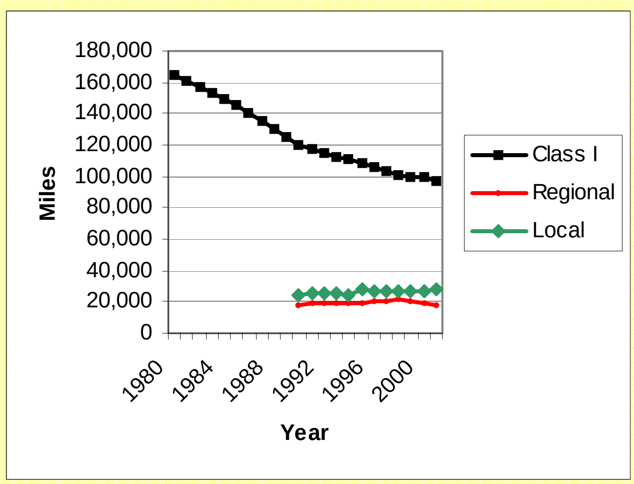


3.2 Rail Capacity Issues

3.2.1 Infrastructure

As discussed above, before deregulation and the Staggers Rail Act of 1980, the rail industry was widely considered to have much more capacity than was needed. But physical capacity (measured by the miles of rail line) has been steadily

Exhibit 14: Miles of Rail Line in the United States (1980 - 2001)



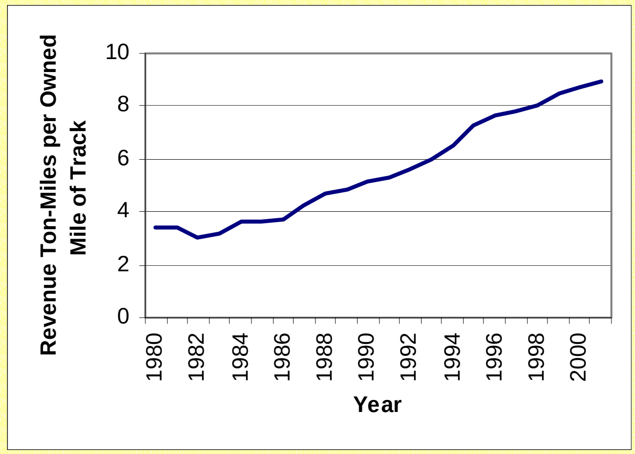
[36] For a more detailed discussion of the range of issues affecting the trucking industry, please see the FHWA report (prepared by ICF Consulting) entitled Evaluation of U.S. Commercial Motor Carrier Industry Challenges and Opportunities, March 31, 2003.

decreasing since deregulation (see Exhibit 14).

Although the reduction in capacity experienced since 1980 has led to increased productivity for the rail freight industry, there are signs that capacity levels are beginning to show signs of strain.

Exhibit 15 portrays growth in Class I rail traffic density, defined as revenue ton-miles per mile of track owned. The figure shows that density has almost tripled since 1980 and furthermore shows no signs of abatement. This trend cannot be increased indefinitely since moving greater volumes of goods over a shrinking network is unsustainable. Additionally, as the nation's rail system becomes more saturated with traffic, it will be even more sensitive to shocks, such as unanticipated levels of demand, infrastructure failures, or operational issues.

Exhibit 15: Revenue Ton-Miles per Owned Mile of Track (in Millions: 1980 - 2001)



Rail mainline capacity, however, is not the only infrastructure related issue that the industry faces. The evolution of the rail system and new trends in international trade and intermodalism have led to other problems, such as:

- *Highway Access from Terminals and Intermodal Terminal Capacity:* The evolution of rail infrastructure produced many terminals located in dense urban areas where little room for facility expansion exists. Higher capacity utilization rates necessitate additional access to these terminals, but providing this access is more difficult now than ever as land is scarcer and highway access routes are congested. In recent years, this situation has led to the development of rail terminals away from urban areas. These remote terminals, however, come with their own problems as they often lack the road infrastructure needed for their efficient use. The development of this infrastructure would have a significant effect on intermodal freight capacity.

- *Deteriorating Bridges and Tunnels:* A significant part of our modern day rail infrastructure was constructed in the 1800s when rail was the preferred mode for East-West shipments and for connecting regional hubs. Much of this infrastructure, especially bridges and tunnels, is now in serious states of deterioration. Repairing this infrastructure will require a substantial investment over the next decade. These improvements, however, would yield benefits for years to come.

- *Height Clearances:* As intermodal freight grows, double-stack rail is becoming more commonplace, especially at large port facilities. The rail industry needs to invest and modernize in order to provide adequate double-stack access. This is crucial for the growth of intermodal rail.

3.2.2 Non-Infrastructure Related Rail Capacity Issues

As with the trucking industry, a number of non-infrastructure issues affect the effective capacity of the railroads. Examples include the following:

- *Inefficient Carload Operations:* Carload service is movement of small shipments—one or a few cars in a shipment—in all-rail trips from origin to siding. These trips are made in a series of mixed trains running through a railroad's terminal network. Although carload service accounts for over 30 percent of carloadings and 40 percent of rail revenue, it has been handled, until fairly recently, in an inefficient manner. Rather than maintain schedules for the trains running between terminals, railroads pursued a strategy of holding trains until some tonnage level was reached. This resulted in lower labor costs per ton for line-haul movements but led to higher equipment costs because of poor utilization and to unreliable service. Railroads are now moving to scheduled operations, which hold the potential of making this service both more reliable and profitable.[37]

- *Labor Agreements and Short Lines:* All of the Class-I carriers have union crews and a variety of labor agreements that affect crew sizes and working practices. Over the past two or three decades, substantial progress has been made in removing inefficiencies from these agreements. Many industry observers, however, believe that there are still obstacles to efficiency in these agreements, especially regarding practices in local service—pick-up and drop-off of carload shipments. There are marked contrasts between the way local service is handled on big railroads and the way it is handled on short lines, the latter being free of union contracts. Some experts believe that the current mode of operation of local service is one of the biggest obstacles to achieving efficient carload operation.[38]

- *Interchanges:* A great deal of traffic, especially carload traffic, moves on more than one Class-I railroad. While special arrangements are made for high-priority service (e.g., motor vehicles and parts), the general pattern is that current practices for handling cars between railroads are slow and cumbersome, contributing both to unreliable service and inefficient use of equipment.

3.3 Water Freight Capacity Issues

The importance of our ports and harbors to an efficient and reliable freight system cannot be overstated. This is because the advent of globalization, with the concomitant increases in international trade, means that the efficiency and reliability of our ports now have a larger influence on the efficiency and reliability of our trucking and railroad industries,

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[37] ICF Consulting and ZETA-TECH Associates, Scheduled Railroading and the Viability of Carload Service, Executive Summary, prepared for the Federal Railroad Administration, Office of Policy, March 2004.

[38] Ibid., pp. 8, 24.

since these modes now function more as “one system” than ever before. Consequently, our ports have a growing influence on the nation’s ability to minimize transportation costs and foster economic productivity.

The role that our port system plays in multimodal freight transportation can best be explained through examples of inefficiencies. Consider the following, which is borrowed from ICF’s report to FHWA entitled *Evaluation of U.S. Commercial Motor Carrier Industry Challenges and Opportunities*.

> *Port facility delays are crucially important to trucking firms that pick-up and deliver freight to ports. Port drayage firms operate in a highly competitive market, with many small firms and owner-operators competing to provide services. These firms typically use older equipment, charge low carriage rates, and operate on very slim profit margins. Delays at port facilities impose a cost on these firms in lost revenue and profits. The reduced efficiency of this critical link in the transportation system also imposes costs on the downstream customers of port drayage services.*
>
> *Generally speaking, port facilities can impose long wait times on truckers with impunity since the ports do not bear the economic cost of the delay. Long wait times and congestion at port facilities are caused by a set of factors that are fairly distinct from the wait times encountered at other shipper facilities. These include lack of sufficient gates, limited hours of terminal operation, poor intermodal chassis maintenance, and vessel bunching.*
>
> *The Maritime Administration recently conducted a survey of port facilities to determine which system elements of the intermodal transportation network were operating in an acceptable manner.[39] Unacceptable conditions were defined as those where “efficient and effective cargo movement cannot occur … nor can additional cargo flows be easily handled”. In the case of ports, gate hours of operation were deemed to be a problem at 38 percent of the largest container ports and 11 percent of all ports. Gate automation is a consistent problem at about half of all ports, both large and small.*
>
> - *Gate access - Ports often do not provide enough gates and only operate these gates during limited hours, creating lines to enter terminals that can back up for miles and wait times that can stretch into hours. Limited gate access can be attributed to several factors:*
>
>   1. *Peaks in daily traffic are caused by the desire of firms for morning pickups and afternoon deliveries. Additionally, a mismatch between the hours of operation of marine terminals and those of the steamship lines and rail terminals exacerbates the need to move containers during peak hours.*
>   2. *Rail terminals are typically open 24 hours a day and steamship lines unload containers during hours when terminal gates are not open. Terminal gates are typically open during normal business hours, sometimes on a 9 – 5 schedule. Required breaks can cause gates to be closed during these hours as well. The need to move containers during*

[39] U.S. DOT, Maritime Administration. *Intermodal Access to US Ports, Report on Survey Findings*. August 2002.

these restricted hours to meet the pick-up and delivery schedules of customers causes congestion.

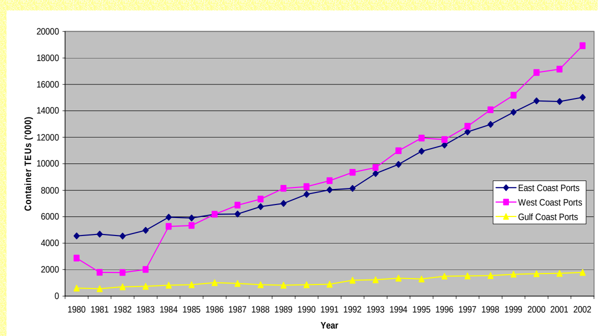
3. *Labor agreements often prevent expanding the hours of gate operation limit hours of operation. In some cases terminal operators can keep gates open longer by paying overtime to the required staff. Some labor contracts require a full crew be paid for an 8-hour shift, even if the gates are kept open for only a couple more hours. Terminal operators argue that restrictive labor practices make the cost of keeping gates open prohibitive. Unions tend to see restrictions on labor hours as one of the key benefits derived from negotiated labor contracts. The tense relationship between labor and management in marine terminal operations has made resolution of this issue difficult.*

- *Chassis condition - The steamship lines own an overwhelming majority of the chassis used to haul containers. Some steamship lines do not properly maintain these chassis, and in some cases drivers are required to move chassis to repair facilities without compensation. When no roadworthy chassis are available, drivers may face the choice of waiting for a chassis to be repaired or using an existing one that may have mechanical defects. While the steamship lines are required by law to maintain safe chassis, the driver is most often the one who is punished through fines and tickets.*

  A related problem is that ports frequently do not maintain enough space for chassis storage, resulting in chassis being stored in any available space. This creates traffic impediments within the terminal, further increasing wait times and congestion.

- *Vessel bunching - Although port facilities are open seven days a week, the fixed schedules maintained by shipping lines can result in a number of vessels arriving at the same time. Vessel bunching causes vehicle congestion as trucks line up to load or unload cargo. The more efficient scheduling of vessel arrivals and departures may require a collaborative effort between port authorities. Shipping lines often have difficulty predicting the arrival dates of their vessels at particular ports since these often depend on uncertain arrival and departure dates from other ports.*

Exhibit 16: Trends in U.S. Ports Container Traffic



Source: American Association of Port Authorities www.aapa-ports.org

Note that according to a recent article in the *Washington Post*, Wal-Mart estimates it spent $15 billion on Chinese-made products in 2003. If Wal-Mart were a nation, it would be the fifth largest export market for China, ahead of Germany and Britain.

3.3.1 Infrastructure

As shown in Exhibit 16, port traffic has increased significantly over the last few decades. During this time, however, the physical capacity of our ports has not changed very much. With capacity becoming more constrained, disturbances create larger and larger shocks. For example, the recent collision of an offshore supply boat and a container vessel at the mouth of the Mississippi River's only channel deep enough for large oceangoing vessels created major bottlenecks delaying tankers and cargo ships at costs as high as $35,000 to $40,000 per vessel per day.[40]

The following exemplify the infrastructure-oriented capacity issues that are affecting our water transportation system.

- *Dredging:* Not only is traffic growth into U.S. ports increasing, but industry consolidation and the ever-present drive for increased efficiency is leading to greater use of mega-containerships and traffic consolidation (hub-ports). This additional traffic necessitates wider and deeper channels. For example, the newest class of mega-containerships requires channels 50 to 53 feet deep compared to historic standards in the 36-to-40-foot range. Although expansion dredging is an important issue, many of the nation's ports have not even been able to fulfill their maintenance dredging needs. For example, a 2001 U.S. DOT survey found that nearly 30 percent of all U.S. container ports reported unacceptable channel depths.[41] This could be particularly problematic should the Panama Canal be widened to accommodate post-Panamax vessels.

- *Land-side Port Access:* Land-side access is a problem of increasing importance for U.S. ports and is becoming one of the primary bottlenecks for the movement of goods from ships to the rest of the transportation system. Once vessels arrive at a port it makes little difference how efficient the rest of the port is if goods cannot be unloaded off a vessel promptly. In 2001, several of the top 15 U.S. deepwater ports reported unacceptable flow conditions on landside elements of the intermodal access system.[42] Compounding this problem is the fact that many ports do not have sufficient room to expand landside access nor do they have the funds required to maintain this additional capacity even if it was acquired.

- *Congested Locks in Inland Waterways:* U.S. inland waterways are an important component of the nation's transportation system. These waterways transport approximately 20 percent of the nation's coal and 60 percent of the nation's grain movements.[43] Investment in the infrastructure required to support these waterways (e.g., locks) has not been adequate to maintain the system. In 1997, the U.S. Army Corps of Engineers reported that the median age of all lock chambers is 35 years.[44] This survey also concluded that locking delays have been increasing throughout the

[40] *Collision Brings Chaos: Main Mississippi Channel Blocked*; The Advocate; Baton Rouge, Louisiana; February 23, 2004.
[41] U.S. Department of Transportation Maritime Administration, 2002 Intermodal Access to US Ports Report on Survey Finings, August 2002.
[42] U.S. Department of Transportation Maritime Administration, 2002 Intermodal Access to US Ports Report on Survey Finings, August 2002.
[43] The American Waterways Operators: http://www.americanwaterways.com/
[44] Reported in: *Freight Capacity for the 21st Century, Special Report 271*; National Academies of Sciences; Transportation Research Board.

inland waterway system, and that delays averaged around six hours at the most congested locks and were sometimes much longer.

3.3.2 Non-Infrastructure Related Water Capacity Issues

There are also a number of regulatory and institutional issues that affect water transportation, of which the most influential are:

- *The Jones Act:* Originally known as the 1920 Merchant Marine Act, the Jones Act limits all waterborne trade between U.S. ports to U.S. flag vessels. Many critics of the Jones Act advocate its repeal since the Act inhibits capacity by reducing the available pool of transport vessels, raising the price of transportation and final cost of goods. A study by the International Trade Commission estimates that the Jones Act costs the nation $2.8 billion annually and its repeal would lead to reductions in relevant shipping prices by around 26 percent.[45]

- *Port Rate Competition:* Many U.S. ports charge users fees below their costs. This is partly due to subsidies from various levels of government, but also due to competition among ports where raising user fees would lead to losses of business. This creates an environment where individual ports may have excess capacity much of the time, but are characterized by severe congestion during peak periods.

3.4 Air Cargo Capacity Issues

At an annual growth rate of 5.1 percent from 1990 to 2000, air cargo is by far the fastest growing mode of freight transportation (unless one counts intermodal rail as a separate mode). Available forecasts predict air cargo will continue to grow at rates of 4.0 percent to 5.2 percent through 2020. Growth at these rates will put considerable strain on an aviation system already characterized by frequent delays and traffic control safety concerns. To date, however, this growth in air cargo has yet to severely constrain the system as a whole although certain hubs are beginning to experience chronic problems. About 16 percent flight takeoffs and landings at LaGuardia Airport, for example, experience delays.[46]

The conditions at heavily trafficked airports such as LaGuardia suggest that air cargo may be beginning to strain the system. There are a number of issues involved in airport capacity expansion including terminal and runway expansion and need for additional landside connections for freight. Interrelated are freight and passenger conflicts and safety concerns such as the adequacy of the air traffic control system.

Non-infrastructure related air cargo capacity issues include regulations restricting the operations of non-U.S. carriers.

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[45] U.S. International Trade Commission; *The Economic Effects of Significant U.S. Import Restraints*; May 1999.

[46] Reported in: *Freight Capacity for the 21st Century, Special Report 271*; National Academies of Sciences; Transportation Research Board.

- *Economic Regulations:* Similar to the Jones Act in relation to water freight, air cargo also has regulations stating that foreign-flag carriers may not operate between U.S. points. These regulations, however, are not likely to receive the same scrutiny as the Jones Act due, in part, to security concerns.

- *International Regulations:* Other international regulations, such as customs regulations, impact goods movements into the U.S. and the efficiency of those movements. For example, there are new Customs rules on electronic pre-filing for air cargo imports and exports (except to Canada). For long flights, import data must be filed well before landing. For flights less than four hours, import data must be filed before wheels-up.

3.5 Summary of Freight Transportation Capacity Issues

Exhibit 17 summarize the capacity challenges that characterize our current freight transportation system. Ensuring an efficient, reliable, and safe freight system will require concerted efforts from both government agencies and the private sector. There is ample evidence that the system is becoming increasingly strained, and disruptions in one part of the system can reverbrate across the others and create bottlenecks that can adversely affect our national economy.

Of particular concern is the rapid growth in the demand for freight transportation that is expected for the future. Given the capacity of our current freight system and projected increases in demand suggests that our freight system could become severly strained. The following Section of this report presents information on the future demand for freight transportation.

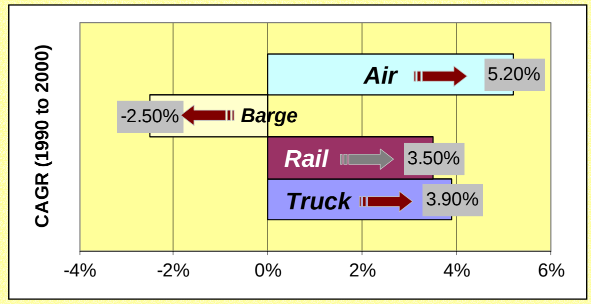
Exhibit 17: Summary of Capacity Issues by Mode

	Trucking	Rail	Waterways and Ports	Air Cargo
Infrastructure-based	✓ Urban bottlenecks ✓ Congestion on rural highway corridors ✓ Border crossing delays ✓ Terminal specific congestion	✓ Mainline capacity ✓ Deteriorating bridges and tunnels ✓ Height clearances (e.g. double-stack access) ✓ Highway access from terminals ✓ Intermodal terminal capacity ✓ Inefficient interchanges at rail hubs	✓ Land-side access ✓ Channel depth (dredging) ✓ Road and rail access to terminals ✓ Congested locks and limited inland waterway infrastructure	✓ Airport capacity (major issue pre-9/11) ✓ Landside connections ✓ Air traffic control ✓ Cargo/passenger conflicts
Regulatory- or Institutionally-based	✓ Truck size/weight regulations ✓ Hours of Service (HOS) regulations ✓ Regulations slowing project delivery/capacity improvements (e.g. EIS) ✓ NAFTA harmonization ✓ Driver retention ✓ Project financing	✓ Organized labor ✓ Scheduling challenges ✓ Dedicated service vs. mixed ✓ Steady decline in rail revenues on a ton-mile basis due to competition ✓ Return on investment has fallen short of cost of capital, affecting railroads' ability to generate funds for infrastructure investment	✓ Lack of national/regional focus for port planning and development ✓ Inefficient pricing due to port competition ✓ Jones Act	✓ Landing rights restrictions ✓ Cabotage restrictions (Open Skies) ✓ Belly cargo safety concerns

4. Expected Increases in the Demand for Freight Transport

As depicted in Exhibit 18, with the exception of river barge and coastal/lake waterborne freight, during the ten years from 1990 to 2000 all modes of freight transportation experienced increases in demand (as measured by ton-miles). Intercity trucking grew at an annual rate of almost 4 percent, while intercity rail grew at about 3.6 percent per year. The demand for air cargo services grew at a whopping 5.2 percent per year.

Exhibit 18: Historic Growth Rates by Mode (Ton-Miles)



Source: Compiled by ICF Consulting using data from the Bureau of Transportation Statistics (BTS), U.S. Department of Transportation, and other sources.

To more clearly understand the severity of the capacity issues that are discussed in Section 3 of this study, it is helpful to review how the demand for freight transportation is expected to change in the future. Will trucking, for example, continue to grow at annual rates of 4 to 5 percent? If so, what does that mean from the perspective of system performance? Likewise, will the demand for freight-rail continue to grow, and at what pace? Answers to questions such as these, with current capacity issues as a backdrop, facilitate policy analysis and decision-making on the part of government.

In a nutshell, numerous studies have been conducted to forecast growth in freight transportation demand. Although the results of those studies may differ, they all point to significant increases in demand—increases that are almost certainly sure to erode the performance of our current freight system unless something is done. This section presents information on the future demand for freight transportation in the U.S. and on the factors that affect that demand. We rely on previously developed freight demand forecasts to generate a plausible demand scenario for 2020. The goal is to demonstrate qualitatively how expected demand increases and existing capacity issues come together; and, in turn, how public policy can help to ensure that performance does not erode to levels that adversely affect our economy and living standards.

4.1 Demand Factors

Generally speaking, the factors driving the demand for freight transportation, in terms of both magnitude and structure, are as follows:

- ***Growth in economic output.*** Specifically, growth in the production of goods in the U.S. destined for both domestic and international markets and growth in imports directly affects the demand for freight transportation. Those two metrics define the number of goods that must be transported within the U.S.

- ***Share of economic activity attributable to international trade.*** Our increased dependence on imports means that more finished goods move directly from our ports to distribution and consumption centers across the country, increasing the emphasis on carrier service flexibility and reliability and influencing the need for a leaner supply chain.

- ***Technology.*** In the past, technological innovation has enabled significant decreases in logistics costs as shippers have consolidated distribution centers and substituted more transportation for costly inventory. This substitution effect has contributed to the "warehouses-on-wheels" phenomenon.

- ***Carrier productivity.*** Carrier productivity directly affects demand. For example, unproductive practices imply that more movements will be needed to carry a given amount of cargo from an origin to a destination. Carrier productivity is affected by regulation (such as the Hours of Service rules, truck size and weight limits, the Jones Act, etc.) and business practices (such as dedicated versus scheduled rail services).

The following subsections discuss expected trends in these factors, providing context for the demand forecasts that are presented later in Section 4.2.

4.1.1 Economic Growth

Given that freight transportation is all about moving goods, the state of our nation's economy is the primary determinant of the demand for freight movements. At the broadest level, both the production and consumption of goods and services determine the number of freight movements that are needed to support economic activity in the country.

Production affects freight demand both directly and indirectly. First, final goods that are manufactured in the U.S. must be transported to markets where end consumers can purchase them for consumption in the U.S. or where they can be exported for consumption in other nations. Second, inputs that are needed to produce goods must be transported to production sites from either other intermediate production facilities or resource regions (such as agricultural fields or coal mines). The demand for these intermediate goods and commodities is central to the business of some of the freight modes (e.g., the barge industry).

Likewise, the consumption of final goods directly determines the demand for freight transportation. Be it from production sites in the U.S. or from ports that receive imported goods, the number of finished goods that must move consumption markets is the major determinant of the demand for freight transportation, especially trucking.

Although researchers usually focus on the growth in the nation's GDP as an indicator of the expected growth in the demand for freight, it is more useful to

Exhibit 19: Historic Growth Rates by Mode (Ton-Miles)

	1987 to 2000 Growth Rate	
GDP*	3.19%	
GDP Mfg.*	1.68%	
GDP Mfg. + Imports*	4.26%	This is the number that matters most.
Federal Reserve Board Mfg.**	3.60%	
BEA Mfg.**	3.25%	

* Value based
** Based on a combination of value and quantity

Note that the President's budget estimates 3.5 percent annual growth in GDP for the period from 2004 to 2009.

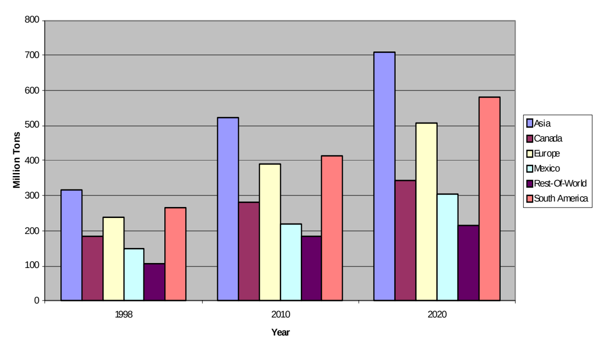
isolate growth in the number of goods that are manufactured in the U.S. for domestic and export markets and growth in the number of goods that are imported into the U.S. from other countries. This metric is more indicative of the number of goods that must move from production and import facilities to consumption and export facilities. As depicted in Exhibit 19, this metric has been growing at a faster clip than GDP and other indicators commonly used to characterize economic activity from the perspective of freight transportation (e.g., U.S. manufacturing). Although Exhibit 19 provides value-based growth, the 4.26 percent annual growth in manufacturing plus imports is close to the overall growth in the demand for freight transportation over this period.

4.1.2 International Trade

Between 1970 and 1999 the portion of our nation's GDP that is attributable to international trade grew from 10.7 percent to 26.9 percent. According to Global Insight[47], U.S. trade will represent 27.1 percent of GDP in 2004 and 36.7 percent by 2025. As depicted in Exhibit 20, trade between the U.S. and Asia will grow to over 700 million tons by 2020, almost double that of today. Likewise, trade between the U.S. and South America is expected to reach almost 600 million tons by 2020.

According to FHWA, international trade-related transportation in the U.S. accounted for roughly 10 percent of the total tonnage moved on our domestic transportation system by the close of the 1990s.[48] As the portion of our nation's GDP that is attributable to trade grows, the effects on the transportation system can be expected to be significant.

Exhibit 20: Growth in Trade



Source: FHWA, Trade: From National Markets to Global Markets (Theme Paper #1) – Global Insight Data

- First, the relative increase in trade, together with potential relative decreases in manufacturing's share of GDP, means that more finished goods will move directly from our ports to distribution and consumption centers across the country. This puts added pressure on carrier service flexibility and reliability, and influences the need for a leaner supply chain. It also means that the efficiency and reliability of connections between ports, railways, highways, and intermodal facilities will become even more important to the performance of the overall freight transportation system.

- Second, depending on how trade patterns evolve, new trade-transportation corridors may need to be developed, or existing ones expanded to accommodate trade flows. Increased trade with Asia (especially China) will continue to put pressure on our

[47] Global Insight, Inc. was formed to bring together two economic and financial information companies, DRI and WEFA.
[48] FHWA, Trade: From National Markets to Global Markets (Theme Paper #1) – Global Insight Data.

Pacific-coast ports and on east-west inland transportation corridors. China's economy is not expected to take a major downturn, and as industries in China continue to develop significant economies of scale, productivity can be expected to increase. Productivity gains and relatively inexpensive labor costs likely will ensure that China's role in the global economy increases in importance as Chinese made products offered increased value to consumers across the world (especially in the U.S.). An increased reliance on China and other Asian economies for our consumer goods will push the need for high performance of our Pacific-port gateways and the inland transportation systems that connect to them. This requirement could change the patterns of goods movement in the U.S. and the structure of the demand for freight transportation.

- Third, the effect of China's comparative advantage in some industries is already being felt by Mexico. However, trade with both Mexico and Canada is expected to continue to increase, putting further pressure on the performance of our border crossings and north-south trade corridors. Based on work conducted by ICF for the Federal Motor Carrier Safety Administration, U.S. trade-truck vehicles miles traveled (VMT) is expected to nearly double between 2002 (the baseline year) and 2015 (from 3.8 billion to 7 billion VMT). It is expected that most of the future NAFTA highway trade traffic will continue to move along existing U.S. highway corridors that connect major population and manufacturing centers. Therefore, it is reasonable to expect that north-south trade will compete increasingly with passenger traffic on some of our most congested facilities.[49] Again, a multimodal approach to ensuring acceptable levels of system performance will be required, and these potential trends in north-south trade will alter the structure of the demand for freight transportation.

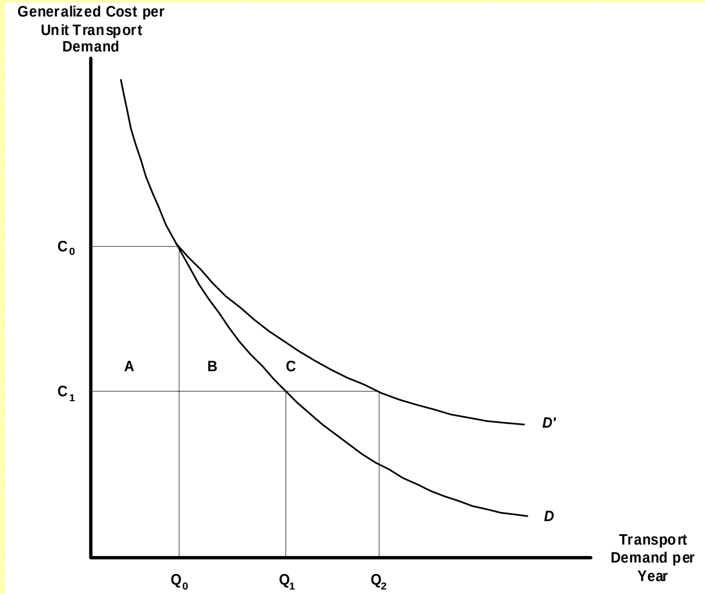
4.1.3 Technology

In today's highly competitive business world, many manufacturers, distributors, and retailers maintain their profit margins by means of ultra-sophisticated logistics systems. Innovation in information technology facilitates development of new products in robotics, just-in-time inventory control programs, networked dispatching, real-time schedule management, and other manifestations of intelligent production and transportation logistics.

Specifically, using advanced technology and algorithms to calculate optimal quantities in the supply chain, in warehouses, and in stores, logistics systems strike a fine balance between holding down inventories and keeping enough goods in the forward end of the chain to meet customer demand. Part of the design of these systems is the size and spacing of warehouses and distribution centers. Fewer distribution centers can mean lower inventory costs, but fewer distribution centers mean longer distances between supply sources and distribution centers and from distribution centers to stores. It takes speed and a high level of reliability in freight deliveries to make the system work with longer distances.

[49] Ibid.

Exhibit 21: Logistics Reorganization and the Demand for Freight Transportation



A shipper's demand curve reflects the benefits the shipper gets from buying freight transportation. The cost the shipper is willing to incur to obtain freight transportation is what managers believe the freight movement is worth to the firm. They will not incur a cost higher than what they think it is worth (although they will willingly take it at a lower cost if that is possible). Thus, the change in the demand curve reflects the greater benefits the shipper can get from the freight-carriage improvement, once the firm has reorganized its logistics set-up.

In this way, faced with some combination of lower truck rates, increased speed, and increased reliability, shippers will reconsider the amount of freight transportation they buy. In particular, this will take the form of reviewing basic logistics arrangements—the number and spacing of distribution centers, for example.[50] If fewer, more widely spaced warehouses can serve the same set of retail outlets or customers, a firm will be able to reduce inventory costs and increase its sales. The reduced real cost of freight transport lets a shipper buy more freight transport and reduce its inventory costs, thus reducing total logistics costs even though spending more on transportation.

As developed under FHWA's Freight Benefit-Cost Analysis (BCA) Study (conducted by ICF Consulting and HLB Decision-Economics), and as presented in Exhibit 21, a shipper's demand curve for freight transportation (in this case trucking) takes two forms, D and D'. D shows a shipper's demand for freight transportation before an improvement to the freight system (in particular a highway improvement). The new curve, D', shows the change in demand that follows the improvement. The shipper's reaction to the cost reduction can be thought of as occurring in three phases. In the very short run, the shipper makes no response and continues to buy

[50] Consider the effects of the just-in-time revolution, which are palpable and intuitive. Stiglitz shows that the average lead-time for ordering materials and supplies in advance of production has declined from 72 days in 1961 to less than 50 days by 1999. Inventories have fallen from roughly 1.6 times monthly sales in the 1970s to some 1.2 times monthly sales today. Whereas logistics costs (excluding transportation) represented 19.1 percent of U.S. GDP in 1990, these costs had fallen to less than 11 percent of GDP by the turn of the century. We know that investment in advanced logistics is self-perpetuating due to the networked interrelatedness of firms in inter-industry supply chains. For example, Ford now requires all its major suppliers to participate in e-purchasing arrangements, automated inventory management, and just-in-time delivery under stiff late penalties. Suppliers are thus compelled to make the capital investments needed at their end to assure companies like Ford a decent return on investment in the logistics investments made at its end – investments triggered by (among other things) suitable highway transportation. Again, all firms, shippers and carriers, will not share the resulting productivity gains proportionately in such a supply chain. Yet, the overall gain is positive for the regional economy.

the same number of vehicle miles of freight transportation, Q_0. (The benefit to the shipper is the area A, the cost reduction with the existing volume of freight.) In the next phase of response, the shipper takes advantage of the lower cost and buys more freight movement, Q_1. (This adds the area B to the benefit.) But this still reflects the shipper's original demand curve, D. The shipper has not made any changes in the firm's basic logistics. After managers have had time to consider the cost reduction, they may, as already noted, make changes in their logistics. This is when the shipper's demand for transportation would change, and there would be the new freight transportation demand curve, D'. (The additional benefit from the reorganization is area C, the area between the old and new demand curves.) The freight improvement's full benefit is reflected in the sum of areas A, B, and C.

Exhibit 22 provides a summary of findings of Phase II of FHWA's Freight BCA Study regarding the effect of changes in highway performance on the demand for trucking using panel data and three different statistical approaches. Although these results should be interpreted with some caution given the difficulties and data limitations encountered in the course of that project, the estimated impact ranges from a 0.07 to 1.00 percent increase in the demand for trucking (measured by average daily truck traffic) for every 10 percent decrease in measured congestion (measured by delay and/or the volume to capacity, V/C, ratio). Based on that work, a highway improvement leading to a 10 percent decrease in measured congestion–from a V/C ratio of 0.60 to a V/C ratio of 0.54, for example–would increase truck movements along the improved highway segment by about 1.0 percent.

Exhibit 22: Estimated Impact of Changes in Highway Performance on Freight Demand

Model / Reference	Implied Relationship Between the Demand for Trucking and the Measure of Highway Performance	Interpretation
Pooled Regression Trucking Demand as a function of Delay per Mile and a number of other control variables.	-0.0072	Other things being equal, a 10% decrease in delay per mile increases the demand for trucking by 0.07%.
Fixed Effects Regression Trucking Demand as a function of Delay per Mile and a number of other control variables.	-0.0102	Other things being equal, a 10% decrease in delay per mile increases the demand for trucking by 0.1% (or a tenth of a percent).
Fixed Effects Regression Trucking Demand as a function of the V/C Ratio and a number of other control variables.	-0.0849	Other things being equal, a 10% decrease in the V/C ratio increases the demand for trucking by almost 1%.

In this manner, technological innovation affects the logistics practices and decisions of shippers. As evidenced by the work under FHWA's Freight BCA Study, advanced logistics practices, enabled by technology, lead to increases in the demand for freight transportation as shippers use more transportation and hold fewer inventory and consolidate distribution centers.

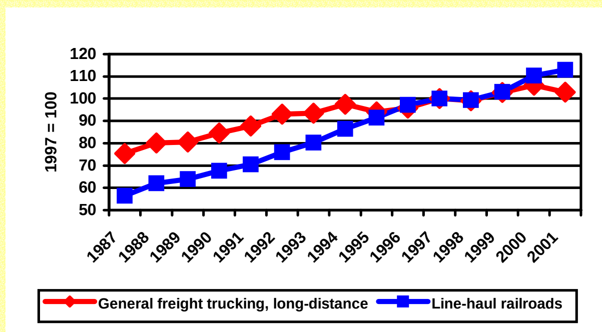
4.1.4 Carrier Productivity

The ability to balance demand and supply is also influenced by increases (or decreases) in carrier productivity. For example, intermodal freight transport has directly affected the effective capacity of our freight system and has helped to optimize the number of necessary freight movements to meet freight transport demand. Today, large volumes of imported consumer goods move speedily and reliably from West-coast ports to the Midwest at low rates. Freight service of this quality and price allows major distributors and retailers to keep a tight rein on their logistics costs to the benefit of their customers and the overall economy.

Intermodal transportation services exemplify the types of changes that have led to improvements in the reliability and quality of this nation's freight system. As shippers have changed their logistics practices to take advantage of a more flexible and demand-responsive freight system, carriers have also improved their operations. In this manner, improvements in carrier productivity are important to ensure that efficiency gains in the freight system are sustainable and that the overall number of freight movements necessary to meet demand is optimized (at the system level).

As depicted in Exhibit 23, both trucking and rail productivity have improved significantly since the mid-1980s (largely because of deregulation). However, the recent decline in trucking productivity suggests that the trucking industry may have difficulty in meeting short-term transportation demands from the manufacturing, service, and trade sectors over the next several years. Furthermore, due to intense competition the railroads have passed most of the productivity gains on to their customers in lower rates. Consequently, revenue losses due to competition may affect their ability to sustain demonstrated increases in productivity.

Exhibit 23: Productivity Trends in the Trucking and Railroad Industries



Overall, productivity losses in the transportation sector can lead to higher costs to the manufacturing, service, and trade sectors in the form of increased operating costs. This, in turn, can exert downward pressure on economic productivity, as transportation and warehousing costs rise relative to output. Coupled with the significant strains that currently exist in the capacity of our freight system, decreasing carrier productivity will result in an overall weakening of the U.S. economy as fewer products and services can be generated with the same amount of resources.

As discussed in Section 3, in the trucking industry, for example, truck size and weight limits, the hours of service (HOS) rules, and cabotage restrictions relevant to NAFTA are examples of regulations that directly affect cargo payloads and trucking operation cycles– and in turn carrier productivity.

4.2 Demand Forecasts

A central goal of this study is to characterize the future demand for freight transportation by mode. Demand projections enable a qualitative analysis of the severity of the capacity issues that are affecting the efficiency and reliability of our freight system, and consequently of the types of public policies that can be pursued.

Numerous recent studies have developed projections of freight transportation demand by mode. Aggregate demand estimation methodologies either implicitly or explicitly account for the demand drivers discussed above in Section 4.1, but no attempt is made in this study to isolate those effects in our review of work conducted by others. Rather, the information provided in Section 4.1 is used to construct a plausible demand scenario based on forecasts prepared by others.

A number of recent forecasts were gathered to determine a plausible demand scenario for the future, by mode. Specifically, for this study the following three sources of freight demand projections were reviewed:

1. Bureau of Transportation Statistics (BTS) forecasts as reported in *The Changing Face of Transportation;*

2. AASHTO's *Freight-Rail Bottom Line Report*; and

3. American Trucking Associations' (ATA) *U.S. Freight Transportation Forecast to 2014*.

4.2.1 BTS's Changing Face of Transportation

Published in 2000, BTS report entitled *The Changing Face of Transportation* covers transportation developments through the last quarter of the 20th century and forecasts the demand for freight transportation by intercity truck, rail, and air in 2025. The report investigates topics such as demand growth, deregulation, intermodalism, safety, globalization, technology, and national security, and presents forecasts that based on empirical data and various econometric methods.[51]

Exhibit 24 presents the BTS forecasts as reported in its publication. It is important to note that the forecasts do not account for the effects of the recent economic downturn that

[51] Forecasts for rail ton-miles are based on 1990 through 1998 BTS data, using damped trend exponential smoothing. Forecasts for truck ton-miles are based on two forecast models: linear trend based on 1990 through 1997 data and double (Brown) exponential smoothing based on 1960 through 1995 data in five year increments; the two forecasts are combined with equal weights. Forecasts for air ton-miles are based on two forecasting methodologies: linear trend based on 1990 through 1998 data and damped trend exponential smoothing based on 1960 through 1995 data in five year increments; the two forecasts are combined with equal weights.

began in 2001 or the effects of 9/11. Nonetheless, the forecasts prepared by BTS are significantly lower than the historic growth rates that are discussed earlier in this Section and provided in Exhibit 18. What is most striking about the BTS projections is the low annual growth rate that is estimated for rail (0.18 percent). As a benchmark, both the American Trucking Associations (ATA) and the Federal Railroad Administration (FRA) forecast a 2.0 percent annual growth rate for rail ton-miles over this period.

Exhibit 24: BTS's U.S. Domestic Freight Ton-Mileage Growth Forecasts by Mode (2000 to 2025)

Mode	Ton-Miles in Billions (2000)	Ton-Miles in Billions (2025)	Percent Change (2000 to 2025)	Compound Annual Growth Rate (CAGR)
Intercity Truck	1,130.1	2,121.8	87.7%	2.55%
Rail	1,416.4	1,484.8	4.8%	0.18%
Air	15.9	33.9	113.2%	3.08%

4.2.2 AASHTO's Freight-Rail Bottom Line Report

The primary goal of AASHTO's *Freight-Rail Bottom Line Report* is to examine the performance and productivity of the nation's freight-rail system. Based upon anticipated levels of investment in that system, the study makes the case that the rail system requires significant investment to ensure that unsustainable volumes of traffic do not spill over onto the highway system as a result of insufficient capacity and service levels in the rail industry.

The Report includes forecasts for the four major modes of freight transport (truck, rail, water and air).

The demand forecasts that are reported in AASHTO's Report are based on:

1. TRANSEARCH data for the baseline year (2000),[52] and

2. Growth rates developed under FHWA's Freight Analysis Framework (FAF).

Exhibit 25 presents AASHTO's baseline forecasts by mode (truck, rail, water, air) in terms of ton-miles for the period 2000 to 2020.

[52] TRANSEARCH is a proprietary freight flow database owned by Reebie Associates.

Exhibit 25: AASHTO's U.S. Domestic Freight Ton-Mileage Growth Forecasts by Mode (2000 – 2020)				
Mode	**Ton-Miles in Billions (2000)**	**Ton-Miles in Billions (2020)**	**Percent Change (2000 to 2020)**	**CAGR**
Truck Total	2,639	4,174	58%	2.32%
Truck < 500 Miles	1,241	2,046	65%	2.53%
Truck > 500 Miles	1,398	2,128	52%	2.12%
Rail	1,239	1,821	47%	1.94%
Water	539	617	14%	0.68%
Air	9	27	200%	5.65%
Total	4,427	6,638	50%	2.05%

Note that AASHTO's baseline data shows a large volume of trucking ton-miles, compared to other data sources. For example, the BTS baseline data reported in Exhibit 24 shows that in 2000 about 1.1 billion ton-miles of freight were moved by truck, less than half the estimate that is in AASHTO's Report. Conversations with staff from Reebie Associates, however, revealed that the higher base used in the AASHTO Report was the result of: 1) incorporating local (non-intercity) truck movements, as well as intercity movements, 2) counting agricultural shipments not usually captured in other datasets on freight movements, and 3) using various data sources to derive ton-miles instead of relying on the carrier reported data that BTS uses.[53] AASHTO's baseline data for trucking ton-miles attributable to moves beyond 500 miles is more consistent with the BTS baseline estimate that only looks at intercity trucking (1.4 billion ton-miles versus 1.1 billion, respectively).

Nonetheless, AASHTO's annual growth rates by mode are lower than the historic averages presented at the beginning of this section in Exhibit 18. Moreover, the estimated 2.05 percent overall freight demand growth rate for the period between 2000 and 2020 is significantly lower than the historic growth rate in relevant economic activity (i.e., the 4.26 percent annual growth rate in manufacturing and imports that is presented in Exhibit 19). The progression toward a service economy and our increased reliance on finished goods imports may account for some of the difference, since the 4.26 percent is a value-of-shipments based number. Yet, when compared with economic indicators that serve as a proxy for the demand for freight transportation, AASHTO's freight demand growth estimate appears to be conservative.

[53] Again, using BTS data as a benchmark, the baseline ton-miles for all other modes appear to be lower in the AASHTO Report. Air freight shows the greatest percentage discrepancy at only 9 billion ton-miles in 2000 as compared with BTS' figure of nearly 15 billion. Additionally, freight moved by rail in 2000 was 15 percent lower than what BTS reported and water freight volumes were nearly 17 percent lower.

4.2.3 American Trucking Associations' (ATA's) U.S. Freight Transportation Forecast to 2014

ATA's *U.S. Freight Transportation Forecast to 2014* provides demand forecasts for trucking, rail, water, and air from 2002 to 2014. Global Insight and Martin Labbe Associates developed the forecasts for ATA using proprietary models, databases, and other available sources. While the actual model algorithms and supporting data are not documented, the study accounts for the U.S. economic outlook, energy prices, consumer spending, foreign trade, business investment, industrial output, regional economic growth, and the world economy; and applies models of freight flows.

Note that ATA's study provides ton-mile and tonnage forecasts by class of truck (Class 8, 6-7, 3-5). For other modes, however, forecasts are provided only in tons.[54] Additionally, for modes other than trucking, ATA's study only includes "primary shipments" (i.e., the first movement of freight from an origin to a destination). For trucking, ATA addresses both primary shipments and "secondary shipments" (i.e., additional truck hauls of the commodity that was primarily shipped).[55] Furthermore, forecasts for rail are broken down by total rail traffic and rail intermodal.

Exhibit 26 presents ATA's freight volume forecasts in tons for trucking, rail, rail intermodal, water, and air. ATA's growth rates indicate that air freight will experience the highest level of growth followed closely by rail intermodal, which is forecast to even exceed the air freight growth rate during the first half of the forecast period (2003 to 2008).[56] The primary driving force behind the high growth rate for rail intermodal is our increased dependence on international trade, which is projected in ATA's study to grow by 5.0 to 6.5 percent per year. Alternatively, freight water volumes are predicted to grow at 1.6 percent per year from 2002 to 2014, while total rail tonnage is predicted to grow at an annual rate of 1.8 percent.

Exhibit 26: ATA's U.S. Domestic Freight Forecast by Mode, 2002 - 2014

	Volume – Millions of Tons			Compound Annual Growth Rates		
Mode	2002	2008	2014	2003-2008	2009-2014	2003-2014
Truck	8,882.3	10,108.6	11,470.2	2.3%	2.2%	2.3%
Rail	1,751.2	1,983.8	2,142.5	2.2%	1.3%	1.8%
Rail Intermodal	155.8	201.2	252.1	4.9%	4.2%	4.6%
Air	17.4	22.3	29.1	4.7%	5.1%	4.9%
Water	1,006.7	1,129.7	1,213.6	2.0%	1.2%	1.6%
Total	11,813.4	13,445.6	15,107.5	2.2%	2.0%	2.1%

Exhibit 27 presents ATA's trucking forecasts, by truck class, in ton-miles. Shipments by Class 8 trucks (primarily highway tractors pulling trailers) account for almost all of intercity trucking. Note, however, traffic from medium and light duty trucks (Classes 3-7)

[54] The study also provides forecast revenue.
[55] These hauls are characterized by being regional in nature with typical lengths of under 100 miles.
[56] ATA's forecast account for the effects of security concerns on the air transport industry, which dampen somewhat the projections of the demand for air cargo.

is expected to grow at a faster rate during the forecast period. Much of this is due to trends toward more frequent but smaller shipments that characterize modern supply-chain management (e.g. just-in-time shipments). Overall, ATA's study notes that the driving force driving the growth in trucking is general freight and small package shipments which are expected to grow at a faster rate than bulk traffic.

Exhibit 27: ATA's Trucking Ton-Mile Forecast by Class, 2002 - 2014

Truck Class	Volume – Billions of Ton-Miles 2002	2008	2014	CAGR 2003-2008	2009-2014	Percent Change 2003-2014
Class 8	1,202	1,393	1,653	2.5%	2.9%	38.0%
Classes 6/7	115	138	169	2.7%	3.5%	44.0%
Classes 3-5	17	22	27	4.7%	4.0%	66.7%
Total	1,334	1,553	1,849	2.6%	2.9%	38.6%

4.3 Summary of Forecasts and Interpretation of Trends

Exhibit 28 compares the recent history of growth rates and our plausible demand forecast by mode based on the studies that are discussed above and the factors that affect demand. The modes are listed in descending order of their historic and forecast growth rates. The exact amount of each future rate is certainly open to debate and adjustment; but there can be no doubt about the relative order of these rates, and that order is unlikely to change in the foreseeable future.

Exhibit 28: Ton-mile Percentage Annual Growth Rates (Recent History and Plausible Demand Forecast)

Mode	History 1990-2000	Forecast 2000-2020
Air	5.2%	4.0%
Truck	3.9	2.5
Rail	3.5	2.0
Water	-2.5	0.7

4.3.1 Interpretation of the Plausible Forecast Scenario

The forecasts presented in Exhibit 28 reflect both the price-and-service characteristics of the major freight modes and the evolving character of American industry and the economy. As discussed earlier, for some years now, there has been an increasing drive to reduce inventories throughout manufacturing and distribution supply chains. This has led to a substitution of transportation spending for inventory holding and, thus, to increased demand for fast and reliable goods transport. For longer moves, air transport is the fastest choice and by far the most expensive. That is why it accounts for a mere sliver of ton-miles (around one-half of a percent) but a significantly higher fraction of intercity freight revenue (more than two percent).

Truckload (TL) trucking with team drivers can also provide a relatively high-speed service, up to 1,000 miles in 24 hours. Even though the premium for team service over solo driving—in the range of $0.10 to $0.20 per mile—is not nearly as great as for air over truck, a comparatively small share of total truck-miles are in team operation.[57] This tells us that the great preponderance of shippers are not willing to pay extra to get speeds greater than those of solo trucking, roughly 500 miles a day in most of the country, around 400 miles per day in the I-95 corridor. Most shippers are willing, however, to pay the extra price of truck compared to rail to obtain the relative speed of highway service and the generally greater reliability and flexibility of trucking.

It is the higher-valued, time-sensitive traffic for which shippers are under pressure to reduce inventory costs and are, therefore, willing to pay for reliability and speed, especially the former. This traffic is also associated with newer, faster-growing sectors of manufacturing or fast-growing imports. This is the traffic where, for the most part, shippers will choose truck or air, and these modes will continue to grow faster than rail or water. Air will show the highest growth rate because it is starting from a small base and pressures for a lean supply chain will continue to drive traffic to air cargo.

Traffic in bulk commodities—coal, grain, petroleum products, ores—does not grow as fast as the total economy. These commodities comprise almost all the inland waterway and other domestic waterborne traffic, and they are the major part of rail tonnage. This will keep the waterways at the bottom of the growth table. Railroads do have opportunities for growth aside from their bulk markets and will be able to grow much faster than water traffic but still not as fast as trucks.

Railroad markets can basically be divided into four categories: bulk, intermodal, carload, and automotive. Automotive traffic, both vehicles and parts, is technically carload traffic, but is a separate market segment with high-value traffic and a high standard for reliability. This business will grow as fast as the automotive industry does, but, in tonnage terms, it is a small percentage of the rail total. Bulk, the majority of tonnage, will continue to grow slowly.

Carload traffic comes from shippers who can never load enough cars at one time to make a whole train. This traffic must be collected by local service, put in mixed trains in a terminal and then be moved through a succession of terminals in different trains before it is delivered by local service. Scheduled operation offers some hope of improvement in rail reliability, but growth of this traffic is constrained because a shipper cannot use it without a facility on a rail siding. The great majority of manufacturing and distributing facilities are no longer on rail sidings. Most shippers can use intermodal rail, and for that reason it is the one rail market-segment with a potential for strong growth. Rail intermodal is likely to grow faster than total trucking. Overall, however, rail growth will be slower than trucking growth.

Our plausible forecast shows future growth for air, truck, and rail at rates somewhat diminished from those of the 1990s. For air, this reflects a judgment that the recent high percentage growth rate (5.2 percent) will not be sustained as the base grows. For truck,

[57] We do not have an exact number for team driving as a fraction of truck-miles in intercity service. The anecdotal evidence is strong, however, that the fraction is small. Many large firms will not supply team drivers. It requires a high level of management effort to find and retain compatible partners. There are niche TL companies that specialize in team service.

the drop from 3.9 percent in the past to 2.5 percent in the future may be based on a perception that the substitution of transportation for inventory holding has gone almost as far as it can go. Rail growth in the 1990s was driven more by increasing length of haul than by increasing tonnage, the longer hauls coming from the growth of intermodal traffic from West-coast ports and coal traffic from the Powder River basin. Future growth of 2 percent in ton-miles is an extension of the tonnage growth of the 1990s. The fall in water traffic in the 1990s was a result, in part, of falling grain exports and new offerings of low-priced rail service to the Pacific Northwest. The forecast for slow, positive growth is based on a belief that these negative factors have had their full effect.

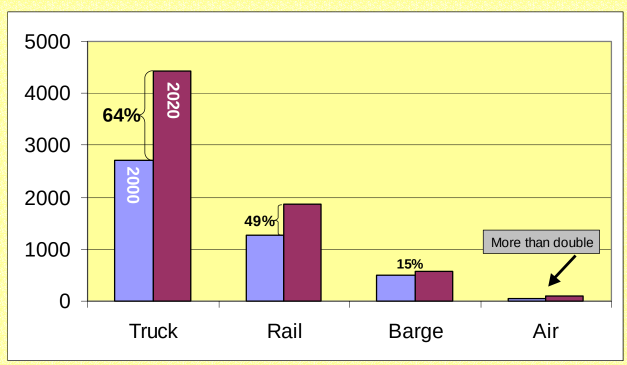
4.3.2 Implications on System Performance

So, based on an evaluation of multiple studies and on analyses of the primary factors that determine the demand for freight transport, a plausible demand growth scenario for each mode was developed for this analysis. Under our scenario, the annual growth rates in ton-miles for the period between 2000 and 2020 are repeated below.

- Trucking = 2.5% per year,
- Rail = 2.0% per year,
- Barge = 0.70% per year, and
- Air freight = 4.0% per year.

Given historic growth rates, expected growth in economic activity, expected increases in our dependence on imports to satisfy demand for finished goods, and the likelihood of continued technological innovation, one could argue that the growth rates that are provided above are conservative. As depicted in Exhibit 29, however, these growth rates mean that by the year 2020 our freight system will have experienced a 64 percent increase in trucking ton-miles, a 49 percent increase in rail ton-miles, and a 15 percent increase in barge traffic—all while the demand for air freight will have more than doubled. To put these growth rates in context, consider the following.

Exhibit 29: What do these forecasts mean? (Billions of Ton-Miles)



- **Trucking**: At the national level, a 64 percent increase in truck ton-miles between 2000 and 2020 means 79 million more intercity truck shipments per year by 2020. As an example, at a regional level, this growth would mean 5 million more intercity truck shipments per year out of the Houston region by 2020, or nearly 7 million more truck VMT per year on Houston area roadways by 2020.

- **Rail**: At the national level, a 49 percent increase in railroad ton-miles between 2000 and 2020 means that 7.8 million more rail carloads will be originated per year by 2020, or 90,000 more freight train movements will be originated per year by 2020. At the regional level, such growth implies 360,000 more rail carloads originated per year in Chicago by 2020, or more than 4,000 more yearly freight train movements in the Chicago area per year by 2020.

- **Barge**: A 15 percent increase in barge ton-miles between 2000 and 2020 means that 37,000 more barge movements will occur on the Ohio River per year by 2020 and 25,000 more barge movements will occur on the Lower Mississippi River per year by 2020.

- **Air**: A 120 percent increase in air cargo ton-miles between 2000 and 2020 means 9,600 more annual air cargo plane departures at LAX by 2020 and 3,500 more annual air cargo plane departures at Dallas-Fort Worth Airport by 2020.

In addition to the underlying drivers of the volume freight transportation, a number of specific events could affect the structure of future demand (both modally and spatially) further straining specific parts of the system.

Shifts From Rail to Other Modes (Especially Trucking)

First, as estimated by AASHTO's *Freight-Rail Bottom Line Report*, significant investments are needed to ensure that the nation's railroads can accommodate future demand. AASHTO presents four investment scenarios.

1. *No Growth*: This scenario assumes minimum investments in our rail industry, only sufficient to maintain current traffic volumes. Rail loses market share *vis a vis* the other modes.

2. *Constrained Investment*: Under this scenario, selected investments are made that to accommodate growth in traffic. However, the investments are not sufficient to accommodate the baseline forecast in 2020 (see Exhibit 26). In other words, rail traffic spills over to other modes.

3. *Base Case*: This scenario assumes that enough investments are made to retain the rail industry's current share of freight traffic.

4. *Aggressive Investment*: Under this scenario, the railroads make the investments and service improvements needed to more than accommodate the baseline forecast for 2020. Rail-freight increases its market share *vis a vis* other modes.

Exhibit 30: Effects of Trucking of Insufficient Investment in our Rail System

Source: AASHTO Freight-Rail Bottom Line Report

Exhibit 30 (above) summarizes the effects of the "no-growth", "constrained investment", and "aggressive investment" scenarios on the demand for trucking (in vehicle miles traveled). The AASHTO analysis shows that if significant investments are not made in our rail system, truck traffic will be much higher than predicted. Under the "no growth" scenario, the equivalent of 31 billion VMT would spillover onto our roadways. To put this in context, that amount of VMT represents about 22 percent of the total combination truck VMT reported by FHWA's Highway Statistics for 2002, and is roughly three times the VMT that is expected in 2015 for trade movements between Mexico and the U.S.[58]

As this shows, it will be critical that a holistic perspective be taken by decision-makers at all levels of government when it comes to investments in our freight transportation system. Lack of sufficient investment in one mode will affect the ability of other modes to deliver reliable and efficient performance, thus affecting the performance of the overall system.

Widening of the Panama Canal and the Advent of Post-Panamax Vessels

A second consideration that likely will affect our nation's freight system both modally and spatially is the widening of the Panama Canal. The Panama Canal Authority has embarked on a $1-billion modernization and improvement program designed to meet growing transit demands with greater operating capacity and more flexible traffic scheduling. Once completed, two Panamax-sized vessels will be able to transit simultaneously without compromising navigational safety. In the future, the Panama Canal will offer nearly unrestricted two-way transit services to the world's merchant fleet 24 hours a day, and will be able to accommodate larger post-Panamax vessels that require deeper channels and harbors.[59]

Note that by the end of 2001, the Panama Canal Authority had finished the drilling and blasting portion of the Gaillard Cut segment, significantly ahead of original schedules. Once the Canal can accommodate fully post-Panamax vessels, the effects on the freight system in the U.S. could be significant.

- First, changes in world trade patterns could effect the distribution of movements within our domestic freight system. East-to-west freight corridors that serve as land bridges today may not be as critical in the future as shippers take advantage of a more efficient and reliable Canal.

- Second, the competitiveness of some of our ports will be affected as liners call on ports that can more readily accommodate post-Panamax vessels. Determining which ports should receive dredging resources will become even more important.

[58] ICF Consulting estimates based on work for FMCSA on the NAFTA EIS.
[59] Growth in world trade and ongoing rationalization in the liner shipping industry are two of the principal factors that will continue to push the development and implementation of post-Panamax vessels. The introduction of post-Panamax ships already has affected the ports and terminals businesses. Shippers also are accepting more transhipment and relay type services.

- Third, some of our economic sectors may be adversely affected, especially agriculture as less costly transportation routes increase the competitiveness of producers in South America, for example. Should the agricultural sector be adversely affected, our inland waterways and major bulk port facilities would suffer as well.

Overall, the widening of the Panama Canal will necessitate additional investments in many of our busiest ports to ensure that larger vessels can be accommodated. Given current port capacity challenges, this development will further strain our maritime port system and increase the importance of well-crafted investment programs that account for changing trade patterns and new port facility requirements.

Increased Trade with China

Since the initiation of economic reforms in 1979, China has become one of the world's fastest growing economies. From 1979-1999, China's GDP grew at an average annual rate of 9.7 percent. Even with the effects of a global economic downturn, 9/11, SARS, and the Iraq war, China's economy still managed to grow at a rate of 8 percent in 2003. Some economists predict that China may be the world's largest economy by the middle of the 21st century.

The effects of China's continued growth on our domestic freight system could be very significant.

- First, the distribution of freight movements that are generated by international trade is shifting from ports-of-entry on the U.S.-Mexico border to our West-coast ports. Mexico's major export-oriented businesses (i.e., *maquiladoras*) are having difficulty competing with Chinese companies that pay significantly lower wage rates (roughly $2 per day compared with the $8 per day paid by Mexico's *maquiladoras*).[60] By December of 2002, trade with China accounted for 45 percent of the containerized imports in Los Angeles-Long Beach, compared with 39 percent in 2000. Yet, during that same period, 529 factories in Mexico were closed.[61] If this trend continues, as is expected, the reliability and efficiency of our West-coast freight system (from ports to connecting rail and highway systems) will become even more important.

- Second, the relocation of production from Latin America, North America, and Europe to China is taking place rapidly. As trade patterns shift and the U.S. becomes even more reliant on imports to satisfy demand for finished goods, shipper logistics patterns will change, possibly leading to more movements over longer distances. In that case, carrier flexibility and reliability will become even more important.

Overall, Federal, state, and local transportation agencies in their decision-making, should account for increases in trade with China.[62] Specifically, changing trade patterns likely

[60] Alan M. Field, The Journal of Commerce, *Headed South*, April 14-20, 2003.
[61] Bill Mongelluzzo, The Journal of Commerce, *Maquila Meltdown*, April 14-20, 2003.
[62] Note that the rapid pace of economic development in China (and India) is one of the major factors that has led in increased fuel prices in the U.S. and elsewhere. China is rapidly becoming a motorized nation and vehicle ownership is expected to increase significantly in the coming years. This means

will affect the distribution of movements on our freight system. Special focus should be given to system reliability and efficiency needs in the West Coast, as that part of the system becomes relatively more strained.

Technological Innovation (the "Second Wave" of the IT Revolution)

It is likely that future technological innovation will continue to affect our freight system. For instance, driven by the needs of "high-cycle" commerce, a "second wave" of improvements in information technology may enable the development of freight villages or city logistics. In turn, regional networks could develop changing the spatial and institutional/organizational make-up of freight transport. Regional networks could further improve the productivity of carriers and directly affect the number of freight movements that are needed to satisfy customer demands. For example, city logistics is taking hold in some European cities and has decreased the number of truck trips into city centers. The European Union describes city logistics as follows.

> *"City logistics involves setting up new partnerships and styles of cooperation between all those involved in the logistics chain and in delivering/receiving goods in city centres. These partnerships offer significant reductions in vehicle kilometres and truck numbers and are currently in existence in Germany and Switzerland. City logistics is a very clear illustration of the importance of developing high-quality 'software' to match high-quality 'hardware'. The hardware in a transport operation is well understood and well managed, e.g. vehicles and depots. The 'software' relates to organisational linkages, cooperation, thinking about marketing and packaging strategies and thinking about different ways of doing things. City logistics has taken transport operations into an area of development that builds links and emphasises cooperation across all players and interest groups.*
>
> *In Germany partnerships between logistics contractors are reducing lorry numbers and improving the urban environment. These partnerships (known as City Logistik companies in Germany) are in operation in Berlin, Bremen, Ulm, Kassel and Freiburg. The Freiburg example has several pointers to the future shape of freight transport in urban areas. There are currently 12 partners in the scheme. Three of the partners leave city centre deliveries at the premises of a fourth. The latter then delivers all the goods involved in the city centre area. A second group of five partners delivers all its goods to one depot located near the city centre. An independent contractor (City Logistik) delivers them to city centre customers. A third group, this time with only two service providers, specialises in refrigerated fresh products. These partners form an unbroken relay chain, one partner collecting the goods from the other for delivery to the city centre.*
>
> *The Freiburg scheme has reduced total journey times from 566 hours to 168 hours (per month), the monthly number of truck operations from 440 to 295 (a 33 % reduction) and the time spent by lorries in the city from 612 hours to 317*

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that China will become a major energy demand nation, and given limited supply it is reasonable to expect that fuel prices will remain relatively high. This has important ramifications for the freight transportation industry in the U.S. since fuel cost is an integral driver of the cost structure that motor carriers operate under. As shown in Exhibit 13, changes in fuel prices are closely correlated with the number of bankruptcies in the trucking industry.

> *hours (per month). The number of customers supplied or shipments made has remained the same. The Kassel scheme showed a reduction of vehicle kilometres travelled by 70 % and the number of delivering trucks by 11 %. This has reduced the costs of all the companies involved and increased the amount of work that can be done by each vehicle/driver combination."*

It is interesting to note that the concept of freight villages, city logistics, and regional networks is receiving the attention of carriers in the U.S. During a presentation by JB Hunt at the TRB Annual Meeting in 2004, JB Hunt's representative discussed the evolution to regional networks. Part of the push is originating from driver shortage and retention issues, as well as the continued progression toward "high-cycle" commerce. Yet, without improvements in technology that enable advanced logistics systems, this progression would not be possible.

The ramifications on our freight system's inability to accommodate anticipated demand growth, partly driven by the events that are described above, could be severe. Especially given little or no change in government policies and programs designed to enhance the system's effective capacity.

5. Possible Types of Government Responses

The findings of Sections 3 and 4 of this report indicate that given little or no change in government programs there are likely to be significant strains on the capacity of the national freight system over the next ten to 20 years. “Little or no change” means a continuation of past trends in funding levels and patterns of practice in programs affecting freight-system performance. It does *not* mean a world in which there is no further investment in freight-transportation infrastructure and facilities. It means a world in which Federal-aid highway funds continue to flow, states and local governments continue to spend on roads, railroad firms continue to invest in track and equipment, and so forth. But the current level of effort, allowing for some uptrend in funding in light of historical trends, is insufficient to maintain the current performance of the freight system, let alone enhance it.

There is no doubt, therefore, that the expected future strains on the freight system merit a response from government. “Response” means some significant change; it could be a change in funding levels, changes in the structure of existing programs or creation of new programs, changes in regulatory practice, or some combination of these types of changes. The clear message thus far is that some significant response is definitely needed. The cost to the economy of a poorly performing freight system is too great to ignore.

It is important to recognize that the need to ensure an efficient, reliable, and safe freight transportation system is getting the attention of decision-makers at all levels of government. The Federal Highway Administration, for example, has for years focused on the needs of the freight system and has formalized its initiatives under the auspices of organizations such as the Office of Freight Management and Operations. Similarly, many regions across the country have conducted detailed assessments of their freight system. As a result, progress is being made.

However, the capacity issues and demand trends that are discussed in this report highlight the urgency of the situation and the need to accelerate the pace of problem solving. As decision-makers consider how to move forward, three overarching needs should be accounted for in their deliberations.

- First, we need a national vision for our freight system. The performance of our freight transportation system affects our national competitiveness. As a result, ensuring efficiency and reliability in the nation’s system should be a national priority.

- Second, we need regional/local freight transport decisions that are consistent with national goals, objectives, and strategies. The transportation decision-making process is largely executed at the state and local levels. It is imperative that decisions at these levels do not result with suboptimal outcomes when it comes to the performance of the freight system as a whole.

- Third, we need strong, well-coordinated leadership at all levels. Although it is true that freight shipments “don’t vote”, the people that own businesses and ship products do. Elected officials and other high-level decision-makers must recognize the importance of ensuring a high-performing freight transportation system as they formulate policies, design plans, and implement projects. Leadership is also critical to forging successful partnerships with business interests that have a direct stake on the performance of the system.

This section provides examples of actions that government can implement (relatively quickly) to get us on the path of ensuring a high-performing freight transportation system over the long-term. To provide a more robust context, Appendix B reviews existing laws, regulations, and financing mechanisms, policy ideas that have been formulated by other researchers, and how ongoing legislative processes (in particular the highway bill) are dealing with freight needs.

5.1 Some Fundamental Guiding Principles

Government acts to bring about results that would not occur if firms and individuals made all their decisions on the basis of the signals they get from the marketplace. At the most basic level, the government may act in three ways. It can spend, it can tax, and it can regulate.

- *Government spending* brings about a set of investments the private market would not have made. Spending in the form of operating subsidies can also sustain services (e.g., mass transit) that would not otherwise be provided. But note that government has other tools to change the market's choice of investments. Loan guarantees, special bonding authority, tax exemption for interest on state and local-government bonds, and a host of other devices can steer investment towards projects or purposes favored by the government without any direct government outlay. But the economic effect is the same; the government has caused investments to be made that the market would not have made.

- *Taxes*, in the form of excise taxes, user fees, and the like are not just devices for raising money. They also change the prices of affected goods and services and, thus, change the decisions that firms and individuals make.

- With *regulation*, government affects behavior directly by prohibiting certain actions or requiring government approval for certain actions or types of activity. For example, you cannot offer commercial air service without government certification that your operations and safety practices meet certain standards. But the government may also modify behavior in other ways. It can attach conditions to financial assistance. The grants that flow to states and MPOs through the highway program, for example, come with strings attached–for instance, states and MPOs must follow certain planning practices.

These are the basics: government can direct funds to certain purposes; it can use the taxing power to change prices; it can regulate behavior directly with rules or with conditions on financial assistance. But, if we consider the kinds of actions the government could take to improve the performance of the freight system, a number of nuances are introduced.

Consider, for example, the funds for highway, transit, and other purposes that flow through the Federal-aid highway program. The issue is not simply one of whether, or by how much, to increase the amount of those funds. At least as important as the total funding level, are issues of program structure. Important results could be obtained by changes that bring more focus on freight-related projects without any change in total program dollars. These could be changes regarding the eligibility of certain types of projects (e.g., rail freight). They could also be institutional changes of one kind or another that raise the profile of freight in planning. A list of possible variations would be almost endless.

5.2 A Spectrum of Options

As can be discerned from the material in Appendix B, a wide spectrum of actions is available to decision-makers for addressing freight transportation needs and system inefficiencies.[63] One common element in these choices is a direct focus on freight movement. Simply increasing dollar levels for existing programs would not ensure that freight-system issues are addressed effectively.

For any potential government response, careful analysis will reveal both advantages and disadvantages. The principal criteria that should be applied in judging the strengths and weaknesses of various actions for addressing freight transportation needs and system inefficiencies are discussed below.

- *Clear Focus on Freight*–Programs, especially those that involve financial aid, must be structured so that funds go to projects that clearly and significantly enhance the performance of the freight system. Without a requirement for direct and significant effects on freight, any program is in danger of being merely one more general-purpose transportation program.

- *Economic Efficiency*–Of all criteria, this is the most important. It should be demonstrable that any policy action, whether investment, regulation, pricing, subsidy, or some variant, returns economic benefits greater than its costs. And this should be determined through application of techniques such as benefit-cost analysis.

- *Benefit to the Public*–This criterion would apply in the case of investments in the facilities of a private firm, most likely a railroad. There would have to be clear and demonstrable benefits to the public from such an action, and it should be shown that the firm in question would not otherwise have made the investment.

- *Avoidance of Subsidy*–Any program of on-going subsidy for operations, whether for public or private entities, should have to pass an exceptionally rigorous benefit-cost test and require a demonstration that there is no other way to achieve the purpose in

[63] In addition to the information that is provided in Appendix B, AASHTO has developed a number of freight transportation recommendations for consideration by policy-makers during the TEA-21 reauthorization process. AASHTO's recommendations can be found by visiting the following Web site: http://freight.transportation.org/doc/FreightOverview.pdf

question. Once subsidy programs are in place, it can be extremely difficult to terminate them, regardless of their actual effects in economic terms.

Selection of government responses should be made in a careful process in which the above criteria are applied. But the choice of responses should also be based on a clear national vision for our freight system. The programs and projects that are implemented by states and localities in turn must support that vision, as well as the goals, objectives, and strategies that flow from it.

Exhibit 31: Where do we want to be 10 or 20 years from now?

- An efficient, reliable, and integrated freight system, enabled by technology, that
  - Optimizes generalized logistics costs
  - Helps to maximize manufacturing productivity
  - Helps to minimize the prices of imports
  - Enhances efforts to make our homeland more secure
  - Enhances our ability to deal with congestion in urban areas
  - Is energy and environmentally efficient
  - Limits effects on community livability and cohesiveness
  - Minimizes the probability of accidents and associated fatalities and injuries

Exhibit 31 articulates a vision for our freight transportation system, one that is predicated on economic efficiency and societal goals. Recognizing the numerous medium-term and long-term system performance challenges that are described in this report, and drawing from the input received from the expert panel that participated during the course of this study, achieving this vision likely will require programmatic approaches. For example, national-level programs designed to select and help fund freight projects of national significance can help to address major capacity bottlenecks and accelerate the development of projects that enhance the performance of the nation's freight system. Such programs could be based on detailed and strict guidelines for project selection, monitoring, and evaluation. Likewise, national-level programs for funding, evaluating, and disseminating the results of innovative multimodal freight planning and programming at the state and local levels can help to address the need for meaningful freight planning at the state and local levels. Such programs could help to push the envelope on issues related to collaborative institutional arrangements, public/private partnerships, freight-passenger interferences, regional freight networks (e.g., freight villages, city logistics), land use needs, freight analysis data and tools, and operations-oriented strategies.[64] Similarly, national-level programs designed to improve the efficiency and productivity of our nation's harbors can help to address the current lack of national and/or regional focus for port planning, as well as address needs related to changing trade patterns and post-Panamax vessels. Such programs could help fund channel dredging projects according to the national interest and include an efficient user fee that adheres to trade treaties.

Certainly, a number of options are available to decision-makers, and consideration should be given to the full range of options for improving the performance of our freight transportation system. The three examples described above, however, can be implemented within the construct of current decision-making processes. In this way, they

[64] Given the importance of intercity freight movements to our economy, effective freight policy and planning will require a high degree of coordination between state-level agencies (such as between neighboring state DOTs) and between state- and local-level agencies (e.g., between a state DOT and a city government).

exemplify options that are actionable and of actions that (if implemented) should generate long-lasting benefits to our nation’s economy.

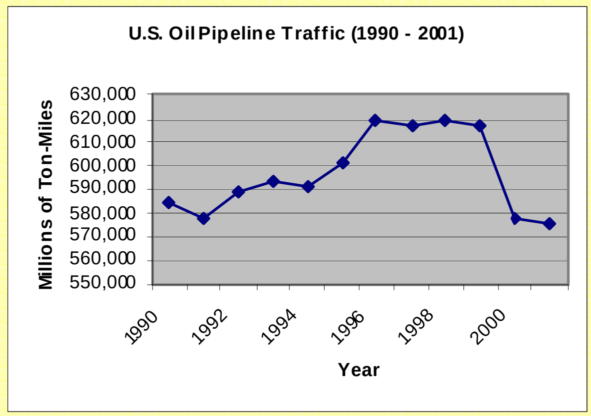
Appendix A: Information on Pipelines

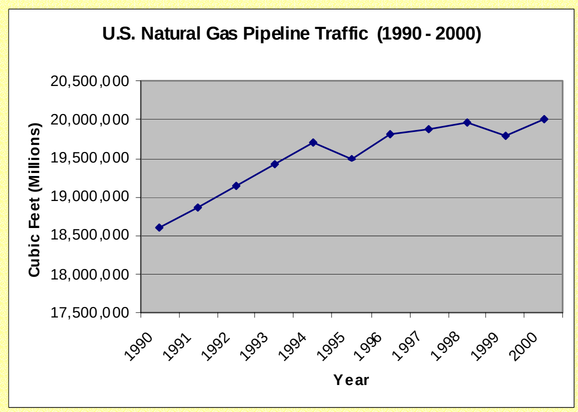
Pipelines carry crude oil, petroleum products, and natural gas. Due to the difference in the physical properties of these commodities, different pipeline systems are involved in transporting them from production/refinery sites to end users.

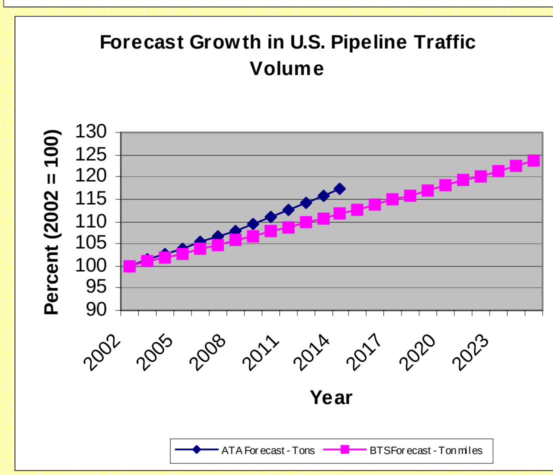
As depicted in Exhibit A-1, oil pipeline traffic volumes declined modestly (1.4 percent) from 1990 to 2001–although volumes were above the 1990 level throughout most of the decade. Natural gas pipeline traffic (measured in millions of cubic feet), however, increased by 7.6 percent from 1990 to 2000, at an annual growth rate of 0.7 percent.

As also shown in Exhibit A-1, both oil and natural gas pipeline traffic are expected to grow steadily over the next 15 to 25 years. Combined, volumes (ton-miles) are anticipated to grow by 1.4% annually from 2003 to 2014.[65] Alternatively, the Bureau of Transportation Statistics predicts that volumes (in tons) will grow at an annual rate of 0.9% from 2002 to 2025.

Exhibit A-1: Trends and Forecasts Relevant to Oil and Natural Gas Pipeline Traffic







65 U.S. Freight Transportation Forecast To 2014; American Trucking Associations, Inc.; 2003.

Appendix B: A Review of Relevant Policies and Policy Research

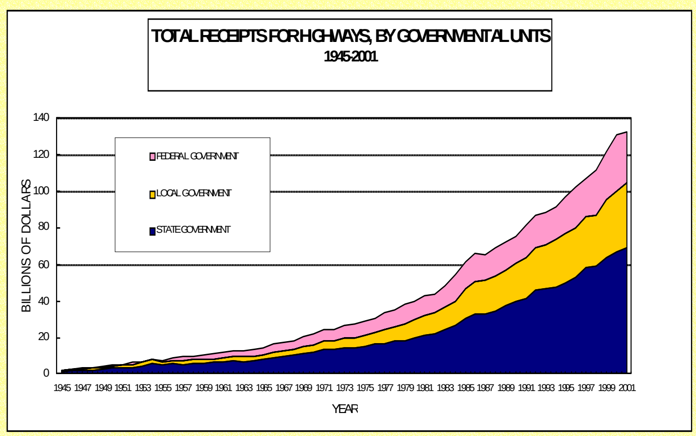
B.1 Overview of Existing Laws, Regulations, and Financing Mechanisms

This sub-section briefly summarizes the laws, regulations, and financing mechanisms that currently guide investment in and the operation of our nation's freight transportation system. It is organized by mode (trucking, rail, waterway, and air). The summary of each mode is further divided among economic regulation, other regulation, and financing mechanisms.

B.1.1 Trucking

There is no longer any significant economic regulation of the trucking industry, but the Federal government continues to regulate the industry with regard to safety and the environment. For example, the new hours-of-service (HOS) rule specifies ten hours of rest for truckers between work periods, two more hours than before. This rule is intended to improve safety on the highways, but it could lower the productivity of truckers. Truck size and weight regulations also affect the productivity of the trucking industry by limiting the amount of freight that each truck can carry. Customs requirements and border-crossing procedures affect the flow of freight between the U.S. and its neighbors, Mexico and Canada.

Exhibit B-1



Federal surface transportation laws provide the basic structure of financing for the nation's major highways. Federal excise taxes on fuels and taxes on trucks, truck tires, and trailers are deposited into the Highway Trust Fund. A portion of these proceeds are dedicated to funding mass transit programs, but the bulk of the funding is distributed to states through a number of programs and formulas. As depicted in Exhibit B-1, states and localities provide the majority of funds for highways (79 percent of highway expenditures in 2001), which they raise through their own fuel taxes, other user-based fees, and from other sources.

Although the trucking industry is highly dependent on the condition and performance of the highway system, until recently trucking concerns have not been featured prominently in state and local highway-planning processes.

B.1.2 Rail

Economic regulation of the rail industry is largely a thing of the past, although some price regulation still applies in areas when a single railroad dominates a market; this situation is most likely to arise in coal and grain markets. Some observers believe the recent mergers and consolidations in the rail industry have increased market power for the remaining companies. As a consequence, there have been some calls for more economic regulation of industry.

The Federal Railroad Administration (FRA) is responsible for regulating the rail industry with regard to safety-related operating practices, transport of hazardous materials, signal and track controls, and grade crossings. Collectively, these regulations affect the productivity of the rail industry and its ability to compete with other modes of freight transportation. Also crucial to the rail industry's productivity are Federal labor laws and regulations and the labor agreements that rail companies make with their union work forces. These labor agreements affect the industry's productivity by dictating such things as crew sizes and operating practices.

The freight-rail industry is for the most part privately financed, although the Federal government does provide some financial assistance to the industry. FRA administers the Rail Rehabilitation and Improvement Financing (RRIF) program, which provides direct loans and loan guarantees to acquire, improve, or rehabilitate intermodal or rail equipment and facilities. FHWA also administers the Transportation Infrastructure Finance and Innovation Act Program (TIFIA), which is available for some rail-related projects.

Some of the Federal funding provided to states through the Federal-aid highway program can be used for projects that benefit the rail industry. Within the Surface Transportation Program (STP), a portion of the funds that a state receives must be set aside for improving rail-highway grade crossings. Federal funds distributed to states for the National Highway System (NHS) can be used to improve intermodal connectors, the routes that connect major freight centers such as ports and rail terminals to the National Highway System. Finally, intermodal freight facilities are eligible for funding provided by the Congestion Mitigation and Air Quality Improvement (CMAQ) program.

B.1.3 Waterways

The Jones Act is the Federal cabotage law that requires that vessels transporting goods between U.S. ports be owned by U.S. citizens, built in U.S. shipyards, and manned by U.S. citizens. The Federal government also regulates waterborne shipping with regard to customs, environmental protection, and homeland security. For example, the Coast Guard requires double hulls on tankers in order to prevent environmental damage from oil spills. The Department of Homeland Security (DHS) now houses the Customs Service, which issues requirements concerning waterborne imports. DHS, through the Coast Guard and the Transportation Security Administration, is primarily responsible for port and cargo security.

Federal funding for operation and maintenance of the nation's waterborne transportation network is focused primarily on maintaining channels, aiding navigation, and monitoring the entry of ships into the nation's ports. The U.S. Army Corps of Engineers maintains more than 12,000 miles of inland waterways, operates over 200 locks, and maintains channels in roughly 300 commercial harbors. State and local governments generally finance landside infrastructure such as terminals, berths, piers, and freight-transfer facilities.

Roughly 80 percent of Federal expenditures for the commercial waterborne transportation system come from general funds. The remaining 20 percent come from the Harbor Maintenance Trust Fund and the Inland Waterways Trust Fund. These trust funds receive receipts from fees on users of the waterway system.[66]

B.1.4 Air

Aside from antitrust regulation in the case of mergers, the only remaining economic regulation of air cargo transportation concerns the right of foreign-flag carriers to operate between U.S. airports. The Federal Aviation Administration (FAA) is responsible for regulating the safety of air passenger and air cargo transportation. Air freight transportation is also subject to the security requirements of the Transportation Security Administration (TSA). In addition, international air freight shippers must comply with applicable customs requirements.

The national air traffic control system is the responsibility of the Federal government. The Federal government also provides funding for airport infrastructure through the Airport Improvement Program. This funding, as well as most of the operating funds of the FAA, comes from the Airport and Airway Trust Fund. Federal user fees on air passengers and cargo are deposited into this trust fund. Separate security fees pay for TSA's activities at airports. Hub airports are largely self-financing through gate leases, landing fees, and payments from concessions such as parking lots and restaurants. State and local governments provide a significant portion of funds for infrastructure and operations at smaller airports.

B.2 Recent Policy Recommendations and Developments

There have been a number of important reports, recently produced, that have approached the freight industry from different angles and have developed guiding principles for government action or sets of specific policy recommendations. The following are brief summaries of four of the most important reports that were reviewed as part of this study.

B.2.1 TRB's 21st Century Freight Capacity (2003)

In this 2003 report, a committee of the Transportation Research Board (TRB) considered the long-term implications of trends in freight transportation markets and how government policies could produce a more efficient level of freight transportation system

[66] *Marine Transportation: Federal Financing and a Framework for Infrastructure Investments*, U.S. General Accounting Office, September 2002, p.3.

capacity. The report recommends four principles to guide decisions about using, enlarging, funding, or regulating the freight transportation system.

1. Economic efficiency ought to be the primary goal of transportation policy.

2. Government involvement should be limited to circumstances in which market-dictated outcomes would be far from economically efficient (e.g., monopoly power, non-market costs).

3. A government responsibility to provide facilities or leadership in developing a project does not necessarily justify government subsidy of the costs.

4. The government should rely on revenue from users and on local matching funds to increase the likelihood that worthwhile improvements will be made and that facilities will be operated and maintained efficiently.

TRB's 21st Century Freight Capacity report also delineates a number of recommendations for moving forward with surface transportation policy, port development, harbor maintenance, inland waterways, and regulation. Overall, the report recommends that state and local governments should routinely conduct evaluations to quantitatively test the economic rationale for government involvement in freight transportation infrastructure projects, and that Federal rules should require such evaluations.

As for mode-specific suggestions, TRB's report presents the following considerations:

TEA-21 Reauthorization

The report argues that any programs created during TEA-21 reauthorization to encourage states to select freight-related projects should: 1) sustain the user-pays principle of the Federal-aid program, 2) fund projects that have the broad support of fee payers, 3) maintain the competitive balance between trucking and other modes by adjusting user fees, not by supplying offsetting subsidies to the competing modes, and 4) require ongoing and retrospective evaluations of the performance of projects. In general, TRB's report provides the following guidance for TEA-21 reauthorization:

- Maintain and reinforce the principle of user financing by aligning fee structures more closely with the costs each highway user imposes (e.g., Value Pricing Pilot Program, toll financing).

- Support improved operation and maintenance of existing highway facilities.

- Provide funding adequate to ensure that states have the resources to maintain the overall performance of the highway system.

- Require DOT to study the costs and market potential of exclusive truck facilities (i.e., truck-only roads).

Port Development

With respect to port development, the report recommends that Congress and the Administration consider the following reforms.

- *Deauthorization Reviews*—reviews of all authorized harbor and waterway projects, considering commercial, defense, and environmental criteria,
- *Regional Planning*—regional decision-making for port investment decisions,
- *Cost-Sharing and Fees*—greater reliance on local cost-sharing and user fees,
- *Outside Reviews*—stronger requirements for independent review of the economic and environmental evaluations of large or controversial projects.

Harbor Maintenance

As for harbor maintenance, the report recommends the development of a new revenue source for maintenance dredging of navigation channels, preferably tying channel capacity expansion and maintenance to project-specific user fees.

Operation and Management of the Inland Waterways

The report also makes specific recommendations on how to improve the performance of our inland waterways. The authors suggest the following:

- The U.S. Army Corps of Engineers should improve the efficiency of congested locks on inland waterways through demand management.
- Congress should begin to rely on revenues from user fees to fund operations and maintenance as well as capital expenditures.
- New institutional arrangements should be sought for management of inland waterways (e.g., regional authorities) that would require less Federal subsidization of waterway operation and expansion.

Air Transportation

With respect to air freight, TRB's report recommends that the Federal government should pursue multilateral agreements as well as bilateral agreements to liberalize the international air freight market.

Decision-making Processes and Planning

TRB's 21st Century Freight Capacity report also investigates needs associated with the transportation decision-making process. Specifically, the report investigates options for better mainstreaming freight needs into the process, and recommends the following.

- *U.S. DOT Data and Analysis Programs*–Congress should give continued support to the development of U.S. DOT's capabilities for economic analysis of the Federal-aid highway program and Federal highway user fees and to the application of this analysis in support of decisions. Congress should support joint state-Federal efforts to transfer and adapt these tools to state and local needs.

- *Evaluation Method*–Congress should create a clearinghouse within the U.S. DOT devoted to evaluation methods in which the U.S. DOT and state and local agencies can share and compare methods and examples of evaluation.

- *Reducing Project Delivery Time*–The U.S. DOT should implement a streamlined environmental review process. Congress should consider allowing Federal agencies to accept funds from non-Federal public agency applicants to pay for expedited project reviews.

B.2.2 GAO's Freight Transportation: Strategies Needed to Address Planning and Financing Limitations (2003)

In December 2003, the General Accounting Office (GAO) issued a report regarding the challenges facing the freight transportation industry and strategies that could help the country overcome those challenges. GAO found that congestion problems are common across the country, but are particularly nettlesome at freight-specific "chokepoints," such as entrances to port facilities, at-grade highway-rail crossings, and roads linking Interstate highways to ports and other intermodal facilities.

GAO concluded that the fundamental limitation to maintaining and improving freight mobility is that the public planning and financing processes are not well suited to addressing freight concerns. GAO recommended two strategies for remedying this situation. First, the agency argued for a more system-wide perspective in the transportation planning process. Second, GAO advocated a wider range of financing options for projects that enhance freight mobility.

Specific recommendations included the following:

- Improve the collection and sharing of freight-related data with state and local planning organizations.

- Develop consistent and sound analytical methods and evaluation approaches for freight-related projects.

- Expand the eligibility criteria for existing programs to cover a broader range of freight projects.

- Use low-cost alternatives to expand capacity through more efficient use of existing infrastructure.

B.2.3 AASHTO's Freight-Rail Bottom-Line Report (2002)

In 2002, the American Association of State Highway and Transportation Officials (AASHTO) issued a report to present its views concerning the capacity of the nation's freight transportation system, especially the freight-rail system, to keep pace with the expected growth of the economy over the next 20 years. The report describes the freight-rail industry, estimates investment needs and the capacity of the industry to meet these needs, and quantifies the consequences of not investing in freight-rail, including the impact on highway congestion and condition.

The AASHTO report points out that in the recent past, public investment in the rail sector has focused on the bottom of the rail system, such as grade crossings, branch lines, and commuter rail services. According to the report, the need today is to address key elements of the national rail network, including nationally significant corridors, urban rail interchanges, and intermodal terminals and connectors.

The report concludes that the rail industry will be unable to invest enough in its infrastructure to keep up with the growing demand for freight transportation over the next 20 years. The report explores a number of options for public investment, such as:

- Allowing highway funds to be used for freight projects that have benefits for highway users and the general public,
- Creating a separately funded Federal rail program,
- Expanding Federal loan and credit enhancement programs for the rail industry,
- Utilizing innovative financing, such as tax-exempt or tax-credit bonds, and
- Developing multi-state partnerships such as infrastructure corporations or banks.

B.2.4 TRB's Policy Options for Intermodal Freight Transportation (1998)

This TRB report was motivated by the fact that intermodal freight transportation is one of the major technological and organizational trends affecting the performance of the freight transportation industry. In the report, the authors set out guiding principles for public investment in intermodal transportation and make policy recommendations.

In general, the report sounds a cautionary note about public investment in intermodal facilities, noting that these facilities have usually been financed exclusively by the private sector. The report concludes that introducing public funds into this mix could undermine the "user pays" principle of highway finance, fuel interstate rivalries, and build expectations in the private sector for continuing public subsidies.

As part of this cautionary stance, the report recommends that government agencies develop and apply standard analysis tools to estimate costs and benefits and winners and losers of any public investments. The report also recommends that the public role in financing major facilities should receive close scrutiny to ensure that public benefits (e.g., congestion relief or reduced pollution) justify the expenditure of public funds and that users pay to the extent that they benefit.

Among the report's specific policy recommendations are the following:

- Seek ways to increase the involvement of freight interests in the public process of selecting infrastructure projects.

- Ensure that the Federal government's information systems in areas such as customs, enforcement, and the military are interoperable with those of private industry.

- Undertake research on standard methods for evaluating freight infrastructure investment proposals and on defining, measuring, and forecasting the performance of the national freight system.

B.3 Recent Legislation

The Transportation Equity Act for the 21st Century (TEA-21) was the law that authorized Federal surface transportation programs for fiscal years 1998-2003. In the spring of 2003, the Bush Administration submitted its reauthorization proposal (known as SAFETEA) to Congress. Due to significant disagreement over the appropriate overall funding level for the bill, Congress was unable to pass a reauthorization bill before TEA-21 expired in September 2003 and has had to pass two short-term extensions. The reauthorization bill is now in conference committee. The following is a description of the major freight-related components of the Administration's proposal and the House and Senate bills.

All three of the bills are focused on highway safety, and, as part of that focus, they include provisions to improve the safety of rail-highway crossings, which would benefit freight as well as passenger traffic. In addition, all of the bills amend the environmental review process for infrastructure projects in an effort to shorten the time devoted to that process. If successful, this reform would result in faster timelines for new highway capacity, with obvious benefits for the trucking industry. Finally, all three bills include provisions intended to advance the use of information technology and intelligent transportation systems, which could increase the productivity of the freight sector.

B.3.1 The Bush Administration's Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2003 (SAFETEA)

The Administration's reauthorization proposal contained little new funding specifically for freight-related concerns, but it did contain a number of new set-asides and eligibility changes to increase the availability of funding for freight-related infrastructure. The Administration referred to these changes collectively as the "Freight Gateways Program." The main features of the Administration's proposal were the following:

- Dedicating a portion of NHS funds for highway connections between the NHS and intermodal freight facilities such as ports and freight terminals;

- Allowing STP funds to be used for publicly owned intermodal freight transportation projects that address economic, congestion, security, safety, and environmental issues associated with freight transportation gateways;
- Allowing private freight rail projects to qualify for TIFIA credit assistance;
- Expanding the availability of tax-exempt private activity bonds to include highway projects and freight transfer facilities; and
- Requiring states to designate a freight transportation coordinator and to integrate intermodal freight transportation needs into the planning and project development processes.

B.3.2 Senate Bill (S.1075)

The Senate-passed reauthorization bill mirrors the President's proposal in many ways. The Senate bill also creates a "Freight Gateways Program" consisting of many of the same set-asides and eligibility changes that were in the President's proposal. However, since the Senate bill contains significantly more overall funding than the President's proposal, the amount of funding generated by these set-asides is much larger in the Senate bill. The Senate bill does differ from the President's proposal in some key respects, such as:

- The Senate bill does not expand the use of the TIFIA program or private-activity bonds for rail or other freight facilities;
- The Senate bill creates a non-governmental, non-profit corporation to issue bonds for certain infrastructure projects, including freight-related infrastructure such as freight corridors, intermodal freight transfer facilities, border crossing facilities, freight rail facilities, and port and airport facilities;
- The Senate bill contains rail-related provisions not found in either of the other two reauthorization bills. The Senate bill would create two new rail-related grant programs, one for improving the tracks of Class II and III railroads and another for relocating rail lines.

B.3.3 House Bill (H.R. 3550)

As originally conceived, the bill put forward by the House Transportation and Infrastructure Committee contained $375 billion for the period 2004-2009 and therefore, could accommodate several new, ambitious programs that would have benefited the freight transportation industry (primarily trucking but to some extent the rail industry as well). However, the version of the bill passed by the House contained less than $300 billion for the six-year period, so these initiatives were trimmed back.

The bill's major freight-related provisions are:

- New funding for improving intermodal connectors, public roads that connect major intermodal facilities to the national highway system,

- New funding to improve the flow of traffic across the borders with Mexico and Canada,

- New funding for "projects of regional and national significance" that will improve the flow of traffic beyond the immediate area of the project (includes freight railroad projects),

- A National Corridor Infrastructure Improvement Program to fund regional and multi-state corridor projects,

- A new pilot program for truck-only lanes, and

- A new requirement that states obligate a certain portion of their highway formula funds for congestion relief activities in urbanized areas of 200,000 people or more.