

The Transportation Challenge

MOVING THE U.S. ECONOMY



Prepared for
National Chamber Foundation

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table of contents

SECTION	TITLE	PAGE NUMBER
1.0	Introduction	4
	Background	4
	Purpose and Structure of Report	6
	The Linkages Between Transportation Investment and Economic Growth	7
2.0	The Economy and Transportation.....	12
	Changing U.S. Economy	12
	Changing U.S. Freight and Logistics Systems	20
	Changing Passenger Transportation Demand	23
3.0	Industries and Transportation	25
	Introduction	25
	Agriculture and Natural Resources Sector	26
	Manufacturing Sector.....	33
	Retail Sector	40
	Services Sector.....	45
	Transportation and Logistics Services Sector	51
4.0	Transportation Systems and Services	57
	Overall Demand for Transportation	57
	How Well Are the U.S. Transportation Systems Performing?	58
	Underinvestment Is Affecting Transportation System Performance	70
5.0	Emerging Transportation Policies and Programs	72
	Surface Transportation Programs up Through SAFETEA-LU	72
	Beyond SAFETEA-LU: Public Policy Choices for the Future	74
6.0	Conclusions and Next Steps	80
	Conclusions	80
	Next Steps	82
A.	Measuring Transportation's Share of GDP, Including Household Transportation Expenditures.....	83
	Summary	83
	Transportation Components of GDP	84
B.	Review of the Literature Assessing the Benefits of Transportation Investment	97
C.	International Transportation Comparisons	103
	Introduction	103
	International Comparisons of Transportation and Logistics Costs	104
	Other Countries Are Catching Up Through Massive Infrastructure Investments	107
	Supporting Information for Transportation and Logistics Costs as a Percentage of GDP	110

List of Tables

TABLE TITLE

PAGE NUMBER

3.1	United States Gross Domestic Product in Agriculture and Natural Resources Industry.....	26
3.2	Employment in Agriculture and Natural Resources Industry.....	27
3.3	Employment in Manufacturing Industry.....	34
3.4	U.S. Gross Domestic Product in Manufacturing Industry	35
3.5	Employment in Retail Industry.....	40
3.6	U.S. Gross Domestic Product in Retail Industry.....	41
3.7	Employment in Services Industry.....	46
3.8	U.S. Gross Domestic Product in Services Industry	47
3.9	Employment in Transportation Industry.....	53
3.10	U.S. Gross Domestic Product in Transportation and Logistics Industry.....	53
4.1	ASCE, "Nation's Infrastructure Report Card, 2005"	59
A.1	Transportation Measures	85
A.2	Transportation Industry GDP: 2003 to 2006 (Billions of 2000 Dollars)	86
A.3	U.S. Gross Domestic Product Attributed to Transportation-Related Final Demand 2002 to 2006 (In Chained 2000 Dollars [Billions]).....	88
A.4	Spending in Average American Households Since 2000.....	91
A.5	Comparison of Spending for Urban, Suburban, and Rural Areas	95
B.1	Rough "First-Cut" Estimate of the Supply Chain Benefit from a 10% Transportation Improvement.....	99
C.1	Top Access Nations.....	107
C.2	Top Infrastructure Projects: Millions of U.S. Dollars.....	108

List of Figures

FIGURE TITLE	PAGE NUMBER
1.1 Linkages Between Transportation Investment and Economic Development.....	7
2.1 GDP Growth Rates for Top 10 Global Economies	14
2.2 Value of U.S. Global Trade Compared to U.S. GDP	14
2.3 Changing Structure of the U.S. Economy: 1950 to 2006	15
2.4 National Emerging Megaregions	17
2.5 Total Logistics Cost: Percentage of Gross Domestic Product	22
3.1 United States Agricultural Trade Balance: 1975 to 2007	28
3.2 Regional Concentration in Agricultural Cultivation	29
3.3 Coal Flows by Water, Rail, and Truck: 2004	29
3.4 Average Freight Railroad Rates: 1981 to 2006.....	30
3.5 Share of World Manufacturing Output: 2006.....	34
3.6 Manufacturing Employment in the United States	35
3.7 Retail Employment Concentrations in the United States	41
3.8 Goods-Producing and Services-Producing Employment Share: 1940 to 2005	46
3.9 Labor Productivity of the For-Hire Transportation Industries: 1993 to 2003	52
3.10 Bureau of Transportation Statistics, Annual Index of Transportation Services: 1990 to 2006	54
4.1 Congestion Growth Trends: 1982 to 2005.....	60
4.2 Anticipated Truck Volumes: 2035	62
4.3 Change in Truck Volumes: 2005 to 2035.....	63
4.4 Estimated Peak Congestion on National Highway System: 2035	64
4.5 Anticipated Train Volumes on Primary Rail Corridors: 2035.....	65
4.6 Change in Trains per Day from 2005 to 2035 by Primary Rail Corridor.....	66
4.7 Future Corridor Volumes Compared to Current Corridor Capacity: 2035 without Improvements.....	67
A.1 Transportation Share of Spending: 2005	90
A.2 Main Transportation Spending Categories.....	91
A.3 Transportation Spending by Number of Earners per Household.....	92
A.4 Percent of Transportation Spending of Total Household Expenditures by Income Group.....	93
A.5 Transportation Spending by Income Group.....	94
A.6 Transportation Spending by Age Group: 2005.....	96
C.1 Transportation and Logistics Costs as a Percentage of GDP for Selected Countries	105
C.2 Comparative Logistics Performance Indicators.....	106
C.3 Transportation Infrastructure Lending Supported by the Multilateral Investment Guarantee Agency	109

1.0 Introduction

1.1 Background

Transportation is a vital part of the nation's economy. Business, consumer, and government spending on transportation represents 10% of gross domestic product (GDP) by most estimates.¹ But if household contributions and other missing components are included, transportation is estimated to be as much as 16% to 18% of the economy.

Substantial population and economic growth is forecast for the coming decades. Over the next 30 years, the U.S. population is projected to grow by 80 million people, from 300 million today to 380 million in 2035. The economy is projected to grow faster, at about 2.8% per year in real terms over this period.² To support this population and economic growth, the demand for freight transportation is projected to nearly double by 2035.³

Recent studies and testimony show that as a nation we are underinvesting in our transportation systems. We are not adequately maintaining the transportation systems we already have, we are not providing sufficient capacity to meet today's demand, and we are not planning and making the improvements required to support a 21st century economy. The American Society of Civil Engineers (ASCE) recently gave the nation's overall transportation network a grade of D and cited the need to invest \$1.6 trillion in upgrades over the next 20 years.⁴ The U.S. Chamber of Commerce's *Future Highway and Public Transportation Finance Study* found that we need to invest an additional \$50 billion a year in our highway and public transportation systems just to maintain their current performance, and more than \$100 billion annually to improve the performance of the highway and transit systems.⁵ Ports need to accommodate a near doubling of cargo volumes by 2020, with some ports facing a tripling or quadrupling of container volumes moving across their piers. ASCE estimated it would require \$125 billion to replace the locks on our aging inland waterway system.

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- 1 Table M-6, *Transportation Statistics Annual Report 2006*. U.S. DOT, BEA Accounts Data, 2005–2006. The statistics cited are for transportation final demand. Additional measures illustrating the relationship between transportation and GDP are presented in Appendix A.
 - 2 *Future Options for the National System of Interstate and Defense Highways*. NCHRP 20-24(52), Transportation Research Board, 2007, based on forecasts prepared by Global Insight, Inc.
 - 3 AASHTO, *Freight Transportation Bottom Line Reports*. Cambridge Systematics, Inc., based on forecasts prepared by Global Insight, Inc.
 - 4 American Society of Civil Engineers, *Infrastructure Report Card*, 2005.
 - 5 U.S. Chamber of Commerce, *Future Highway and Public Transportation Finance Study*. Prepared for the National Chamber Foundation, Washington, D.C., by Cambridge Systematics, Inc., 2005.

The Association of American Railroads (AAR) estimates that an investment of \$148 billion is needed just to keep pace with economic growth and ensure that the freight railroads can carry the volume of freight forecast for 2035.⁶ Projections developed by the U.S. Department of Transportation (DOT) indicate that as early as 2013, 16 airports and seven metropolitan areas will need additional capacity to meet the expected demand for air travel. The Federal Aviation Administration (FAA) estimates that \$41 billion of Airport Improvement Program (AIP)-eligible infrastructure development will be needed in the next five years. The Airport Council International/North America projects that during this same period, more than \$87 billion will be needed for aviation infrastructure, including projects not eligible for AIP support. In addition, \$15 billion to \$22 billion will be needed over the next 15 years for the NexGen air traffic control system.⁷

Underinvestment in transportation systems is costing us time and money. The Texas Transportation Institute (TTI) recently reported that congestion forced Americans to travel an extra 4.2 billion hours and purchase an extra 2.9 billion gallons of fuel for an annual congestion cost of \$78 billion in 2005.⁸ The Federal Highway Administration (FHWA) calculated that delays caused by highway bottlenecks cost freight trucks alone more than \$8 billion a year. These costs are ticking upward as the price of oil increases. The cost of delays to each individual car, truck, rail, ship, and air movement is modest, but the cumulative effect is large. Delays make commuter trips, business travel, and industry supply chains less cost-effective, and drive up the cost of doing business and the cost of living in the United States.

We need to reexamine our transportation investment policies and programs. We must ensure that our transportation policies and programs serve our economic, social, and environmental goals. As noted in the recent Center for Strategic International Studies' report, "It is time to reexamine priorities for the nation's infrastructure."

America's economic growth was built on one of the most integrated and efficient infrastructure systems in the world—from canals to railroads to highways. But our national leaders have rested on these accomplishments rather than extending them... One sign of this is that Federal infrastructure spending as a percent of GDP dropped in half between 1980 and 1997... It is time to reexamine priorities for the nation's infrastructure. America's economic well-being and physical security depend on safe and reliable public infrastructure. Roads, airports, railways, ports, and other public investments are instrumental in boosting America's productivity and global economic competitiveness.

Source: Center for Strategic International Studies, PUBLIC WORKS, PUBLIC WEALTH: New Directions for America's Infrastructure, November 2005.

6 Cambridge Systematics, Inc., *National Rail Freight Infrastructure Capacity and Investment Study*. Prepared for the Association of American Railroads, September 2007.

7 United Parcel Service, *Getting America Moving Again*, December 2007.

8 David Schrank and Tim Lomax, *The 2007 Urban Mobility Report*. Texas Transportation Institute, September 2007, available at <http://mobility.tamu.edu>.

What is at stake is simple and stark, as Thomas Donohue, president of the U.S. Chamber of Commerce, pointed out when he launched the Chamber's *Let's Rebuild America Initiative*:

Decades ago we built the best infrastructure system the world has ever known and then proceeded to take it for granted.

Our global competitors are building and rebuilding while America is standing still. China, India, and the developing world are building at a staggering pace. China spends 9 percent of its GDP on infrastructure; India, 5 percent and rising. While they start well behind us, they are catching up fast!

What's at stake is simple and stark. If we fail, we will lose jobs and industries to other nations. If we fail, we will pollute our air and destroy the free, mobile way of life we cherish. If we fail, we will see more senseless deaths across our bridges, on our roads, and, yes, in the skies above our cities.

And so, we must not fail. We must embrace a bold vision for the future and start building on it today.

We cannot treat infrastructure like other problems or programs where you can wait until the very last minute...and then write a big check. Infrastructure projects require foresight and years of careful planning. It shouldn't take a disaster like the bridge collapse to focus the nation's attention on our vast infrastructure challenges. But now that we have that focus, we must not lose it.

Source: Thomas Donohue, U.S. Chamber of Commerce, Let's Rebuild America Initiative, remarks, August 10, 2007.

1.2 Purpose and Structure of Report

Transportation plays a critical role in the nation's economy. This report examines the relationships between transportation investment and long-term economic productivity, growth, and competitiveness. Section 1.3 begins with a brief summary of the literature addressing the effects on the economy resulting from investments in transportation infrastructure. Following that,

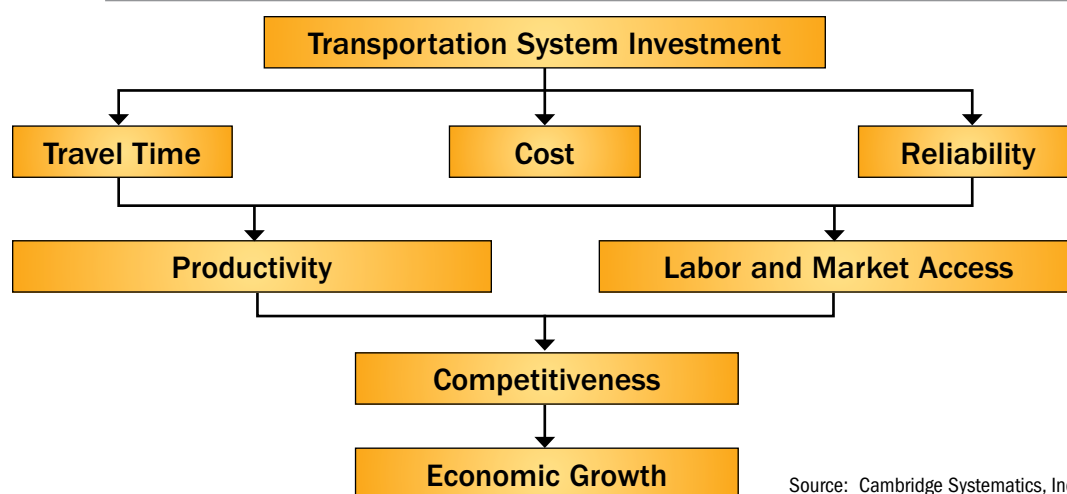
- **Section 2.0: The Economy and Transportation** examines the changing structure of the U.S. and global economies. The U.S. economy is rapidly becoming a services- and knowledge-based economy supported by a large and increasingly automated manufacturing sector. Much of the developed and developing world also is moving in this direction. These structural changes in the U.S. and global economy are changing the demand for transportation.
- **Section 3.0: Industries and Transportation** explores changes in four major sectors of the U.S. economy—manufacturing, retail, services, and agriculture and natural resources—looking at how they use transportation today and how the nation's transportation systems are helping and hindering them. It also examines the transportation industry itself.
- **Section 4.0: Transportation Systems and Services** reports on the performance of the nation's transportation systems—the condition and performance of the highway, public transit, rail, port, and waterway systems that serve international trade, national production and distribution, urban commuting, and business and recreational travel.

- **Section 5.0: Emerging Transportation Policies and Programs** reviews the emerging transportation visions and proposals for new federal surface transportation programs.
- **Section 6.0: Conclusions and Next Steps** presents the conclusions of the study with recommendations for next steps by the U.S. Chamber of Commerce.

1.3 The Linkages Between Transportation Investment and Economic Growth

The linkages between transportation investment and economic growth are illustrated in Figure 1.1. Similar to land, labor, technology, and capital, transportation is a key input to production and economic activity. Investment in transportation—whether to increase capacity or to improve service—reduces travel time, lowers trip cost, and improves travel-time reliability. For individuals as well as for businesses, these improvements translate into greater productivity and better access to labor and markets, making industries more competitive and enabling economic growth.

Figure 1.1 Linkages Between Transportation Investment and Economic Development



Source: Cambridge Systematics, Inc.

Numerous domestic and international studies, summarized in Appendix B, have looked at the relationship between public infrastructure investment and GDP growth. According to a recent British study, these studies indicate that, on average, a 10% increase in public infrastructure capital stock increases GDP by around 2%.⁹

THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

Numerous domestic and international studies demonstrate that transportation investments have significant measurable benefits to national and regional economies. Public investments in regionally and nationally significant transportation projects offer rates of return equal to or exceeding private rates of return. The studies also report that we are underestimating the industry logistics and trade benefits of these investments because of the difficulty of measuring them.

The types of benefits related to transportation investments are detailed in a publication released by the Transportation Research Board in 2002.¹⁰ Benefits were grouped into eight broad categories:

1. Transportation investment boosts industry competitiveness and productivity.

A strong transport network reduces costs of production and distribution. It does so by lowering barriers to mobility; giving the manufacturing, retail, and services sectors access to varied, specialized, and productive sources of labor; providing a diverse selection of inventory and raw materials; and ensuring a broad customer base, both at home and abroad.

The nation's infrastructure plays a vital role in its economy. Vigorous commerce and the daily activities of the nation require reliable means of transporting merchandise from producers to consumers and of conveying passengers to their destinations.

Source: Congressional Budget Office, Trends in Public Spending on Transportation and Water Infrastructure, 1956 to 2004, August 2007.

2. Transportation investment enhances household well-being. A strong transport network gives households access to a broader range of higher-paying jobs, a wider selection of competitively priced consumer goods and housing options, and a convenient selection of health and human services. Well-maintained roads can reduce personal vehicle repair costs, while efficient public transport networks reduce costs associated with driving and automobile ownership.

3. Transportation investment strengthens local, regional, and state economies.

The benefits of transportation investment are not limited to the microeconomic level—that is, the level of firms and households. Transportation spending benefits local, regional, and state economies as well by energizing city centers, breaking the isolation of rural areas, and boosting employment.

4. Transportation investment boosts state tax revenues. The additional economic activity brought on by highway investment can generate additional tax collections for a region. Transportation investment reduces the cost of production and distribution for businesses, allowing them to expand and hire additional workers. This additional

10 Cambridge Systematics, Inc., *The Benefits of Transportation Investment: Economic, Environmental, Community and Social, Congestion Reduction*. Prepared for the National Cooperative Highway Research Program (NCHRP) Transportation Research Board, Washington, D.C., 2002.

activity increases federal, state, and local revenue from personal income, sales, motor fuel, and corporate/business taxes.

5. **Transportation investment facilitates business and leisure travel.** Both business and leisure travelers depend on transportation infrastructure for access to activities and destinations such as conferences, trade shows, parks, shoreline resorts, and everyday business meetings and social events.
6. **Transportation investment reduces economic losses associated with accidents.** Each year, traffic accidents create significant costs in lost productivity, property damage, and medical expenses in the United States. Investments to improve the safety of the nation's transportation infrastructure can mitigate these losses.
7. **Transportation investment reduces economic losses associated with congestion.** The costs of time delays and fuel consumption associated with congestion in the nation's largest urban areas reached \$78 billion in 2005. Investments that reduce traffic delays benefit businesses and households alike.
8. **Transportation investment creates jobs.** Nearly 18 million people are employed in for-hire transportation and transportation-related industries in the United States—13.5% of total U.S. employment.

The most notable empirical research on the relationship between investment in highways and industry economic growth rates was done by Professor Ishaq Nadiri of New York University for the FHWA. Dr. Nadiri showed that each dollar invested in the nation's highways generated about 30 cents of production cost savings to businesses per year over the life of the improvement, generally exceeding the initial investment in four years.¹¹ Highway investments were estimated to have contributed an average of 25% of total productivity growth nationwide during the Interstate era. The average annual rate of return for highway investments was estimated at 16% nationwide, although returns were lower in later years as the network matured.

The performance of the UK's transport networks will be a crucial enabler of sustained productivity and competitiveness...The case for targeted transport intervention is compelling, even after taking account of environmental effects. Interventions targeted on the worst problems and bottlenecks caused by competing demands on the transport system, such as surface access links and corridors close to major urban areas, are likely to offer some of the highest returns...Even in a world with carbon pricing and widespread congestion-targeted road pricing there seems to be a good case for more transport infrastructure.

Source: The Eddington Transport Study: Main Report: Transport's Role in Sustaining the UK's Productivity and Competitiveness, December 2006.

11 Ishaq Nadiri and Theofanis Mamuneas, *Contribution of Highway Capital to Industry and National Productivity Growth*. U.S. Department of Transportation, Federal Highway Administration Office of Policy Development, Washington, D.C., 1998.

THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

In a review for the United Kingdom government, Sir Rod Eddington found that “a five percent reduction in travel time for all business travel on the roads could generate around 2.5 billion pounds of cost savings—some 0.2 percent of GDP.”¹² The Eddington report also highlighted positive economic effects that are not captured by most project cost-benefit assessments, such as impacts on business location decisions. For some regionally significant projects, the Eddington report estimated that between 30% and 50% of economic benefits are not accounted in current benefit analyses.¹³ The research also stressed the importance of transportation networks and corridors to the productivity and success of metropolitan areas, in particular in providing access to larger labor and product markets. Finally, it highlighted that transportation improvements are critical to trade flows and the competitiveness of a country's exports and imports.

It is estimated that passenger and freight border delays in the Imperial Valley of southern California caused economic output losses of more than \$7 billion for Mexico and the U.S. combined in 2007.

Source: San Diego Association of Governments.

In related international research, Rene Prud'homme and C. W. Lee described the link between transportation performance and the economies of metropolitan areas. Increasing transportation speeds in a city by 10% increases productivity by 2.9%.¹⁴ Further, the study found that a 10% increase in travel speed leads to a 15% to 18% increase in the labor market size, benefiting both workers and regional economies.

Numerous studies have been conducted of the economic impacts of transportation investments on specific states and regions. One of the most comprehensive studies addressed the transportation needs of the Portland, Oregon, metropolitan area, and found that without adequate investment in infrastructure, the regional economy could lose 6,500 jobs and \$844 million in output annually by 2025.¹⁵ In addition, the study reported how industries have been negatively impacted by worsening travel conditions:

- Intel changed its chip shipment schedule in order to avoid peak-period congestion.
- Sysco Food opened a new regional food distribution center because the old central facility in Portland could not serve the entire area in a timely manner.
- OrePac increased inventory levels by 7% to 8% to compensate for congestion delays.
- Other companies are planning to either adopt different delivery schedules or acquire new warehousing facilities in order to offset the cost of delays on congested highways.

12 The Eddington Transport Study: The case for action: Sir Rod Eddington's Advice to Government, Prepared for HM Department of the Treasury, U.K., December 2006. <http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/>.

13 Ibid.

14 Prud'homme, R. and Lee, C-W., *Size, Sprawl, Speed, and the Efficiency of Cities*, November 1998.

15 Economic Development Research Group, *The Cost of Congestion to the Economy of the Portland Region*, December 2005.

Sound infrastructure forms the backbone that is critical to maintaining and enhancing regional economic growth, competitiveness, productivity, and quality of life. For businesses, infrastructure has the greatest influence on location after tax rates, the availability of an educated workforce, and low crime. Where time is money, moving people to and from jobs, facilitating deliveries and shipments, freedom from business interruptions like loss of power, and ample telecommunications capacity all enter the equation. Prime access to ports and airports along global pathways becomes more essential for expanding enterprise and profits. Congestion and transport bottlenecks, meanwhile, can threaten regional sustainability.

Source: Urban Land Institute, *Infrastructure: A Global Perspective*, 2007.

These delays impact the cost structure of businesses, and ultimately prices, for consumers.

As highlighted in the Portland study and similar international work, an important function of good transportation is expanding the effective size of a metropolitan region's labor market. Good access to workers is correlated with improved labor and business productivity. Studies in Philadelphia, Chicago, and New York have shown that investments in transit provide a return as high as six to one for overall regional economies. The recent TTI State of Congestion report highlighted the importance of public transportation improvements, particularly in congested corridors and in serving major activity centers during times of the day when there are no viable options to increase the capacity of the street and highway system for single-occupant vehicle travel. TTI concluded that if there had been no public transportation service and travelers used their cars instead, in 2005 there would have been an additional 493 million hours of delay and \$9 billion in costs due to congestion in the regions with more than one million population.¹⁶

2.0 The Economy and Transportation

For the past four centuries, transportation has been a key factor in the growth and competitiveness of the U.S. economy. East Coast ports and harbors provided links between the Colonies, Europe, and the West Indies for flows of trade, immigrants, and capital. The Mississippi River and Great Lakes waterway systems connected the Midwest and Great Plains to the rest of the nation and world, creating America's Breadbasket and later the Rust Belt. The transcontinental railway system enabled flows of freight and people between the East and West Coasts. In the 20th century, the nation invested in a national Interstate network of highways to link communities and enable national defense, creating unprecedented mobility for both people and freight. Major cities invested in subways and elevated rail and commuter rail to underpin development, economic growth, and quality of life for their citizens. Long-distance air travel became common for both business and personal travelers, and also enabled overnight delivery of high-value, low-weight packages. And the containerization of cargo and dramatic increases in the size of ships revolutionized how trade moves around the globe, helping accelerate the integration of the United States into the global economy.

As the U.S. economy has shifted from rural to urban, from agrarian to industrial, and from "Frostbelt" to "Sunbelt," the nation's transportation system has responded. Transportation investments have shifted from ports and waterways to rail lines, to highways, and to airports. The U.S. transportation system today is one of the most extensive in the world, providing a level of mobility that would have been unthinkable two generations ago. Looking to the future, can this transportation system adapt yet again to meet the needs of an evolving and increasingly complex 21st century global economy?

2.1 Changing U.S. Economy

The U.S. economy is experiencing a fundamental transformation, resulting from a confluence of several trends:

- Markets are shifting from local and regional to national and global, with U.S. companies achieving a larger share of sales from export markets and developing a growing reliance on other countries for raw materials, lower-value manufactured goods, and some services.
- The drivers of U.S. economic growth are shifting from manufacturing to services, information, and innovation. The economy is less dependent on natural resources and production and more dependent on technology, knowledge, and creativity.

- The location of U.S. economic growth is continuing to shift from the Northeast and Midwest to the South and West, and from rural areas to urban areas, which are linked together economically into massive “megaregions.”
- The U.S. population and workforce are becoming older and more diverse.

U.S. and Global Economic Growth

Transportation demand is strongly correlated with economic growth. The U.S. economy has seen tremendous growth as measured by GDP over the last three decades, growing from a \$2.7 trillion economy in 1980 to a \$13.2 trillion economy in 2006. Throughout this period, the United States has maintained its role as an economic catalyst for the world, consistently accounting for more than one-fifth of the global economy and outpacing other industrialized nations.

Even as the mature U.S. economy continues to grow robustly (nearly doubling in size over the next 25 years), other countries, particularly developing parts of Asia, are now seeing their economies expand more quickly and offering formidable competition to the United States. Figure 2.1 ranks the top 10 world economies by the projected size of their real GDP for each decade between 2000 and 2050. China, which had the seventh-largest economy in 2000, is projected to be the second-largest economy by 2020, eventually overtaking the United States to become the largest economy in the world by 2050.

A More Global Economy

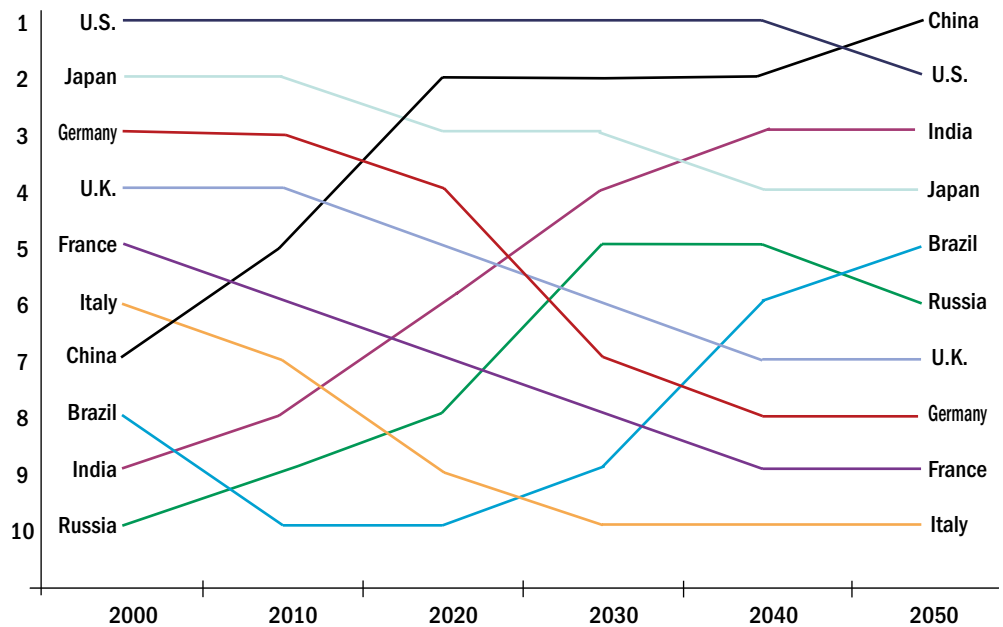
Historically, the U.S. economy has not been heavily dependent upon international trade. Between the 1860s and the 1960s, the value of international trade (most of it through Atlantic Coast seaports) grew slowly, accounting for a relatively small portion of U.S. economic activity. Exports and imports each represented less than 10% of the U.S. economy. By 1997, the combined value of imports and exports (including trade in both merchandise and services) was equivalent to 23% of the U.S. real GDP (i.e., GDP adjusted for inflation). This value increased to 28% in 2006.

The rapid increase in trade value and volume is expected to continue, with trade growing faster than the economy as a whole. Figure 2.2 compares the value of imports and exports to the real GDP from 1997 through 2030. The value of imports and exports is forecast to be equivalent to 37% of GDP in 2015, and to be equivalent to 60% of GDP by 2030.¹⁷ This will intensify the flow of imports and exports moving through the U.S. international trade gateways. And as global economic growth increasingly shifts to Asia (especially China and India) and Latin America (especially Brazil), the United States’ key trading partners will shift in importance as well. This will alter the volume of freight moving through individual gateways and along domestic highway, rail, and inland waterway trade corridors.

17 The value of U.S. imports and exports is compared to GDP to provide a sense of the scale of import and export activity, but they are different measures. Trade is measured by the total value of import and export sales; GDP is measured by the value added to the output of the economy.

Figure 2.1 GDP Growth Rates for Top 10 Global Economies

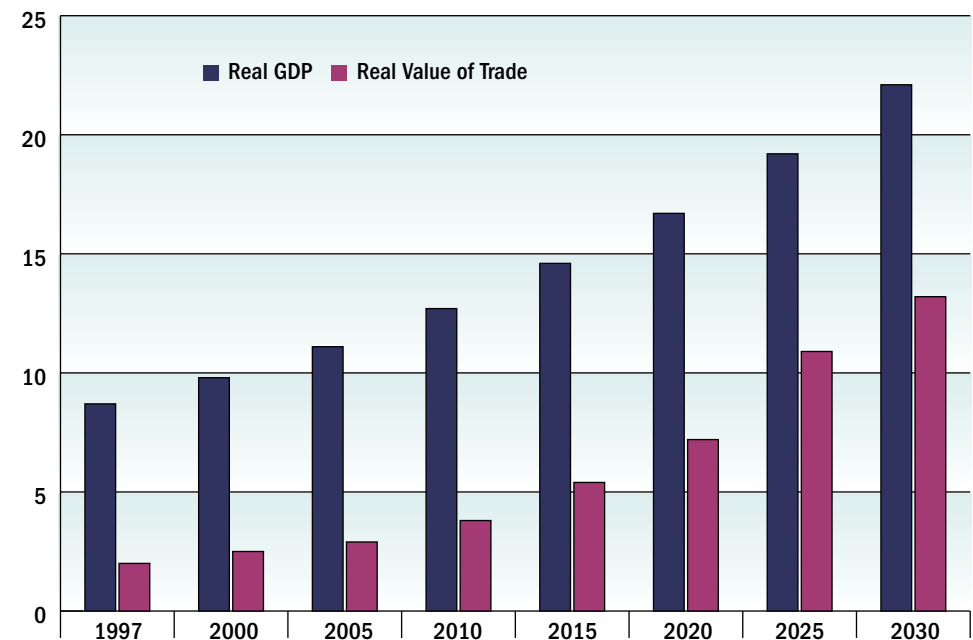
Country GDP Rank Based on Billions of Real (2003) U.S. Dollars



Source: Global Insight, Inc.

Figure 2.2 Value of U.S. Global Trade Compared to U.S. GDP

In trillions of 2000 dollars

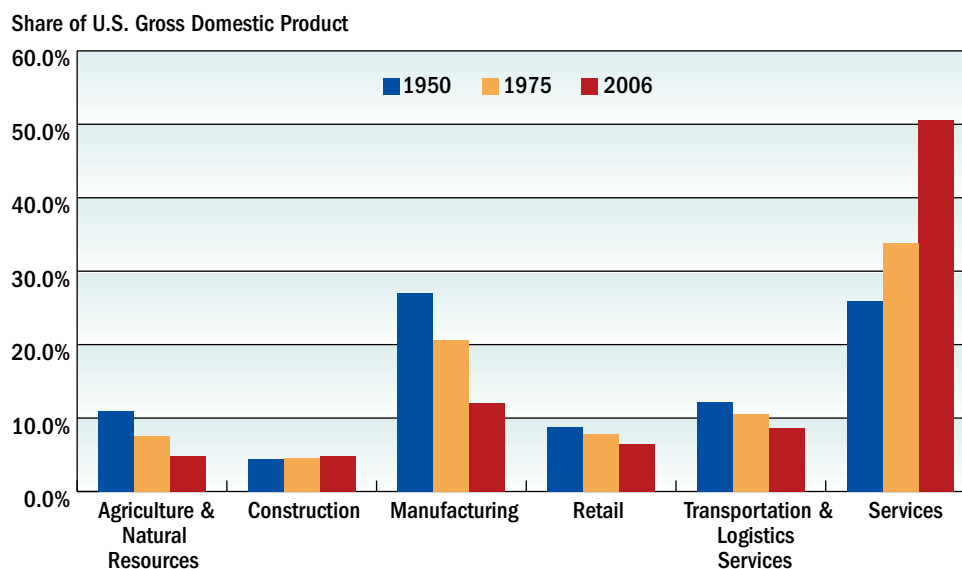


Source: Global Insight, Inc.

A More Diverse Economy

The United States is at the forefront of a structural economic shift in the role and importance of service industries. While manufacturing, agriculture, and mining remain crucial elements of the nation's economy and have played pivotal roles in its development, the United States' rapid economic growth over the past decades has been fueled by the services industries (including finance, communications, healthcare, hospitality, and professional and business services). The impact of the transformation has been massive. Figure 2.3 shows the shift in the major U.S. industry sectors' contribution to GDP between 1950 and 2006. By 2006, services accounted for more than one-half of the U.S. economy, up from 25% in 1950. Over the same period, agriculture and manufacturing's share of U.S. production fell dramatically. However, when analyzing manufacturing's employment decline, it is important to remember that many services formerly contained in-house, such as human resources, payroll, engineering, design, marketing, and finance, have been outsourced by many manufacturers—a trend that has reduced employment in manufacturing industries and added employment to service industries.

Figure 2.3 Changing Structure of the U.S. Economy
1950 to 2006



Source: Cambridge Systematics Collation, data from Bureau of Economic Analysis (BEA), Gross Domestic Product by Industry, November 2005, and BEA interactive tables (data for 2006)

The news media have tracked the shift to services and the loss of manufacturing employment, but amid this transformation, the United States still remains the world's largest manufacturing country, accounting for about one-quarter of global production.¹⁸

The United States has maintained its position as a major manufacturing center by investing in automation to keep manufacturers competitive, and in transportation to reach national and global suppliers and markets cost-effectively. New technology, better transportation, and more ubiquitous information are supporting a revolution in production and distribution processes that is enabling the U.S. economy to be one of the most productive in the world. In 2006, the United States maintained its historic position as the most productive among major industrialized nations.¹⁹

The United States also maintains its traditional position as a crucial supplier of food, and is the globe's top producer of grain, oilseeds, meat, and poultry, among many other key commodities—again, by making best use of national and global transportation systems. Additionally, the United States continues to be one of the world's largest producers of oil, natural gas, and coal, although the country's energy production largely stays within the United States today to meet domestic needs. Energy will be an area of emerging policy concern to the United States, and transportation will be a key factor in providing access to alternate sources. The expansion of ethanol production in the Corn Belt is one example.

A More Urban Economy

The location of U.S. economic growth is continuing its decades-long shift from rural to urban areas, and from the Northern and Midwest states to the South and West, paralleling the growth and location of the nation's population. In 2007, the United States reached a population of 300 million residents. Federal projections are that the country will add another 80 million residents by 2035, with almost 90% of this growth expected to take place in the South and West.²⁰

The United States also is becoming an increasingly urban nation. By 2030, it is expected that 90% of the U.S. population will be living in metropolitan areas. The 100 largest metropolitan regions in the United States account for just 12% of the land area but contain 65% of the population, 69% of all jobs, and 70% of the nation's GDP.²¹ The largest 100 metropolitan areas also serve the majority of our transportation activity, handling 72% of all foreign seaport tonnage, 79% of all U.S. air cargo tonnage, 92% of all air passenger boardings, and 95% of all public transit passenger miles traveled.²²

The primary trend over the past few decades has been for urban areas to grow out rather than up—that is, to add people and jobs at the fringes of existing development in suburban locations. The Brookings Institution reports that between 1982 and 1997,

19 U.S. Department of Labor, Bureau of Labor Statistics, Real Gross Domestic Product per Employed Person.

20 U.S. Census Bureau, Interim Projections. Released April 2005.

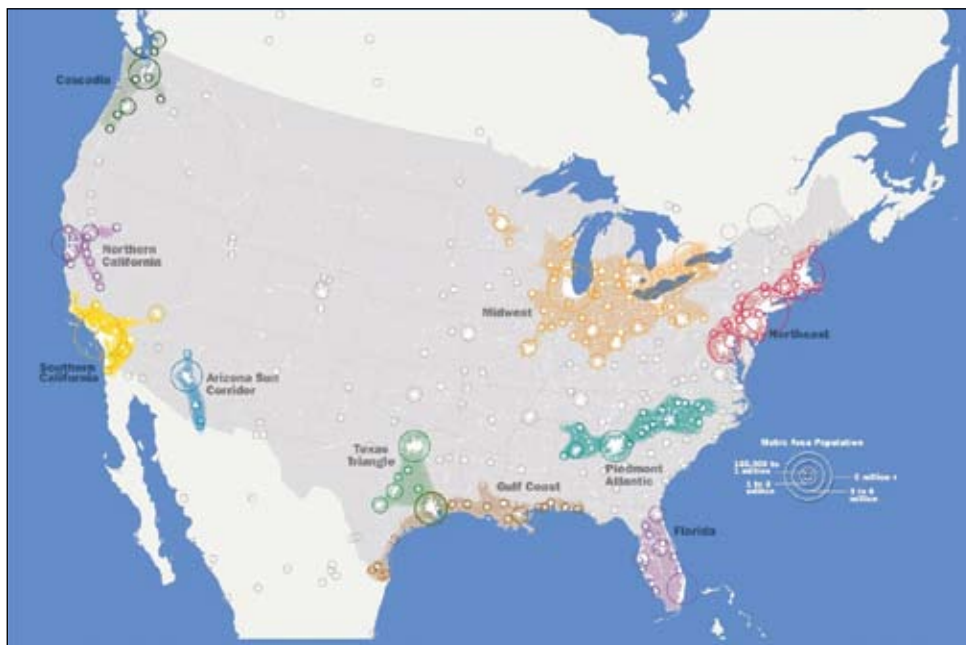
21 *U.S. Metro Economies, Gross Metropolitan Product with Housing Update*. Prepared for the United States Conference of Mayors and The Council for the New American City by Global Insight in January 2007.

22 *MetroNation: How U.S. Metropolitan Areas Fuel American Prosperity*. The Brookings Institution, Metropolitan Policy Program, 2007.

most metropolitan areas added urbanized land at a much faster rate than they added population. Older, bedroom-suburb communities are becoming centers for jobs, pushing housing, retail, and distribution even further out from the central city. Over the next few decades, the tension between high costs of housing in urban centers and pressure to reduce sprawl and its negative environmental and energy impacts will tend to focus urban growth in two locations—far-flung “exurbs” on the outer fringes of urban areas, and infill and revitalization of urban cores.

At the same time, urban areas increasingly are becoming integrated into a series of megaregions that span traditional jurisdictional boundaries. These megaregions are characterized by clusters of interrelated businesses that share common labor pools and customer markets; they are knit together by high volumes of commuting trips, business travel, and freight shipments. Recent national studies have suggested that between eight and 12 megaregions will be the focus of U.S. economic growth in the 21st century. As shown in Figure 2.4, these include more mature regions such as the nearly unending stretch of urban development from Boston to Washington, D.C., as well as emerging regions such as the Piedmont area from Raleigh-Durham, North Carolina, through Atlanta and into northern Alabama.²³

Figure 2.4 National Emerging Megaregions



Source: Regional Plan Association.

Metropolitan areas also tend to specialize in certain goods and service sectors. For example, the Seattle, Los Angeles, Dallas, and Hartford metro areas specialize in aerospace, and together account for 41% of national output in that industry. Another example, finance, tilts enormously toward the New York metro region, which includes nearly 43% of national output in that industry.²⁴

U.S. cities and regions increasingly compete with cities and regions around the world. A recent study classified cities worldwide into five groups based on their relative role in the global economy.²⁵ The authors ranked New York City and London as the world's most global cities, followed by a first bands of 21 world cities that includes Chicago, Los Angeles, and San Francisco. The next two bands include regionally significant cities such as Atlanta, Boston, Washington, and Miami. The final two bands include less integrated cities such as Baltimore. The authors concluded that there appears to be a gap in the globalization of U.S. cities, and that many U.S. cities compete in a very large continental market but have not "gone global" to the extent of other world regions. Obviously, New York, as a truly world city, and Miami, with its link to Latin America, share significant linkages outside the continental United States, but overall, U.S. cities appear to have fewer global linkages than comparably sized metropolitan competitors. Global transportation connectivity will play a key role in helping transition more U.S. cities into this type of global competitive environment.

Spending is not targeted to achieve certain outcomes. Instead of focusing on how much money it should spend, Washington should focus instead on how that money will be spent and how that spending affects our nation and its metropolitan areas. Unlike many other nations in Western Europe and parts of Asia, the U.S. is continuing to grow. Most of this growth will be accommodated in the nation's 50 largest metropolitan areas. Yet funds are not targeted to these growing and complex places. Rather, the federal government takes an almost agnostic approach to where funds are spent and as a result analysis shows a disproportionate amount of investment is happening away from the places that matter most to the prosperity of the nation. The emphasis is on consensus building through logrolling where funds are distributed broadly and thinly rather than on fixing national problems.

Source: Brookings Institution; Testimony to House Committee on the Budget, October 25, 2007.

24 *MetroNation: How U.S. Metropolitan Areas Fuel American Prosperity*. The Brookings Institution, Metropolitan Policy Program, 2007.

25 Hierarchical Tendencies and Regional Patterns in the World City Network: A Global Urban Analysis of 234 Cities, *Research Bulletin 88*; Derudder, Taylor, Witlox, and Catalano, 2003.

A More Diverse and Aging Workforce

Demographic changes will reshape the U.S. workforce and consumer market, with important implications for transportation:

- It will be a sellers' market for workers because of the decline in the number of people of working age. Between 2000 and 2030, the number of Americans over the age of 65 will double, while the working-age population will increase by only 18%. Employers will go where skilled employees are or want to be, creating opportunities for regions with attractive climates as well as rich educational and cultural resources. This trend will keep some Northern cities competitive in the face of the overall shift in population to the South and West.
- Employers will be more flexible regarding scheduling for hours and days of work in order to attract and retain workers.
- The U.S. labor force will become more racially and ethnically diverse, and the attachment of minorities to the center city will likely be broken.
- Both center cities and suburbs will move toward greater balance in jobs and workers (i.e., fewer jobs per worker in cities; more jobs per worker in suburbs), but this will not change the need to commute because of persisting differences in the mix of skills. Greater specialization in the labor force means that workers will need to be drawn from larger worker pools over greater distances.
- Multiworker households, frequent job changes, housing preferences, and the general friction of changes in residence are likely to generate longer work trips.

In the future, it is anticipated that workers will be able to live where they want and work where they want, but they will have to accept the penalties associated with longer commutes. One major indicator of this pattern is the increase in the number of commuters leaving their residence counties to work. In 1990, fewer than 24% of workers left their home counties to work elsewhere. This share increased to 27% in 2000 and 28% in 2005. This share will continue to expand, with substantial shares of the population crossing both metropolitan and rural areas to reach their job sites. This trend will affect not only commuting but also other travel purposes. As medical services and recreation activities become more specialized, their market sheds also expand, and the average trip lengths to these attractions increase. Commuting and other interactions between rural and metropolitan fringe areas will expand in importance.

2.2 Changing U.S. Freight and Logistics Systems

The structural changes in the U.S. and global economies and in trade patterns have forced changes in transportation and logistics systems, but they have been accelerated by changes in transportation technology and practices.

The time required to transport freight over long distances has decreased from months to hours since the mid-1800s. Transportation costs have dropped dramatically, particularly over the last 30 years, and travel-time reliability has improved. The local truck that delivers goods to a neighborhood store is often the last link in a supply chain that spans half the world, with the final retail price of those goods reflecting 10,000 miles of hard-gained freight transportation efficiencies within that chain. This has enabled shippers to buy more transportation and develop longer and more cost-effective supply chains. The following are among the major factors reducing the cost and improving the reliability of the transportation system:

- Economic deregulation and the subsequent restructuring of the freight transportation industry in the 1980s, which triggered strong competition and lower shipping prices;
- Increased public sector investment in the Interstate Highway System through the 1970s, 1980s, and early 1990s, which reduced travel time and improved trip reliability for motor carriers; and
- Adoption of new technologies (e.g., intermodal freight containers, computers and related information technologies, bar coding, radio frequency identification tags, and satellite communications) by shippers and carriers, which significantly improved the productivity and reliability of freight operations.²⁶

Shippers have taken advantage of the lower transportation costs to buy more frequent and reliable long-distance and intermodal freight transportation. These changes have hastened a broad shift in business logistics practices, from manufacture-to-supply or inventory-based “push” supply chains to manufacture-to-order or replenishment-based “pull” supply chains.

Thirty years ago, most businesses operated push supply chains. Suppliers delivered materials to a manufacturer, who pushed products to a distributor or retailer and then to the customer. Each business maintained a large and expensive inventory of critical materials and products to protect against stockouts.

Today, most businesses are moving toward pull or on-demand supply chains, replenishing whatever the customer consumes as soon as it is sold. To ensure that inventory is available, businesses are tracking customer purchases as they occur, reducing inventory, centralizing it at fewer locations, and managing in-transit inventory closely. Industries that once held large inventories of products and could tolerate delays in shipment and receipt of goods are now demanding greater reliability and visibility from their freight carriers.

26 Other contributing factors have been the growth of services, which generate less demand for freight service, and lower interest rates, which reduce inventory carrying costs.

Eliminating inventory and replenishing everything right away results in smaller shipment sizes (since units are consumed one by one) and more individual products per shipment (to make lot sizes economical to ship). This has increased the importance of transportation over warehousing and favored the use of faster and more reliable trucking and air shipments over rail and bulk shipments.

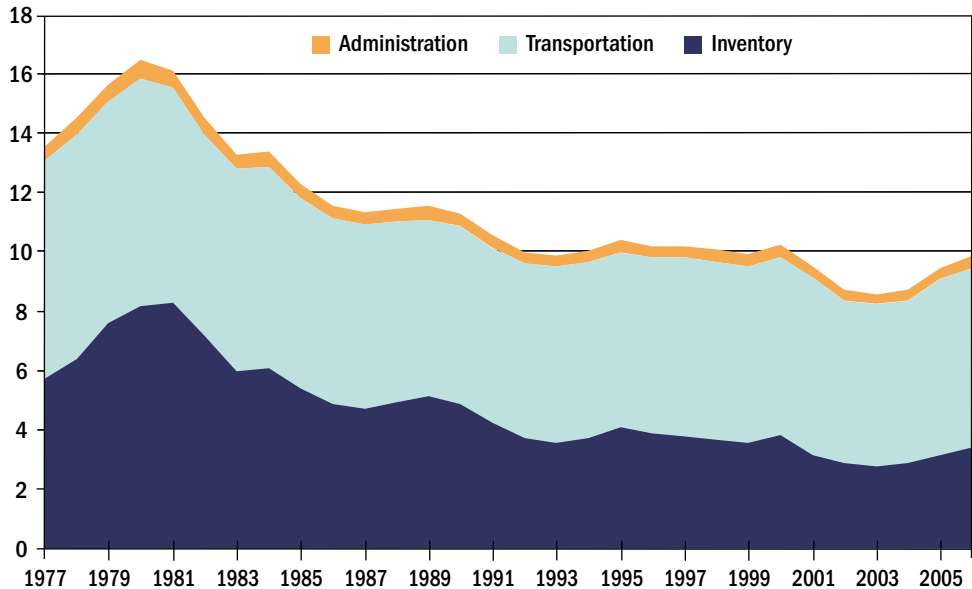
On-demand supply chains are very effective. Inventory turns, a common measure of the speed with which material moves through a company's supply chain, increased from an average of eight turns per year in 1995 to an average of 21 in 2005. Lean, on-demand supply chains are important to consumers as well as businesses. They result in lower-cost items, which means that households can get more product for the same amount of money.

But on-demand supply chains also pressure shippers and receivers to make more "just-in-time" (JIT) shipments with fewer products in each box. This puts shippers closer to the edge when the freight transportation system fails. Small failures—a missed connection, a garbled order, a truck breakdown, or more intensive security inspections—can affect dozens of shippers, carriers, and customers. A large failure—a labor action that shuts down the West Coast ports, a hurricane that closes the Gulf, or a terrorist attack—can quickly disrupt thousands of supply chains, undermining the operations and profitability of many shippers, carriers, and customers. In a world of tightly strung supply chains, freight transportation capacity, reliable performance, and some redundancy are critically important.

The tightening of system capacity across all modes of freight transportation has contributed to the first notable increase in total logistics cost in more than 25 years. Total logistics cost is the cost of managing, moving, and storing goods. Figure 2.5 shows the total logistics cost as a percentage of the U.S. GDP.

Figure 2.5 Total Logistics Cost

Percentage of U.S. Gross Domestic Product



Source: *State of Logistics Report*, Council of Supply Chain Management Professionals, 2006.

Logistics costs rose through the 1970s to a high of about 16% of GDP in 1980, reflecting rising fuel prices, increasing interest rates, and deteriorating productivity across the freight transportation system. Renewed investment in highways, economic deregulation of the freight transportation industry in the early 1980s, adoption of new technologies, and lower interest rates drove down the costs of truck, rail, air, and water freight transportation. The total logistics cost declined through the 1980s and 1990s to a low of about 8.6% of GDP in 2003. Businesses and consumers benefited because lower transportation costs resulted in lower-cost goods and better access to global markets.

But the total logistics cost is rising again. In 2006, the total logistics cost was 9.9% of GDP.²⁷ The change reflects recent increases in fuel prices and increases in congestion on the nation's highways and rail lines and at its international trade gateways and ports.

Deteriorating transportation reliability may have accounted for one-third of the increase in inventory carrying costs between 2005 and 2006.²⁸ Freight shippers and carriers are worried that the productivity of the nation's freight systems may continue to drop and that logistics costs may rise further, undermining future domestic economic productivity, international competitiveness, and economic growth.

²⁷ Rosalyn A. Wilson, *State of Logistics Report*. Council of Supply Chain Management Professionals, 2006 and 2007.

²⁸ Boston Logistics Group estimates.

China competes as a nation. Under current economic growth projections in the U.S. and China, trade flows to the United States from China will continue to grow. China is building the infrastructure to handle them, but there are important questions as to whether the U.S. transportation system is ready. With a limited number of ports of entry, the U.S. transportation system necessarily concentrates these imports at a few strategic locations. If the United States wants to stay competitive globally, investment in transportation infrastructure is needed, new system management technologies should be applied, and institutional change in how we identify, fund, operate and make key infrastructure improvements to key elements of the transportation system should be considered. These improvements help not only to expedite the movement of imported goods, but to reduce the logistics cost of U.S. companies to compete in the global market.

Source: FHWA, International Scan on Freight Mobility and Intermodal Connectivity in China: Trip Summary, December 2007.

The rise in total logistics cost also is of concern because analysis of trends in total logistics cost in other developed countries suggests that the United States is spending more on transportation logistics, while other developed countries such as Germany, Spain, and France are spending proportionately less. If this trend plays out, it will mean that U.S. industries will be at an increasing competitive disadvantage.

Another area of global competitive concern for the United States is illustrated by the Access Index developed by SRI International for FedEx. The Access Index measures a nation's ability to compete in world markets. The methodology considers 22 factors of physical and information access including transportation, trade, and telecommunications. The top 10 countries in the Access Index achieved an average GDP per capita growth rate of 22.6% in the last decade, compared to a growth rate of only 14.1% for the bottom 10 countries on the list. The United States does not make the top 10, ranking 12th among the 75 nations studied. More information on the Access Index is provided in Appendix C.²⁹

2.3 Changing Passenger Transportation Demand

Passenger transportation by automobile and by public transit has changed as much as freight transportation. We have become a much more mobile society. From 1970 to 1997, passenger vehicle miles of travel (VMT) in cars, pick-up trucks, vans, and buses grew at 3% per year, more than twice the rate of population growth. From 1997 to 2005, passenger VMT growth slowed to 2% per year because of near saturation in driver licensing and car ownership. The aging of the population and recent increases in energy prices have slowed demand for driving even more. However, a growing population, economy, and personal incomes will drive demand for greater personal mobility options in the future. All passenger modes will be challenged to meet the demand.

THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

As we look to the future, we will see the following development trends and resulting demands on the nation's passenger transportation systems:

- A highly dispersed, high-value, globally engaged, highly mobile society will emerge, with sharp growth differences among regions and within metropolitan areas.
- Approximately one-half of the U.S. population will live in metropolitan areas of more than five million population. These agglomerations of people and businesses will be critical to national productivity, and serving their transportation needs will be a major factor in ensuring that productivity.
- Continued “suburbanization” of people and jobs is expected, although we are likely to see more infill and densification, including transit-oriented development.
- The total number of trips will continue to increase, with increasing trip lengths to and from more dispersed origins and destinations, putting greater demands on an already congested highway system. Higher rates of metropolitan transit usage will help meet demand and alleviate highway congestion. Transit- and walking-oriented development nodes within these expanding megaregions can help reduce growth in automobile trip-making.
- Rural populations will be critical to the nation's economy, with rural development spurred by trends such as retirees and workers seeking rural amenities, growing recreational and tourism activity, and specialized rural economic development areas.
- Long-distance travel for both business and personal purposes will grow dramatically. Greater competition will arise between air and auto travel for intermediate-length trips of 250 to 500 miles. In a few high-density corridors or megaregions like the Northeast, high-speed rail is likely to become a reality.
- Recreation and tourism will be growing markets. The Travel Industry Association estimated there were two billion tourism-related trips of more than 50 miles in length in 2006. Such travel-generated travel and tourism results in expenditures of \$700 billion, with about \$614 billion of that spending by U.S. residents and \$86 billion by foreign visitors. This is an important growth industry for the United States. There is considerable concern that increasing congestion across all modes will significantly impede tourism growth, detract from the travel experience, and hurt our competitiveness in the global tourism market.³⁰

This section summarized key trends reshaping the U.S. economy and their implications for moving people and freight. The next section focuses on five major sectors of the U.S. economy and their dependence on the nation's transportation system.

3.0 Industries and Transportation

3.1 Introduction

The U.S. economy is one of the most competitive in the world because of its capacity for innovation, higher education system, market size, corporate ingenuity, fluid capital markets, and transportation network. These advantages have allowed U.S. industries to take a leadership role in the global economy, providing products and services demanded worldwide. Transportation is the foundation of this success, but each major industry has its own set of transportation needs and issues.

Five major economic sectors account for 84% of the U.S. economy. Four—agriculture and natural resources, manufacturing, retail, and services—are among the largest users of transportation. The fifth—the transportation sector itself—is a provider of transportation equipment and services.

The intensity of transportation use varies by sector. Transportation represents 7% of the value of output in the agriculture and natural resources sector, 4.7% of the retail sector, and 3.2% of the manufacturing sector. In the rapidly growing services sector—which does not produce material goods but depends on expedited delivery services, long-distance business travel, and employee commuting—transportation is 1.8% of the value of output. While the amount of transportation consumed by the sectors varies, each is critically dependent on the condition and performance of the nation's transportation infrastructure.³¹

This section explores the multifaceted roles transportation plays within these industry sectors. The subsections describe each sector, the trends shaping the industry, the sector's transportation issues, and its transportation needs.

31

The construction industry also is very dependent on the health of the U.S. transportation system to perform optimally, but was not included as a focus industry for this report because its role as the builder of the nation's infrastructure and its linkages to transportation are evident and well documented.

3.2 Agriculture and Natural Resources Sector

Industry Profile and Outlook

The transformation of the economy and the rapid growth of service industries have not reduced the nation's need for agricultural products and natural resources. The agriculture and natural resources sector has three major segments (Table 3.1):

1. Agriculture and forestry (crop and animal production and forest harvesting);
2. Energy (coal, oil, and natural gas extraction and electricity generation); and
3. Mining (copper, iron, gold, and other metals and aggregate industrial nonmetallic minerals and materials).

Table 3.1 United States Gross Domestic Product in Agriculture and Natural Resources Industry

	Gross Domestic Product	Share/Trend
Agriculture and Forestry	\$122.4 billion	Stable
Energy	\$407.6 billion	Recent strong growth
Mining	\$31.5 billion	Stable
<i>Resources Sector</i>	<i>\$561.5 billion</i>	
Total United States	\$13,246.6 billion	4.3% of U.S. economy

Source: Cambridge Systematics calculations, data from Bureau of Economic Analysis, Annual Industry Accounts, 2006.

These industries are the foundation of a value chain that supports almost all of our economic production and activity. In 1900, the U.S. economy consumed 161 million tons of new materials annually. By 2000, the U.S. economy consumed more than 3.4 billion tons of resources and materials annually, 20 times more than a century before.³² These industries contributed \$561.5 billion to the economy in 2005, accounting for 4.3% of the U.S. GDP. They provide food, building materials, and the feedstocks used in the production of plastics, chemicals, medicines, fertilizers, fibers, processed foods, animal feeds, steel, electricity, and a wide variety of other products. The overall output of the sector is expected to increase as a result of population, trade, and economic growth, with the energy industry expected to grow faster than agriculture and mining.

The sector employs 2.6 million people in the United States, accounting for 1.9% of the nation's jobs (Table 3.2).³³ Domestic employment in the sector is expected to decline over the next 20 years as more processes are automated, but output will continue to grow, resulting in more demand for moving bulk materials.

Table 3.2 Employment in Agriculture and Natural Resources Industry

	Employment	Share of U.S. Jobs/Trend
Agriculture and Forestry	1,382,650	1.0% Stable after years of decline
Energy	788,200	0.6% Slowly declining
Mining	432,400	0.3% Slowly declining
<i>Agriculture and Natural Resources</i>	<i>2,603,250</i>	
Total United States	140,206,762	1.9% of U.S. jobs

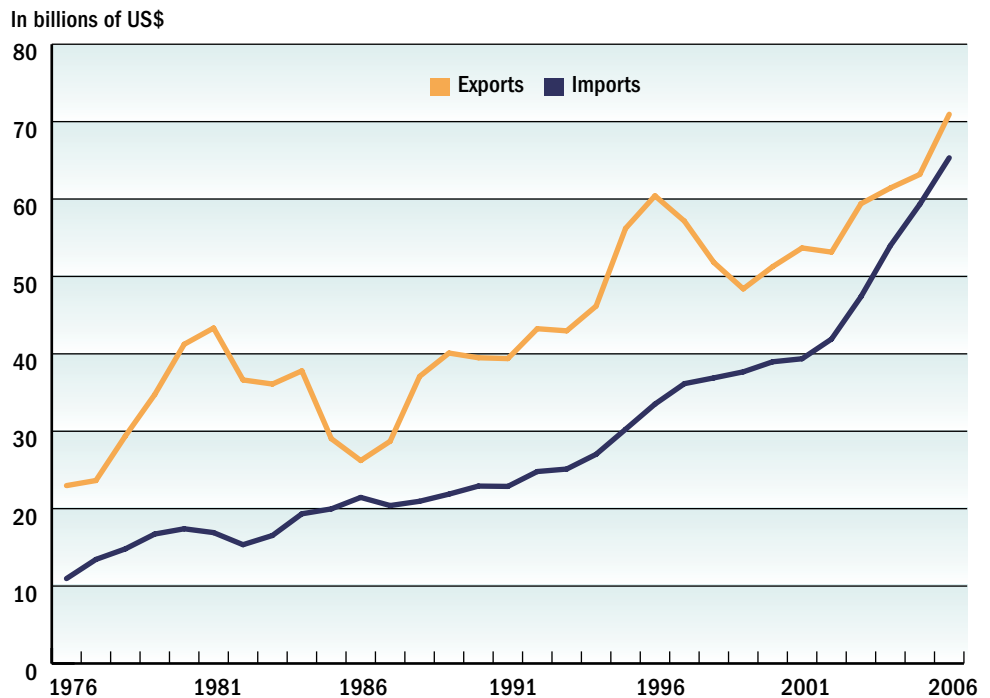
Source: Cambridge Systematics calculations, data from Bureau of Labor Statistics, Census of Employment and Wages, September 2007.

The United States for decades has been the breadbasket of the world, exporting huge volumes of grain and meat to countries with inadequate tillable land or inefficient agricultural sectors. The value of U.S. agricultural exports reached a record \$69 billion in 2006; however, the U.S. trade surplus in agriculture has been shrinking. In 1996, the country had a \$27 billion surplus in agricultural trade; in 2006, this trade surplus had narrowed to \$5 billion. Traditional importers such as China and India have adopted modernized agricultural practices, and other countries such as Brazil have emerged as major competitors in world markets.

For example, today U.S. producers are in head-to-head competition with Brazil in soybean exports. Further, the United States is vying with the European Union for overall leadership in total agriculture and food-related exports. So export competition and transportation's role are very much at the forefront of concern through much of the agricultural industry. Figure 3.1 shows the trends in U.S. agricultural import and export trade from 1975 to 2007. Industry experts anticipate that the United States will become a net importer of agricultural products in coming years.

33 The total number of farm jobs reflects the number of people working at farms that are established as businesses (the job numbers are calculated by a BLS survey of businesses) and does not include sole proprietorship farmers and their families, which comprise a significant number of the jobs in the industry.

Figure 3.1 United States Agricultural Trade Balance
1975 to 2007



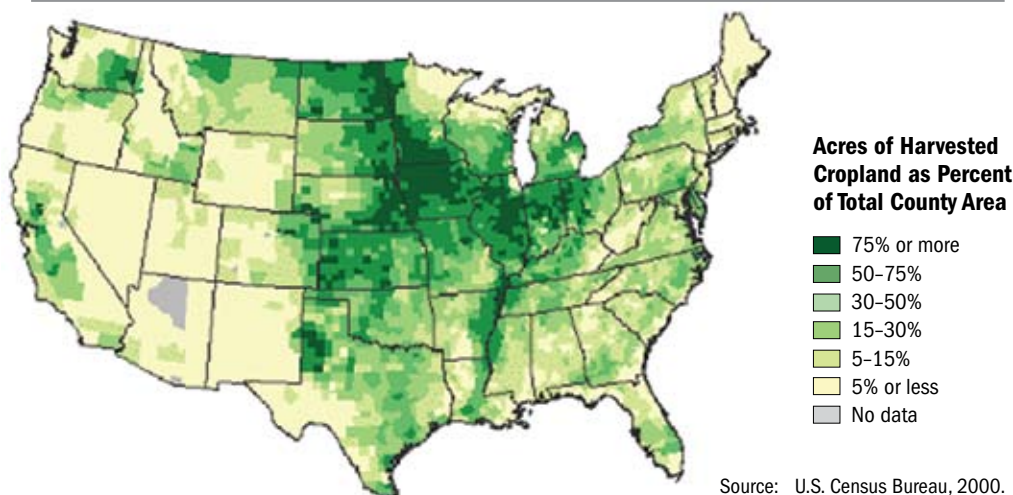
Source: USDA, Economic Research Service, Foreign Agricultural Trade of the United States, 2007.

Transportation and the Agriculture and Natural Resource Industries

The agriculture and natural resource industries ship to domestic and international markets commodities that are heavy, bulky, and relatively low value per ton. Most agriculture and natural resource commodities must be shipped long distances, meaning that transportation costs are a significant portion of the price of delivered shipments and products. Today, every dollar of agricultural output requires about eight cents in transportation services—the highest among all industries. For this reason, agricultural and natural resource shippers stress the importance of lower-cost and reliable rail, barge, and ship transportation over higher-cost truck transportation to keep their industry cost competitive.

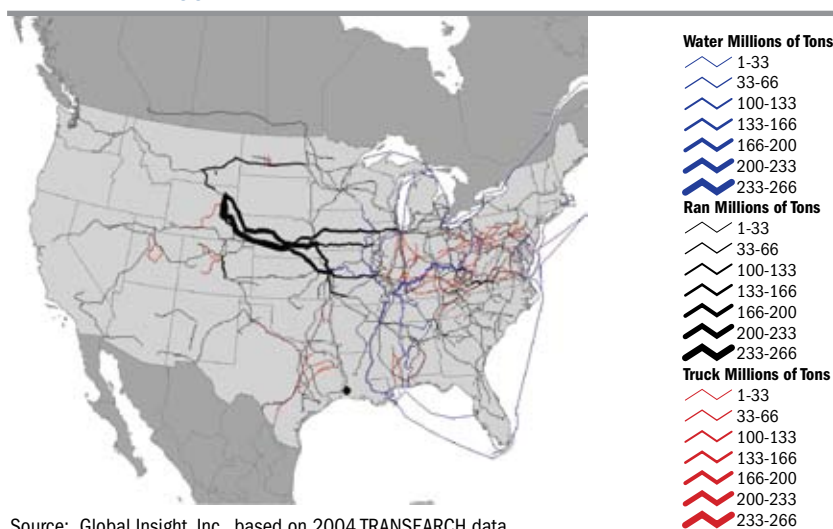
Agriculture and natural resources production is fixed in areas that have fertile land and commercially viable stone, mineral, or energy deposits. Because production areas are relatively fixed, transportation networks can be planned and their costs amortized over long periods of time. Figure 3.2 shows the relative concentration of agricultural crop cultivation in the central United States.

Figure 3.2 Regional Concentration in Agricultural Cultivation



However, transportation needs are changing as new resources and new markets are developed. A recent example is the emergence of the Powder River Basin region as a major supplier of relatively clean-burning coal. The development of this resource, accelerated by the increasing cost of natural gas, has triggered a major realignment and expansion of rail infrastructure and services between the Powder River Basin in Wyoming and the Midwest and Southeast electric utilities markets. Nationally, U.S. coal production reached 3.4 million tons in 2006, produced from 2,000 mines. The industry employed more than 100,000 workers. Sixty-six percent of U.S. coal shipments move by rail, with water transportation and trucks making up the balance. Figure 3.3 shows the volume of coal movements by rail and other modes in 2004.

Figure 3.3 Coal Flows by Water, Rail, and Truck
2004



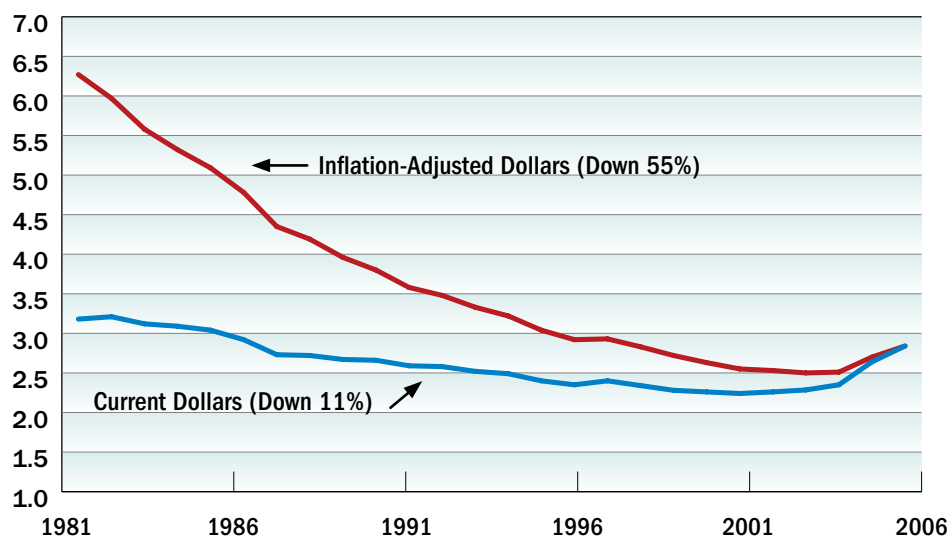
Another realignment and expansion of transportation networks and services serving agriculture and natural resources is happening to meet the nation's demand for reducing automobile and truck engine emissions and to dampen the growth of greenhouse gases. Today in the United States, ethanol is largely refined from corn, while sugarcane is favored by Brazil. Other feedstocks are expected to grow in use in the future. The expansion of U.S. biofuels production and distribution capacity has shifted cultivation and local truck and rail transportation patterns in the Midwest and expanded the demand for longer-haul truck and rail transportation to East and Southeast markets.

The efficient, reliable, and low-cost movement of U.S. agricultural commodities to key gateways for export will be a determinant in how well the United States can compete in overseas markets in the future. U.S. soybean producers are concerned about transportation infrastructure condition and availability, particularly rail, for transporting soybeans and other commodities reliably and cost-effectively. Lower-cost producers such as Brazil have been making significant investments in transportation infrastructure to better serve their agricultural industries by linking their heartlands with ports.

Rail Capacity and Service

Over the last 20 years, shippers have benefited from rail and trucking deregulation. The price of rail transportation has dropped or been relatively stable as railroads have cut prices to compete with trucking following the economic deregulation of the trucking and rail industries in the 1980s. In recent years, after decades of decline, rail prices have begun to rise as excess capacity has been absorbed, long-haul rail services have become more competitive with long-haul trucking, and long-term contracts for transportation service expire (see Figure 3.4).

Figure 3.4 Average Freight Railroad Rates
1981 to 2006
Class I Revenue Per Ton-Mile, All Commodities



Source: Association of American Railroads, Rail Industry Structure and Market Behavior, July 2007.

The natural resource and electric utility industries are sensitive to transportation prices and service reliability, including rail line capacity, regional bottlenecks, prolonged infrastructure maintenance delays, accidents, and natural events.³⁴ The railroads have expanded unit car service, hauling massive volumes of coal from the Powder River Basin to Midwest utilities to meet their customers' needs. Production from the Powder River Basin is expected to increase dramatically through 2030 owing to strong reserves, the hazards of Eastern mining, and a low sulfur content that more easily conforms to environmental regulations. Powder River coal often must travel more than 1,000 miles to reach power plants in the East. As more clean-burning coal power plants come online, the capacity and efficiency of the nation's rail network will be instrumental to ensure the availability of this energy source at a cost that is not onerous to consumers and the nation's industries.

The agricultural sector perceives that it is in competition with the coal/electric power industries and the retail industry for space on the rail network, even as railroads make large capital investments to expand rail capacity. Agricultural shipments—especially by smaller shippers—are less profitable and more difficult to serve than retail and energy customers. Smaller shippers report difficulty obtaining specialized rail cars, such as bulk hopper cars, and getting reliable and timely service for small-lot shipments. While the containerization of agricultural shipments is increasing (e.g., cottonseed exports to China), agricultural shippers often are outbid by retailers for use of containers. And containerization is not feasible or cost-effective for many commodities, such as bagged soybeans, rolls of newsprint, and lumber. Industry experts anticipate that the price and availability of rail service may even influence where crops are grown in the future. For example, soybean production could shift from northern Minnesota, where rail consolidation has resulted in reductions in service, to locations such as Indiana, which have better and more accessible rail service.

Port Congestion and Delays

Port access and modernization are important to agriculture and natural resources industries to improve their export capabilities. Industry representatives noted particular problems at the Ports of Los Angeles and Long Beach and at the Port of Houston, where, at times, there can be a three- to five-hour wait to access port terminals. The ports are not adequately configured to handle today's high volumes and highway and rail access is badly congested. Additionally, the operating hours of many major port terminals—typically 12 to 18 hours per day for five days per week—do not match the 24-hours-per-day and seven-days-per-week work cycles of the major shippers and receivers. This creates backups and adds to congestion.

34 American Mining Association. Coal Statistics from Department of Energy, Energy Information Administration and Mine Safety and Health Administration. Accessed online October 2007.

THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

"We are not investing in our ports and have fallen behind in port landside access."

"China's development of the Shanghai Deepwater Port is an example of massive infrastructure investment overseas that will make it harder to compete with China in the future."

"Dubai, Tsingtao, and Brazil all have better port facilities than the U.S. We're not as advanced as we think we are."

– U.S. Agricultural Industry Representatives

Shortage of Bulk Shipping Capacity

The global demand for breakbulk shipping capacity (e.g., ships designed to carry grains, scrap steel, coal, and other noncontainerized commodities) has been rising sharply as the economies of India, China, and other developing nations have expanded. Businesses around the world have bid up the cost of breakbulk shipping. For U.S. agriculture and natural resource producers, this has added to the cost of exporting already-expensive U.S. cotton, grains, and other commodities. While the containerization of agricultural shipments is increasing (e.g., cottonseed exports to China), breakbulk is still very important for soybeans and other agricultural products.

Aging Inland Waterway System

The inland waterway system also is very important to this industry. For example, grain harvested in Minnesota is often moved by truck to Duluth for international shipment via the Great Lakes or moved by truck and regional railroads to barge ports on the Missouri and Mississippi Rivers system for domestic and international distribution. The aging inland waterway lock and dam system is affecting system capacity and reliability. The recent collapse of the I-35 bridge in Minneapolis also caused significant disruption to Mississippi River barge movements.

Metropolitan Congestion

Stone, one of the top commodities transported in the country based on weight and a critical material for the construction industry, is being quarried farther away from urban centers as quarries located within metropolitan areas run out of capacity or are unable to expand because of encroaching development. Suppliers must make longer trips, increasing the likelihood of delays from congestion, lowering the productivity of customers, and raising overtime costs. In the past, concrete trucks working in the Atlanta region could deliver up to six loads per day of ready-mix concrete to a construction site. Today, industry representatives report that they can deliver only four loads per day owing to congestion. Concrete and stone are critical to the construction of roads, and as the movement of freight becomes less efficient, the expense of rebuilding infrastructure goes up, compounding the nation's transportation issues.

Addressing Industry Needs

Business leaders in the agriculture and natural resources sector believe that current national transportation policies give only limited attention to the concerns of their industry. They believe that the import market gets more attention from government and carriers, and that this is short-sighted because it is hurting U.S. export capacity. Among the transportation proposals advanced by industry to help solve their transportation problems are increasing capacity on highways (including truck lanes), improving rail capacity and service, and shifting more of the movement of agricultural and natural resources to rail and barge. Specific recommendations made by industry representatives³⁵ include the following:

- Increase investment to provide additional capacity and improve reliability across all the modes;
- Ensure access to rail services to support the nation's critical agricultural export markets;
- Improve landside truck and rail access to ports and port throughput to reduce delays and the cost of handling exports;
- Upgrade inland waterway locks and dams to ensure reliable barge service;
- Explore public-private partnerships to create consolidation hubs where agricultural commodities from multiple shippers can be consolidated and offered to the railroads in 50- or 100-car unit, train-sized lots, creating economies of scale and cost savings needed by both agricultural shippers and the railroads; and
- Improve truck corridors by adding truck lanes; enhance truck efficiency by increasing size and weight limits, especially for trucking serving rail consolidation hubs; and ensure trucking hours-of-service flexibility for agricultural producers.

3.3 Manufacturing Sector

Industry Profile and Outlook

Manufacturing has been a mainstay of the U.S. economy, beginning with textiles and tobacco in the 19th century and continuing with the mass production of steel, automobiles, and an array of other consumer products in the 20th century. Today, manufacturing continues to be a key contributor to the economy, producing high-value advanced electronics, medical equipment, and biopharmaceuticals that keep the United States at the forefront of cutting-edge technologies and modern production processes.

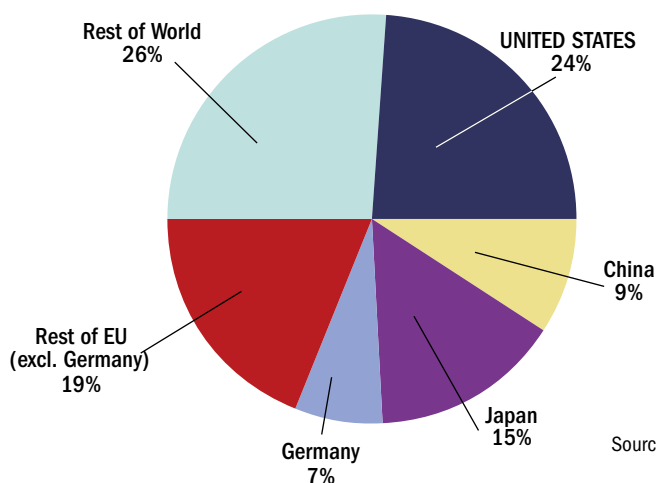
³⁵ These recommendations represent the views of individuals interviewed for this report and are not necessarily those of the U.S. Chamber of Commerce or the Americans for Transportation Mobility coalition.

THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

The United States is the largest manufacturing country in the world, accounting for about one-quarter of total global production.³⁶ In 2003, manufacturing equaled \$1.5 trillion in value-added to the economy, significantly greater than the \$600 billion worth of manufactured goods produced by China the same year (see Figure 3.5). While the recent expansion of manufacturing in China is historic and is changing how and where many products in the world are produced, the United States is a leader in the manufacture of technically advanced products such as computers, aircraft, pharmaceuticals, prototyping equipment, engines, and high-value machinery.

Figure 3.5 Share of World Manufacturing Output
2006



Source: National Science Foundation, Science and Engineering Indicators, 2006.

The manufacturing sector employs 14 million people in the United States, accounting for 10% of the nation's jobs (see Table 3.3). It contributed \$1.6 billion to the economy in 2006, accounting for 12.1% of the U.S. GDP (see Table 3.4).

Table 3.3 Employment in Manufacturing Industry

	Employment	Share/Trend
Durable	8,863,000	63%/decreasing
Nondurable	5,120,000	37%/decreasing
Manufacturing Sector	13,983,000	10%/decreasing
Total U.S.	140,206,762	10% of U.S. jobs

Source: Cambridge Systematics calculations, data from Bureau of Labor Statistics, Census of Employment and Wages, September 2007.

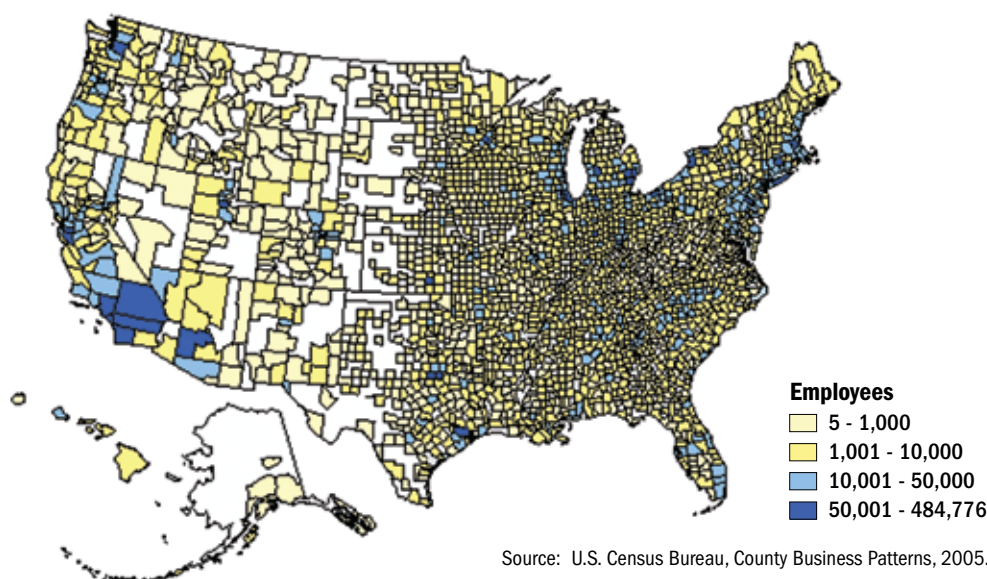
Table 3.4 U.S. Gross Domestic Product in Manufacturing Industry

	Gross Domestic Product	Share/Trend
Manufacturing Sector	\$1,601.2 billion	12%/stable
Total U.S.	\$13,246.6 billion	12% of U.S. economy

Source: Cambridge Systematics calculations, data from Bureau of Economic Analysis, Annual Industry Accounts, 2006.

Manufacturing also is the largest component of U.S. exports. The value of U.S. exports of manufactured goods reached \$923 billion in 2006, accounting for 61% of the nation's overseas shipments.

Employment in the manufacturing sector has been declining steadily, but manufacturing output has been increasing. U.S. manufacturers have invested heavily in automation and sophisticated process technologies, reducing their need for labor while maintaining and increasing output. The drop in manufacturing employment also reflects the internal restructuring of manufacturing firms. To lower costs, maintain competitiveness, and focus on core competencies, manufacturers have been outsourcing functions such as human resources, payroll, maintenance, engineering, and logistics services. This has shifted employment from manufacturing to other sectors, notably the services sector, which has seen continuing increases in employment. The number of manufacturing jobs declined by 19% between 1997 and 2006, but manufacturing output, measured in the value of goods produced, increased by 31%.³⁷ (See Figure 3.6.)

Figure 3.6 Manufacturing Employment in the United States

Industry observers expect the manufacturing sector to grow steadily, but the industry will continue to face competition from lower-cost countries, which will put downward pressure on the prices of manufactured goods. U.S. manufacturers must differentiate themselves through technology and quality because they will be unable to compete on price alone. Producers of easily transferable, low-to-moderate-technology commodity products will be under the most pressure to innovate.

Counterbalancing this is the change in the value of the dollar. As the value of the dollar drops, U.S.-made goods become relatively more attractive and cost-competitive in global markets. Analysts expect that this will encourage the expansion of manufacturing operations within the United States, slowing the outsourcing of jobs. This also could result in the “insourcing,” or relocation, of jobs back to the United States. However, the insourcing of manufacturing jobs can be accomplished only if the domestic labor market can produce a sufficient supply of qualified workers. The shift toward automation and production of high-technology products means that manufacturers must be able to attract highly skilled workers or to relocate near pools of highly skilled workers.

Transportation and the Manufacturing Industry

These trends have several implications for transportation. First is the need to maintain flexible and reliable transportation services across the country. A generation ago, manufacturing employment was concentrated in the Northeast and the Great Lakes, much of it centered around the automotive industry. The Northeast has shifted into high-technology products, medical equipment, and pharmaceutical manufacturing. Automobile production has expanded into the Southeast and South Central states, following and replacing the textile industry. And on the West Coast, the aerospace industry in the Pacific Northwest and Southern California has been the foundation for the expansion of high-technology manufacturing.

What ties this widespread manufacturing capability together today is trucking and the U.S. highway system. Trucks and highways are backbone of manufacturing logistics. The manufacturing sector makes extensive use of intermodal rail, water, and air cargo services, but it is trucking and the highway system that provide manufacturers with the capability to access an extraordinarily wide range of materials, labor, technology, knowledge, and markets, and to integrate these elements into cost-effective, JIT manufacturing operations. The industry consumes 20% of all for-hire truck transportation, the largest amount of any U.S. industry sector. Trucking and the highway system have allowed manufacturing to spread out across the country, building efficient one-story plants on low-cost suburban and exurban land, and yet still have door-to-door freight service as well as quick access to international trade gateways at ports and air cargo hubs. If U.S. manufacturing is to remain cost-competitive in global markets and insource products and jobs within the United States, the truck and highway system must have the capacity to deliver freight reliably and at stable or lower costs.

The second implication of the trends is that more manufacturing jobs will be located in urban areas or in megaregions—clusters of economically integrated cities. Competitive U.S. manufacturing depends on access to highly educated and skilled workers, and more and more of these workers are choosing to locate in urbanized areas. As the U.S. population ages and competition for skilled workers increases among industries, economists expect that more manufacturers will relocate near cities to be near their most critical asset—highly skilled workers. This means that the competitiveness of manufacturing firms will depend not only on access to reliable and cost-effective freight transportation, but also on reliable and cost-effective passenger transportation for commuters traveling by car or by public transit.

Highway Congestion

Over the last two decades, the logistics strategies deployed by manufacturers have changed dramatically as part of a broad effort to control costs and increase productivity. This has included a transition from large, consolidated shipments that supply warehouse inventories capable of feeding a plant for weeks at a time to much more frequent and smaller deliveries for JIT manufacturing. As a result, manufacturers have increased their demand for more frequent, smaller, and varied shipments, almost always involving trucks for at least part of the trip. With orchestrated deliveries to manufacturing facilities (e.g., auto assembly plants mandate deliveries of parts within very narrow time thresholds), JIT is dependent on the reliability of the transportation system.

However, congestion in major metropolitan areas and along intercity corridors is forcing costly changes in manufacturing logistics. Shippers are introducing more trucks and drivers, sending trucks on longer alternative routes, paying overtime to make night and weekend deliveries, and forward-stockpiling parts to ensure the delivery of the same volume of goods. The costs accruing to manufacturers as they adjust their schedules can be subtle. For example, U.S. auto manufacturers using night deliveries to avoid congestion are finding a higher incidence of damage to cars delivered to dealers at night than during the day.

Congestion, deteriorating travel-time reliability, and escalating costs are offsetting the savings of a global supply network. At risk is the ability to hold onto and control the greatest value-added manufacturing operations.

The Boeing Corporation's new 787 mid-size jetliner program demonstrates how the manufacturing supply chain has evolved in a generation and what is at risk if the performance of the U.S. transportation system deteriorates. Earlier airliners such as the 707 and 727 were assembled and built of parts largely sourced from a region-centric system of suppliers located in the Puget Sound area. The 787 also is assembled close to Seattle, but major components are sourced today from an extensive global manufacturing network. Wings, tail cones, rudders, landing gear, and entry doors are flown in from East Asia and Europe; engine pylons, fairings, and the leading edges for wings move by rail from the Midwest, Southeast, and Canada; and vertical fins are transported by truck from locations in metropolitan Seattle. Boeing relies on the robustness of its supply chain and the dependability of a multimodal transport system to assemble its planes, a system affected by Seattle road congestion, rail capacity, air traffic, and border crossing protocols and infrastructure. Similar to other manufacturers, Boeing adapts to transportation challenges (e.g., late deliveries due to delays on Puget Sound freeways) by building time into its logistics systems. This time cushioning is seen as a part of operating a business by most manufacturers and the costs associated with such adjustments (e.g., adding time to delivery windows, creating internal dispatch departments, and fewer turns for delivery vehicles) are not usually estimated. However, the missed delivery of a key component has a tangible effect on Boeing, forcing the removal of planes from the assembly line—a costly and day-long process.

Sources: The Boeing Company.
Seattle Times, "Boeing 787: Build Globally, Assemble Locally," September 11, 2005.

Rail Service and Capacity

Manufacturers prefer rail to receive heavy inputs, such as the soda ash, limestone, sand, and recycled glass used to make glass. Rail congestion at major hubs, especially rail moves going through Chicago, was cited by multiple shippers as a continuing constraint. Some manufacturers report shifting from rail to truck and carrying more inventory to meet tight delivery windows. This adds to cost, erasing the efficiencies and cost advantages of using rail. Beyond the large, nationally visible problems are smaller ones. One shipper reported a localized problem of rail bridges across the Mississippi River that cannot accommodate heavy trains (e.g., 286,000-pound railcars), thwarting manufacturers' and railroads' efforts to increase efficiency and reduce congestion by carrying more freight on fewer trains.

Conflicting Security and Regulatory Policies

Manufacturers need the freight transportation system to function seamlessly while maintaining high security standards, but continuing uncertainty about security requirements makes it difficult to design and quickly modify supply chains to meet market demands. A manufacturer importing shoes from Asia through West Coast ports mentioned concern that new security requirements requiring 100% scanning of containers at foreign ports could disrupt its supply chains. The limited availability of security equipment and likely concentration of traffic into a smaller set of already-congested Asian ports will almost surely squeeze industry supply chains. Similarly, border crossings between Michigan and Ontario are slowing the movements of motor vehicle parts within an integrated automotive regional cluster stretching from Southern Canada to Michigan, Ohio, and Indiana.

This is our plan for our future—and if we do not commit to transportation infrastructure soon, we won't be able to catch up.

– Manufacturer

The U.S. lacks an integrated and holistic policy for freight transportation and manufacturers are concerned.

– Chemical Company

Border crossings in NAFTA countries need to be seamless and they are not today. It is easier to cross between Poland and Germany than to go to Windsor (Ontario) from Detroit.

– Auto Company

The greatness of the U.S. in the 20th century was having unrestricted travel coast-to-coast. Today, Europe is becoming seamless while we're becoming compartmentalized.

– Auto Company

Unreliable Inland Waterways and Insufficient Coastal Shipping

Chemical as well as other manufacturers depend on barges operating along the nation's inland waterway system to carry heavy, bulky, and low-value-per-ton commodities. The lack of maintenance on the inland waterway system results in delays and chronic outages as locks are fixed and rivers are dredged. The service outages can be sudden, giving manufacturers little preparation time to find alternatives. A 10-day shutdown of Ohio River barge traffic forced an unexpected switch from barge to tanker trucks for a chemical manufacturer at significant cost in August 2004. If better maintained, inland waterways could help eliminate some rail and truck congestion, although customers would need to adapt to slower barge movements. The development of “coastal highways” along the U.S. seaboard could provide needed freight capacity, but the Jones Act, which limits intra-U.S. marine movements to U.S.-flagged ships, restricts the development of deep-sea domestic marine shipments as an alternative.

Addressing Industry Needs

The manufacturing industry is looking for broad changes and improvements to the transportation system. First and foremost, industry representatives have called for a clearly enunciated national freight transportation policy. The United States lacks a coherent and clear policy for investing in freight transportation improvements. Europe and Asia have set out investment guidelines and policies, making it easier and less risky for manufacturers to plan and invest in new facilities and markets. Representatives also highlighted the need to do the following:³⁸

38 These recommendations represent the views of individuals interviewed for this report and are not necessarily those of the U.S. Chamber of Commerce or the Americans for Transportation Mobility coalition.

- Create one economic environment among the North American Free Trade Agreement (NAFTA) countries.
- Expand highway capacity by providing truck-only lanes, use private tolling initiatives to supplement public investments, and improve the reliability of traffic flows in and around metropolitan areas.
- Improve port capacity and throughput.
- Add rail capacity and improve service reliability.
- Balance security and freight transportation policies and practices.
- Standardize state freight transportation regulations. The significant variation in size and weight allowances, safety regulations, and taxes and fees among states is onerous and adds considerable administrative costs to shippers and carriers.
- Harmonize commodity classification codes used in international trade. The United States should use the industry classification codes being used in Canada, Mexico, and the rest of the world rather than going its own way. Translating between separate systems increases paperwork and slows the passage of freight across borders.

3.4 Retail Sector

Industry Profile and Outlook

The retail industry comprises establishments that sell merchandise. The retailing process is the final step in the distribution process, a process that includes manufacturing, wholesale trade, and transportation—all leading to the sale of merchandise, either through a store (i.e., a “brick and mortar” retailer) or a nonstore retailer (i.e., catalog or Internet sales), to the general public.

Retail is the second-largest industry in the United States after services when measured in terms of employment or number of establishments. Retail sales in the United States (excluding food) reached some \$3.9 trillion in 2006. The retail industry accounts for about 11% of U.S. jobs (see Table 3.5). Measured in terms of GDP, retail makes up slightly less than 7% of the total U.S. economy (see Table 3.6). Retail employment is concentrated in and around the nation’s most populous areas, employment centers (see Figure 3.7), and business districts, as well as in locations favored by tourists.

Table 3.5 Employment in Retail Industry

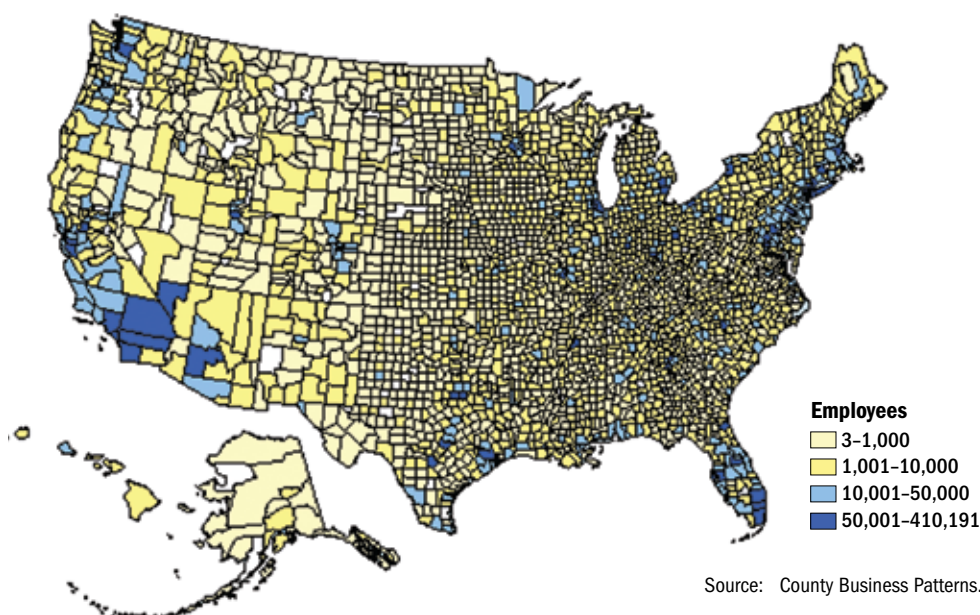
	Employment	Share/Trend
Retail Trade	15,393,300	11%/increasing
Total U.S.	140,206,762	11% of U.S. jobs

Source: Cambridge Systematics calculations, data from Bureau of Labor Statistics, Census of Employment and Wages, September 2007.

Table 3.6 U.S. Gross Domestic Product in Retail Industry

	Gross Domestic Product	Share/Trend
Retail Trade	\$863.2 billion	7% of total/stable
Total U.S.	\$13,246.6 billion	

Source: Cambridge Systematics calculations, data from Bureau of Economic Analysis, Annual Industry Accounts, 2006.

Figure 3.7 Retail Employment Concentrations in the United States

Retail sales growth has remained relatively steady over recent decades. However, the industry has undergone significant transformations resulting from the establishment of large national retail chains, outsourcing of manufacturing, and use of the Internet as a sales channel.

The movement toward online, nonstore retailing has been a significant trend in the industry. In 2006, sales via the Internet increased to \$104 billion, up 18% from the previous year. Internet sales reached 3% of total retail sales. While still a small portion of total sales, these nontraditional channels increase the need for freight services. Whereas most retail shopping is done by consumers driving their own cars to retail outlets, the growth of nonstore shopping increases the need for direct home delivery of parcels provided by FedEx, United Parcel Service, or the United States Postal Service.

The medium-term outlook for the retail industry will be influenced by several factors:

- **Consumer debt.** American consumers are carrying larger personal debt loads, which may reduce the discretionary income needed to buy merchandise. Personal debt combined with declining housing prices, tightened lending standards, and reduced liquidity may impact consumer buying patterns in the short to medium term.
- **Quality concerns for products manufactured overseas.** There have been several product recalls in recent months due to unsafe components found in toys, foods, and other products. Regulations may be strengthened to monitor imports, and quality concerns may affect retail supply chains. U.S. toy retailers and distributors already are showing a renewed emphasis on U.S. sourcing.
- **Depreciation of the dollar.** The decline of the dollar is putting upward price pressure on imported retail merchandise. Higher costs may impact the balance of imported and domestically sourced goods being sold to U.S. consumers by making American products more price competitive.

Transportation and the Retail Industry

The retail industry in the United States is characterized by the tremendous variety of products it delivers to millions of consumers in domestic and international markets. These products are brought to market through sophisticated logistics channels that put significant demands on the nation's intermodal transportation system. Retail goods comprise a large and rising share of total imports, much of which pass through high-volume container port facilities at Los Angeles and Long Beach, then make truck connections in inland intermodal terminals before finding their places on store shelves. The intermodal supply chains essential to the retail industry stretch around the globe are vulnerable to both recurring and unanticipated transportation bottlenecks that restrict the efficient movement of consumer goods.

Worldwide sourcing has been a common trend in the retail industry, and many of the consumer products sold by retailers in the U.S. market are now manufactured in China, Mexico, Jordan, India, and Vietnam. One-third of all U.S. imports (most of this retail merchandise) now come from the Pacific Rim. Trans-Pacific trade is forecasted to grow significantly, fueled by the manufacturing capacity of China and by factors including the elimination of import quotas on textiles and apparel. Despite a clear trend on the part of retail importers to diversify ports of entry, nearly 40% of all U.S. containerized imports enter the country through the ports of Los Angeles and Long Beach. To mitigate the risk of service disruptions at West Coast ports and to better reach the populous eastern U.S. market, some retailers are splitting imports of their consumer merchandise shipments between the Pacific and Atlantic Coasts.

In 2004, the increase in Asian trade, coupled with inaccurate business forecasting by stakeholders, resulted in six to eight days or more of additional transit time for U.S. retailers for most of the June through October peak shipping season, as an

unanticipated spike in container traffic strained the West Coast ports, notably Los Angeles and Long Beach. The overload was felt in virtually all aspects of marine terminal operations and spilled over onto the region's highways and railroads. Although railroads have expanded service and capacity across their networks to meet the demand for high-volume and relatively more profitable intermodal double-stack train service for hauling retail goods imported through West Coast ports to Midwest and East Coast markets, intermodal rail network congestion resulted in two to three days of additional transit time for cargo moving off the West Coast to the Midwest and points east of the Mississippi.

Toys exemplify the impact of congestion and infrastructure weaknesses on retailers. The efficiencies that have been reaped in the toy supply chain are being reversed by inadequate port capacity and unreliable intermodal schedules. In 2001, space and throughput constraints, as well as the threat of work stoppages at the Port of Los Angeles, forced one retailer to ship by airfreight instead of ocean, and to subcontract an offsite third-party distributor to find space for two to three times its historical levels of inventory. Other retailers are routinely diverting imports from Los Angeles to Seattle and Vancouver to mitigate the risk of bottlenecks. The industry-wide effect is higher cost and less reliable product availability. These types of adjustments create significant cost burdens on retailers in terms of higher transportation and inventory expenses.

With trade continuing to rise, delays and congestion are expected to grow in the future, especially through Southern California, but not limited to that region. Retail shippers with distribution warehouse capacity on the East Coast are using all-water routes to alternate ports such as Jacksonville, Savannah, Charleston, Hampton Roads, New York/New Jersey, and the Gulf Coast. Kohl's department store, for example, is almost balanced between its East and West Coast imports. But there are limits to this option. The Panama Canal cannot serve the largest of the modern container ships. Trade through the Suez Canal from Southeast Asia and the Indian subcontinent can be increased, but only if ships are available and the shippers can accept longer transit times.³⁹

Retailers have flexed their muscle in recent years by establishing tight delivery-time windows and pushing transportation and logistics problems back onto their suppliers. In most cases they charge stiff penalties for noncompliance. Depending on the specific schedule of contract penalty charges, rail and truck delays can quickly cost a consumer products manufacturer more than the margin that would have been earned on the shipment. This complex system of performance penalties shows how deep the problem of transportation reliability has become for both manufacturers and retailers.

The trend toward reducing inventory levels to only slim balances, accomplished by pushing the responsibility back into the supply chain, is one of the most significant new business models of this century. Kohl's operates almost entirely as a moving supply

chain—for example, quickly moving consumer goods from the Port of Los Angeles to Chicago by rail, and then making final distribution to retailers by truck—with almost no fixed inventory in the system. The expected transit time for this entire “speed sourcing” process is only five days from port to retailer. This operational strategy to minimize stock levels and optimize labor places tremendous pressure on the transportation system to carry inventory responsively and predictably; with this strategy, in-transit inventories essentially replace warehouses. The reliability of deliveries depends on roadways, ports, rail, and other hard infrastructure to function as planned.

Metropolitan congestion also increases delivery times, making it more difficult for retailers to ensure that they have the right products on the shelves at the right time. Travel delays in major American cities have risen dramatically over the last 20 years, making retail delivery a real challenge for consumer goods companies.

In response to Chicago area congestion, a U.S. auto maker, during a major promotion of a new product, transfers cars from national truck drivers to local truck drivers at a suburban lot so the automobiles can be delivered to retail dealers quickly. The switch from national to local drivers is necessitated by Chicago's congestion and the advantages of having truck drivers familiar with how to avoid local bottlenecks to make deliveries.

– Auto Company

These types of practices demonstrate resilience, and are internalized as a cost of doing business, but they do have tangible impacts (e.g., need for more truck drivers and trucks and lost time). As one of the country's largest employers, retailers also are dependent on local transportation infrastructure—roadways and public transit—to bring workers to their jobs, often to locations within the most congested downtown and suburban areas.

Addressing Industry Needs

Among the transportation proposals advanced by industry to help solve these transportation problems are the following:

- Improve the productivity, efficiency, and throughput of U.S. ports. Suggested improvements include extending port hours and appointment systems, shuttling trains to inland distribution centers, spreading vessel sailings, and using chassis pools.
- Encourage the development of Oakland, California, and Pacific Northwest ports, as well as East Coast and Gulf Coast ports, as alternative gateways for Pacific Rim trade.
- Increase investment in intermodal rail to increase the capacity and velocity of trains moving containers across the country and to address choke points at east-west interchanges such as Chicago, as well as to provide an alternative to trucks on shorter haul north-south routes in the eastern United States.
- Increase public resources on nationally significant freight projects, investing wisely where they will have the biggest return, and in consultation with shippers to help understand business trends affecting the value of future capacity enhancements.

- Deal with metropolitan congestion through highway and transit operations and capacity improvements.

The last federal surface transportation legislation created a program to fund projects of national and regional significance. This program might have partially addressed the problems highlighted by the retail industry, but the SAFETEA-LU program was entirely earmarked, with much of it expended on projects of less than national and regional significance. Early freight-oriented proposals for the reauthorization of SAFETEA-LU, such as the proposals for a Critical Commerce Corridors program, offer hope that more attention will be paid to critical international gateways and corridors in the future.

Meanwhile, state and local governments and the private sector have responded within their capabilities to ease infrastructure pressures in their regions, although community and environmental impacts are an increasing challenge. For example, the Los Angeles/Long Beach Clean Air Action Plan is seeking to reduce diesel pollution by 80% and could cost upwards of \$1 billion. The cost of moving freight through the ports will rise, with one estimate predicting that freight rates could increase 80%. The retail industry believes that a balanced plan that includes improved infrastructure, congestion relief, and pollution reduction will be needed. A combination of public and private funding sources will be required to address these large interrelated challenges.

3.5 Services Sector

Industry Profile and Outlook

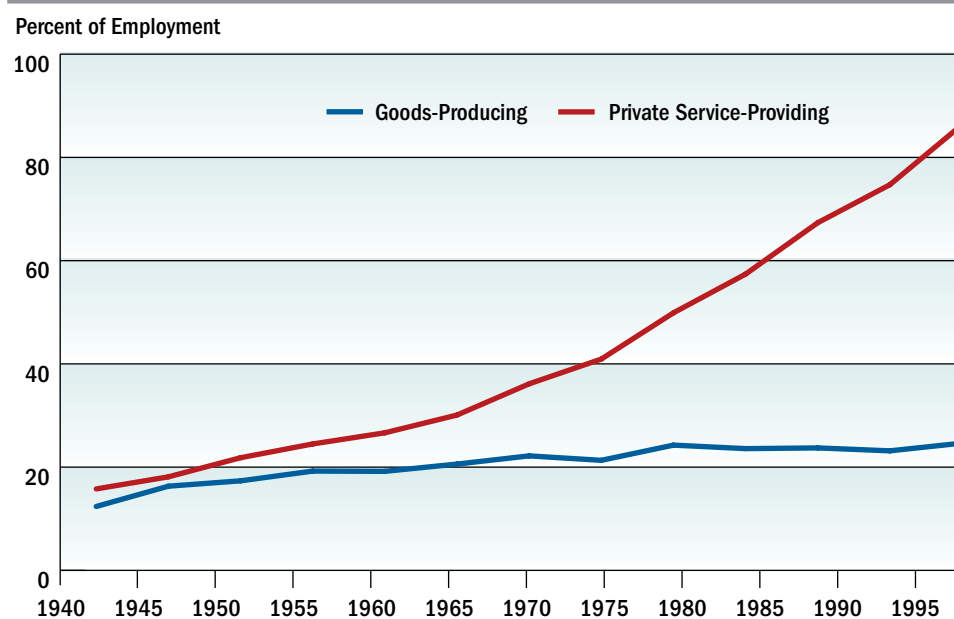
The service industry is the dominant U.S. industry in terms of employment (48% of total) and contribution to economic output (51% of total).^{40,41} As the national proportion of employment in services continues to increase, the effects are seen at every level of the economy. Regionally, even in states considered to be breadbasket economies such as Iowa, or automotive-alley economies such as Michigan, the services sector provides more than two-thirds of state gross product.⁴² As seen in Figure 3.8, the services sector's share of national employment has grown steadily since 1940 and increased more rapidly since 1990.

40 Bureau of Labor Statistics, 2006 Census of Employment and Wages. Services-producing industries include only Transportation, Information, Finance and Real Estate, Professional and Business, Education and Health, Leisure and Hospitality, and other services. Percentage is a total of all nonfarm, private activity and excludes government services employment.

41 Bureau of Economic Analysis, National Economic Accounts, 2006. Services-producing industries include those listed above, and percentage is a total of all private, nongovernment activity.

42 Bureau of Economic Analysis, Survey of Current Business, Regional Data, November, 2006.

Figure 3.8 Goods-Producing and Services-Producing Employment Share
1940 to 2005



Source: Bureau of Labor Statistics, Census of Employment and Wages. This figure depicts a broader definition of services (includes wholesale trade, retail trade, and transportation services) than analyzed in the services industry section of this report.

The services sector includes several large and growing industries, among them information (e.g., media, communications); finance; business and professional services; education and health services; leisure and hospitality; and other services (see Tables 3.7 and 3.8).

Table 3.7 Employment in Services Industry

	Employment	Share
Information	3,099,000	2.2%
Financial services	8,448,000	6.0%
Professional and business	17,950,000	12.8%
Education and health	18,531,000	13.2%
Leisure and hospitality	13,612,000	9.7%
Other services	5,477,000	3.9%
Services Sector	67,117,000	48% of U.S. jobs
Total U.S.	140,206,762	

Source: Cambridge Systematics calculations, data from Bureau of Labor Statistics, Census of Employment and Wages, September 2007.

Table 3.8 U.S. Gross Domestic Product in Services Industry

	Gross Domestic Product	Share/Trend
Information	\$579.2 billion	4.4%/increasing
Financial services	\$2,758.6 billion	20.8%/increasing
Professional and business	\$1,564.6 billion	11.8%/expanding
Education and health	\$1,035.0 billion	7.8%/expanding
Leisure and hospitality	\$471.8 billion	3.6%/increasing
Other services	\$295.7 billion	2.2%/increasing
<i>Services Sector</i>	<i>\$6,704.9 billion</i>	<i>51% of U.S. economy</i>
Total U.S.	\$13,246.6 billion	

Source: Cambridge Systematics calculations, data from Bureau of Economic Analysis, Annual Industry Accounts, 2006.

Growth in the services industries is driven by increasing business and consumer demand. Businesses demand increasingly efficient communication, finance, transportation, and distribution services in order to develop competitive advantages and as essential inputs into the production of goods and other services. For consumers, as personal income grows so does demand for services such as banking, telecommunications, tourism, and entertainment. In general, demand for services caused by population and income growth rises more rapidly than does the demand for manufactured or agricultural products.

These interactions are reinforcing; as personal income grows, consumers demand more services, expanding economic activity and employment in services and driving further income growth. Growth in compensation offered by the services sector contributed more than one-half of the total percentage change in metropolitan area personal income from 2005 to 2006, the largest contribution of any industry sector.⁴³ Similarly, business expansion fuels demand for increasingly complex, layered, and technology-driven services. This results in service innovations that provide additional bases for business growth and competition.

Small, medium, and large service companies all play key roles in terms of capital formation, business expansion, and new job generation. Small firms comprise the majority of service-providing enterprises and continue to provide the most employment generation and growth potential.⁴⁴ Activities once performed in-house by major industrial or retail firms and government are being spun off or outsourced to services firms.

43 Bureau of Economic Analysis, *Personal Income for Metropolitan Areas, 2006*. Measures the contribution of compensation growth to percent change in personal income by industry.

44 Small Business Administration, *The Small Business Economy: A Report to the President*, 2005.

THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

These activities include advertising, marketing, logistics, communications, information technology, engineering, and human resources management. This trend has been a major source of competition and innovation in emerging services industries, and one that has spurred productivity improvements across many other industries. Services businesses are often considered “force multipliers,” or industries that expand opportunities and increase productivity across other sectors of the economy.⁴⁵ Services firms are the primary consumers of information technology services and products. Development of these services and products has spurred much of the growth in U.S. economic productivity.

Trade in services also is changing quickly. International markets for services offer new opportunities for U.S. firms, and trade in services accounts for nearly one-third of total U.S. exports. The United States exports and imports many high-value services, including financial, legal, engineering, architectural, and software development services. Services are increasingly important to international trade, and were highlighted in the most recent Doha round of negotiations on the General Agreement on Trade in Services.

One aspect of international trade in services is the facilitation of business-related travel and the need of U.S. companies to facilitate the temporary entry into the United States of key business personnel, including professionals, managers, consultants, and highly skilled experts and technicians. Many services firms are affected by tight quotas on domestic H-1B entry visas, which constrict the availability of skilled foreign employees. In 2005, \$280 billion worth of services were imported and \$360 billion were exported, primarily in financial services, with major trading markets in Europe and Asia.⁴⁶ Additionally, sales in foreign markets through U.S. services companies operating abroad reached \$489 billion in 2004, the latest year for which figures were available. With dramatic cost and speed reductions and reliability improvements in the transportation of people and the communication of information, the services market now includes some of the most intensive international competition.

Another important example of international trade in services is tourism. Foreign visitation has recovered from the post-9/11 decline and has become a significant source of positive balance of payments. U.S. tourism accounted for 26% of all services exports and 7% of overall exports in 2006. The favorable trade balance of \$7.3 billion in 2006 is the 18th year of a positive balance in tourism; however, since the late 1990s, the balance has been slipping as foreign flag carriers have gained share of U.S. citizens' travel expenditures and overall travel activity waned after 9/11. The year 2006 was the first in which the United States reached a higher level of tourism exports than in the year 2000—\$107.4 billion in international travel receipts compared to the previous record of \$103.1 billion set in 2000. Nevertheless, the number of total

45 Office of the US Trade Representative, *Benefits of Trade and Services*, January 2007.

46 Bureau of Economic Analysis, *U.S. International Trade in Services*, October 2006.

visitors has not rebounded yet to 2000 levels for many of the countries that are major sources of visitors to the United States. Even so, the number of visitors is prodigious. Almost 51 million visitors to the United States arrived in 2006—roughly 16 million from Canada, 13 million from Mexico, and 22 million from overseas origins. This had a substantial impact on the U.S. economy. The Office of Travel and Tourism Industries (OTTI) in the U.S. Department of Commerce is projecting 61 million visitors by 2011, a growth rate of about 20% for the five-year period.

Industry Transportation Issues

The services sector is very dependent on transportation systems to get access to workers. The services sector has been automating many functions, but the majority of its services must still be delivered in person. This means that effective service delivery depends on the mobility of both the producer (the worker) and the consumer (the client) of services.

The following key transportation issues face the industry today:

- Congestion imposes heavy costs on the services industry and its customers, since service delivery is concentrated in metropolitan regions. Industries like education and health service providers traditionally have located in clusters; for example, large urban college campuses and hospital and specialty-care provider centers. However, the benefits of centralizing are eroded by the costs imposed by congestion in our major metropolitan areas.

Valencia Community College in Orlando reported that it was building multiple satellite branches within the Central Florida region because congestion has dramatically reduced the ability of part-time students to get to the central campus. Healthcare and services providers are also shifting to small facilities in neighborhood locations, further away from population centers, sacrificing the benefits of centralization such as quality and breadth of offerings because their customers cannot afford the time and cost of traveling to central locations.

- Some major employers are able to offer commuting and transportation options to their employees (such as carpooling, transit subsidies, in-house transit programs, and private investments in infrastructure) that enable firms to overcome the costs of congestion. However, the majority of businesses in the United States are small firms that are unable to provide these services.
- Employee business travel is increasingly at risk of delay when driving within a congested metropolitan sales region or flying and being subjected to increased aviation delays.
- The favorable trade balance in international tourism has been slipping; post-9/11 security requirements and aviation congestion and reliability exacerbate this trend.

- Services sector employers are having to reach farther out into a bigger market shed to draw on the needed specialized worker pool. Housing costs have tended to push workers farther out from central areas. The transportation system needs to provide for longer-distance commutes to meet these needs. On average, the nation is rapidly approaching 30% of workers leaving their home counties to work.

A June 2007 article in the Washington Post laments the difficulty that parents who work in downtown Washington, DC, but live in the outlying suburbs, have in attending their kids' evening soccer, t-ball, baseball, and softball games. Parents who are coaches and must arrive early to set up equipment, have an especially hard time, often arriving in their office clothes directly from work. Games are routinely pushed back 30 to 60 minutes, and leagues are overtaxed because only one game can be played each evening on a field.

Addressing Industry Needs

Consistent with the scope of its operations, the services industry is looking for broad changes and improvements to the transportation system focused largely on improved state and metropolitan planning and program delivery to do the following:

- Better engage and consider service industry growth needs in the transportation planning process. Many small businesses have difficulty effectively communicating to state and regional transportation officials.
- Better link land-use development and infrastructure planning, including smart growth, mixed-use development, and transit-oriented development approaches, to improve access to services and quality of life.
- Reduce metropolitan congestion through highway operations and capacity additions.
- Increase transit and commuter rail options to provide more choices and access for service workers and clients.
- Better consider tourism visitor needs in planning. This is a large industry for many states, but local planners often are not sensitive to the difficulty of visitors navigating unfamiliar geography and making transfers among modes.
- Address aviation congestion, which is affecting business and tourism travel, among other aspects of the economy and society.
- Increase transportation funding and provide more financing options for states and local governments, including the full range of local option fees and tax choices.

3.6 Transportation and Logistics Services Sector

Industry Profile and Outlook

We would be remiss if we did not highlight the importance of the transportation sector itself—a large part of the U.S. economy in its own right, and the provider of the transportation services that allow the rest of the U.S. economy to operate. The transportation service providers—the motor carriers, railroads, air carriers, steamship operators, public transit providers, and distributors—play an enormous role in the economy, whether moving bulk commodities long distances, delivering express packages to residences and offices, flying people and goods around the globe for next-day delivery, or restocking the shelves of the nation's stores nightly.

Transportation service providers are absolutely dependent on the connectivity, speed, throughput capacity, and reliability of the infrastructure that comprises the U.S. transportation network. These providers, whether private or public, confront and adapt to the conditions of the country's transportation infrastructure constantly to meet the demands of America's businesses and traveling public. Their ability to offer efficient transportation services at economical rates is instrumental to the success of all other sectors of the U.S. economy. Transportation service providers experience the country's transportation deficiencies firsthand—whether traffic jams on overcapacity roadways, delays at major airports with runway configurations that can function only during optimal weather conditions, or a daylong wait to enter a congested port. As these and other transportation deficiencies worsen and infrastructure failures become more common, the ability of transportation providers to offer efficient and cost-effective service deteriorates, damaging not only their own companies' bottom lines but those of the companies and the people they serve.

The transportation industry's history of innovation and application of new technologies can be linked to significant advances in the U.S. economy. The transportation industry has evolved substantially since Wells Fargo and the Pony Express first promised fast and reliable delivery services across the continent. Since then, FedEx and UPS have created an express delivery market with a worldwide reach, and companies of all kinds now have the ability to deliver products quickly, more flexibly, and globally. Quicker delivery has extended sales ranges, allowing businesses to serve customers in relatively remote locations. Quick adjustment to changing modes of transport (rail to truck), full integration of new technologies (e.g., UPC codes and GPS to track shipments and inventory precisely, automated sorting facilities), as well as basic service improvements (same-day delivery) have made the transportation and logistics industry a contributor to business productivity increases around the globe.

Other productivity enhancements within the transportation service industry, including the deregulation of the industry and containerization, also have resulted in cost savings

THE Transportation CHALLENGE

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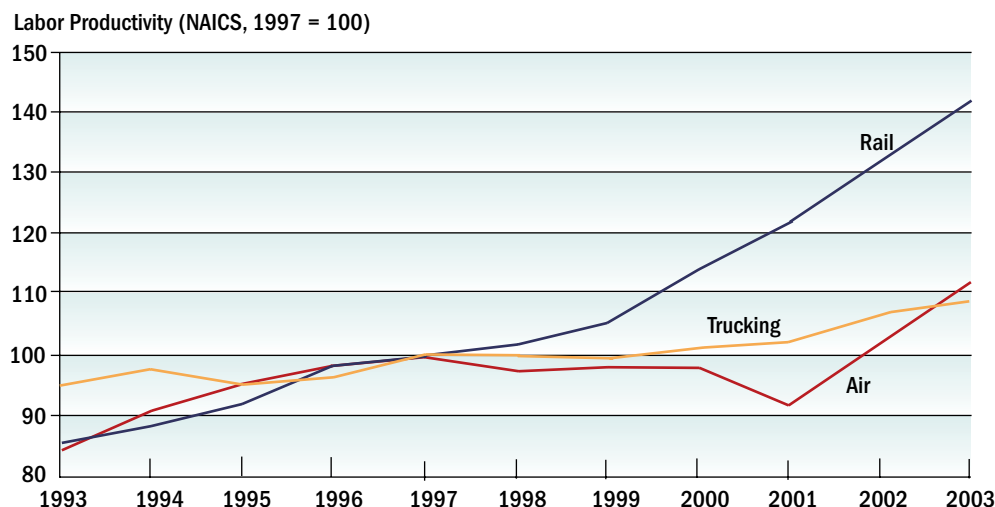
that can be passed on to consumers and businesses. Both passenger and freight transportation industry productivity was spurred by deregulation starting in the late 1970s, increasing competition among providers and pushing companies to identify and adopt practices to differentiate themselves within the marketplace on the basis of service or cost. Growth in transportation productivity also has benefited from the adoption of universal standards for containerization. The growth in containerization has led to more efficient intermodal and international freight transport, as containers can be lifted, loaded, and hauled by companies worldwide using the same equipment.

Constant improvements in productivity have been a hallmark of the transportation industry in recent decades. These improvements have allowed the industry to provide a greater range of services, often at lower cost, to its customers and have reverberated throughout the U.S. economy. The labor productivity improvements experienced by for-hire transportation firms between 1993 and 2003 are illustrated in Figure 3.9.

Productivity Advances Improves Transportation Firm's Wall Street Performance. At Norfolk Southern, moving to a scheduled railroad and making hundreds of small improvements throughout the system has allowed the railroad to make major advances: Since 2000, carload volume has risen 14 percent while the number of cars needed to move that volume has dropped 11 percent. Average train speed has risen 7 percent while downtime in yards has dropped 7 percent. Those metrics resulted in annual savings of \$100 million, against an expenditure of less than \$6 million to overhaul the operating system. And investors have rewarded the company, as the stock has far outpaced the broad market and the peer index over the past few years.

Source: The Scheduled Railroad: A New Paradigm? Carl Van Dyke and Kevin Foy, Mercer Management.

Figure 3.9 Labor Productivity of the For-Hire Transportation Industries 1993 to 2003



The transportation and logistics services industry represents 8% of jobs and 9% of the U.S. economy, as shown in Tables 3.9 and 3.10. The value of the industry's output is steadily growing, but its share of the U.S. economy has actually declined very slowly since 1950—a testament to efficiency and productivity gains that have allowed the transportation industry to meet the nation's mobility needs without having to grow faster than the nation's economy as a whole.

Table 3.9 Employment in the Transportation Industry

	Employment	Share
Transportation	3,882,800	2.8%
Warehousing	659,500	0.5%
Wholesale Trade	6,028,500	4.3%
<i>Transportation Sector</i>	<i>10,570,800</i>	<i>8% of U.S. jobs</i>
Total U.S.	140,206,762	

Source: Cambridge Systematics calculations, data from Bureau of Labor Statistics, Census of Employment and Wages, September 2007.

Table 3.10 U.S. Gross Domestic Product in Transportation and Logistics Industry

	Gross Domestic Product	Share/Trend
Transportation	\$363.7 billion	2.7%/steady
Warehousing	\$34.0 billion ^a	0.3%
Wholesale Trade	\$788.7 billion	6.0%/increasing
<i>Transportation Sector</i>	<i>\$1,152.40 billion</i>	<i>9% of U.S. economy</i>
TOTAL U.S.	\$13,246.6 billion	

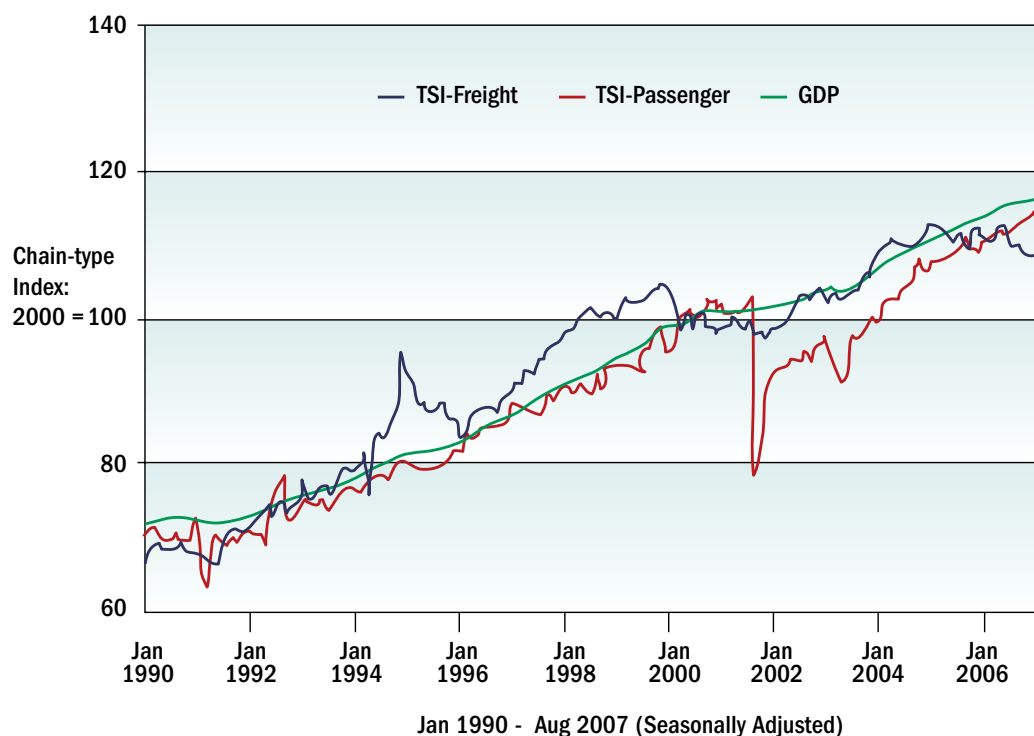
Source: Cambridge Systematics calculations, data from Bureau of Economic Analysis, Annual Industry Accounts, 2006.
^a a Cambridge Systematics estimation.

Transportation and logistics services, like other services, are provided directly to businesses and consumers by specialized firms. However, in many cases transportation services are not sourced to outside firms, but are provided internally by larger retail, wholesale, manufacturing, and even natural resource businesses. The most visible example is the retailer Wal-Mart, whose company trucks are seen regularly on highways. As a result of this internal economic activity, the contribution of transportation services to total economic activity and industry growth is underrepresented in national economic data. Most national tabulations of transportation services account only for the more easily measured value of the for-hire transportation portion of the industry and exclude

the contribution of in-house transportation within nontransportation firms (such as the economic contribution of Wal-Mart's vast trucking fleet).⁴⁷

According to the BTS Transportation Services Index for Freight, and as shown in Figure 3.10, the transport, warehousing, wholesale, and logistics industry has grown in tandem with the robust expansion of the overall U.S. economy during the last 15 years, slowing only recently. Passenger services are now tracking overall U.S. economic growth and have resumed an upward trajectory following a sharp downturn following 9/11. In general, transportation industries are procyclical with the U.S. economy—meaning they expand and contract in parallel with U.S. economic cycles.

Figure 3.10 Bureau of Transportation Statistics,
Annual Index of Transportation Services
1990 to 2006



Source: Bureau of Transportation Statistics.

From a household perspective, for-hire transportation is a relatively small portion of household transportation expenditures, according to the Consumer Expenditure

⁴⁷ See Appendix A for a detailed discussion of the methods used to estimate the transportation industry's share of the U.S. economy, including the portions contributed by in-house truck fleets.

Survey.⁴⁸ It reports that approximately 95% of household transportation spending goes to self-provided transport—the acquisition, use, and maintenance of family vehicles. Only about 5% goes to “purchased transportation,” which includes anything one pays a fare or fee to use: air carriers, transit, taxis, intercity vehicles, cruise ships, etc., but does not include spending to purchase and operate a motor vehicle. Total purchased household passenger transportation spending is about \$450 per year. Of that amount, more than 80% is attributable to travel and tourism, including air fares, intercity and local bus and rail fares, and cruise ships. None of these amounts include business travel for which traveler expenditures are reimbursed by an employer. Of significant interest are the purchases of transportation by foreign visitors—a key component of the economies of many states and cities. While in the United States, foreign visitors spend approximately 14% of their total expenditures for transportation—an average of \$232 per visitor. They tend to be more dependent on purchased transportation and are more likely to use intercity rail and bus and local transit services than the average American.

There are only two states in which travel and tourism is not among the top 10 industries in employment. There are 18 states where it is in the top 5 and in three of those it is the number one employer.

Industry Transportation Issues

As main users of the nation’s transportation infrastructure, transportation and logistics services industries are intimately aware of the system’s benefits and deficiencies, both in terms of how well it serves their own needs and how well it meets the demands of their customers. The needs of the transportation and logistics services industries are represented throughout this report and in the previous discussion of each of the large economic sectors they serve. However, the main issues encountered by the transportation and logistics services industry include the following:

- Near-gridlock conditions on major metropolitan roads during peak travel hours are adding costs to the operations of the country’s trucking firms. Hard-fought gains in productivity are now being eroded by forgone time and the operational expenses (e.g., fuel consumption, vehicle wear and tear, driver costs) of sitting in traffic.
- Transit, commuter rail, and intercity passenger funding is falling well short of needs at all levels of government.
- Rail freight capacity expansion is developing into a key issue. After years of substantial surplus capacity, rail volumes are rising, leading to congestion on major corridors and gridlock in and near major rail hubs and key ports. The Association of American Railroads reports that railroads plan to increase private capital investment to add capacity where needed and meet the growing demand for rail services, but may not be able to meet future needs without public investment.⁴⁹

48 Consumer Expenditure Survey, U.S. Department of Labor, Bureau of Labor Statistics.

49 Association of American Railroads, *National Rail Freight Infrastructure Capacity and Investment Study*, September 2007.

THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

- On the water side, access is constrained by channel depth, which limits the size of ships that call at a port. The largest of the modern megacontainerships and tankers can be accommodated at only a limited number of U.S. ports, and most of those ports must routinely dredge and deepen their harbor channels and pier areas to maintain access.
- The U.S. aviation system was once the envy of the world, but today we no longer lead. Severe congestion in major airports such as Atlanta, Chicago, Philadelphia, and all three major New York City-area airports ripple through the U.S. air traffic system, causing delays nationwide. These capacity problems are caused by both airside and landside traffic bottlenecks. Air space is limited because planes must maintain set distances as they approach busy airports, leading to delays at peak times—a condition exacerbated by an antiquated air traffic control system. On the landside, the United States is falling behind European and Asian rivals in investing in new airports.

“The nation’s next frontier is different modes of transport working together to develop a coordinated multi-modal network—we need to look at our transportation system like a power grid; transportation modes are managed in silos today.”

– Major parcel delivery company

Industry Transportation Proposals

- The freight railroads are proposing investment tax credits to encourage additional private sector investment in rail and related intermodal facilities.
- The American Trucking Associations (ATA) is proposing investments in truck freight corridors, including exclusive truck lanes, as part of SAFETEA-LU reauthorization; both shippers’ groups and the trucking industry are proposing increases in truck size and weight to improve productivity.
- Industry representatives support freight bottleneck relief efforts at gateways (e.g., ports, airports, international border crossings) and along key corridors and intermodal connectors.
- The American Association of Port Authorities (AAPA) advocates spending down the funds accumulating in the Harbor Maintenance Trust Fund for port dredging. AAPA also supports removal of the Harbor Maintenance Tax from domestic cargoes to encourage domestic short sea shipping. Further, relief is sought from the Jones Act, which restricts the development of short sea shipping by limiting intra-U.S. marine movements to U.S.-flagged ships.
- The transit industry is urging Congress to fully fund the federal transit program at the SAFETEA-LU-authorized levels to preserve the existing transit infrastructure and is advocating increased investment at all levels of government to expand and improve transit systems to meet emerging needs.
- A recent report for the National Transportation Policy Commission advocates increased intercity passenger rail investment to enhance passenger service in and between emerging megaregions.
- The industry is looking for expansion of airport capacity and upgrades to the nation’s air traffic control system to relieve aviation congestion.

4.0

Transportation Systems and Services

Freight and passenger transportation are multimodal systems, consisting of a network of highway, transit, rail, marine, and air links connected through intermodal terminals, hubs, and transfer facilities. In examining the potential of the nation's transportation system to support continued economic growth and prosperity, it is important to consider how these transportation systems are performing both under today's conditions and under projected levels of future travel demand.

This section begins with a brief summary of the projected growth in demand for transportation services, and then examines various performance indicators, concluding with a look at increased investment in other countries. The conclusion is that the performance of the U.S. transportation system is deteriorating and projected to worsen in the absence of investments that are significantly larger than those that have been made in recent years. Meanwhile, international competitors are embarking on major new infrastructure improvement programs.

4.1 Overall Demand for Transportation

Sections 2 and 3 provide a picture of the freight and passenger transportation needs of our nation's business sectors and individual households. America's leading role in commerce is placing enormous demands on its transportation infrastructure. At the same time, our citizens depend heavily on much of that same transportation system for access to their jobs, shopping, and recreation.

Substantial economic growth and population increases are projected for the coming decades. In the next 30 years, the U.S. population is projected to grow from 300 million to 380 million. Absent major disruptions such as global sustained recessions, increased trade barriers, and major global conflicts, the U.S. economy will more than double in real terms, and household wealth will increase in real terms from \$37,000 per capita to about \$66,000 per capita. This larger, richer, and more mobile nation cannot ride into the future on today's transportation system.⁵⁰

50 NCHRP 20-24(52), *Future Options for the National System of Interstate and Defense Highways*. Transportation Research Board, Washington, D.C. 2007.

Vehicle-miles of travel are likely to increase by 80% in the next 30 years. To reduce congestion and meet the growing demand for public transportation, AASHTO and others see the need to increase transit capacity to accommodate a doubling of transit ridership by 2030.⁵¹ The FAA expects more than a billion commercial passengers annually by 2015—36% more than in 2006. At the same time, the aviation system must contend with an ever-increasing number of business jets. The existing air traffic control system simply cannot accommodate this growth; it is strained to the limit now.⁵²

The demand for freight transportation to support this economic activity is projected to nearly double between 2005 and 2035. Measured in tons, freight demand will grow from 15 billion tons today to 26 billion tons in 2035, an increase of 89%. Measured in ton-miles, freight demand will grow from six trillion ton-miles today to 11 trillion ton-miles in 2035, an increase of 92%.⁵³

4.2 How Well Are the U.S. Transportation Systems Performing?

Overview

Given the projected growth in freight and passenger travel demand, an important question is whether the transportation system has the capacity to support the movement of people and goods. The American Society of Civil Engineers (ASCE) publishes an annual scorecard that assesses the state of the transportation infrastructure, as well as other public services, by assigning a letter grade for each component. In its most recent survey, ASCE gave the nation's transportation network a grade of D and cited the need to invest \$1.6 trillion in upgrades over the next 20 years. The ASCE ratings and investment needs for the individual modal components are shown in Table 4.1.

51 AASHTO, *Transportation: Invest In Our Future*. Released at 2007 Annual AASHTO Meeting in Milwaukee.

52 http://www.faa.gov/news/testimony/news_story.cfm?newsId=9128.

53 Federal Highway Administration, *Freight Analysis Framework 2*, 2007.

Table 4.1 ASCE, “Nation’s Infrastructure Report Card, 2005”

Roads	D	Poor road conditions cost U.S. motorists \$54 billion a year in repairs and operating costs—\$275 per motorist. Americans spend 3.5 billion hours a year stuck in traffic, at a cost of \$63.2 billion a year to the economy. Total spending of \$59.4 billion annually is well below the \$94 billion needed annually to improve transportation infrastructure conditions nationally.
Aviation	D+	Air travel and traffic have reportedly surpassed pre–Sept. 11 levels and are projected to grow 4.3% annually through 2015.
Rail	C	Freight rail tonnage is expected to increase at least 50% by 2020. The freight railroad industry needs to spend \$175 to \$195 billion over the next 20 years to maintain existing infrastructure and expand for freight growth. Expansion of the railroad network to develop intercity corridor passenger rail service is estimated to cost approximately \$60 billion over 20 years.
Transit	D+	Transit use increased faster than any other mode of transportation—up 21%—between 1993 and 2002. In 2002, total capital outlays for transit were \$12.3 billion. The Federal Transit Administration estimates \$14.8 billion is needed annually to maintain conditions, and \$20.6 billion is needed to improve to “good” conditions.
Navigable Waterways	D–	A single barge traveling the nation’s waterways can move the same amount of cargo as 58 semitrucks at one-tenth the cost—reducing highway congestion and saving money. Of the 257 locks on the more than 12,000 miles of inland waterways operated by the U.S. Army Corps of Engineers, nearly 50% are functionally obsolete. By 2020, that number will increase to 80%. The cost to replace the present system of locks is more than \$125 billion.
Bridges	C	Between 2000 and 2003, the percentage of the nation’s 590,750 bridges rated structurally deficient or functionally obsolete decreased slightly from 28.5% to 27.1%. However, it will cost \$9.4 billion a year for 20 years to eliminate all bridge deficiencies.

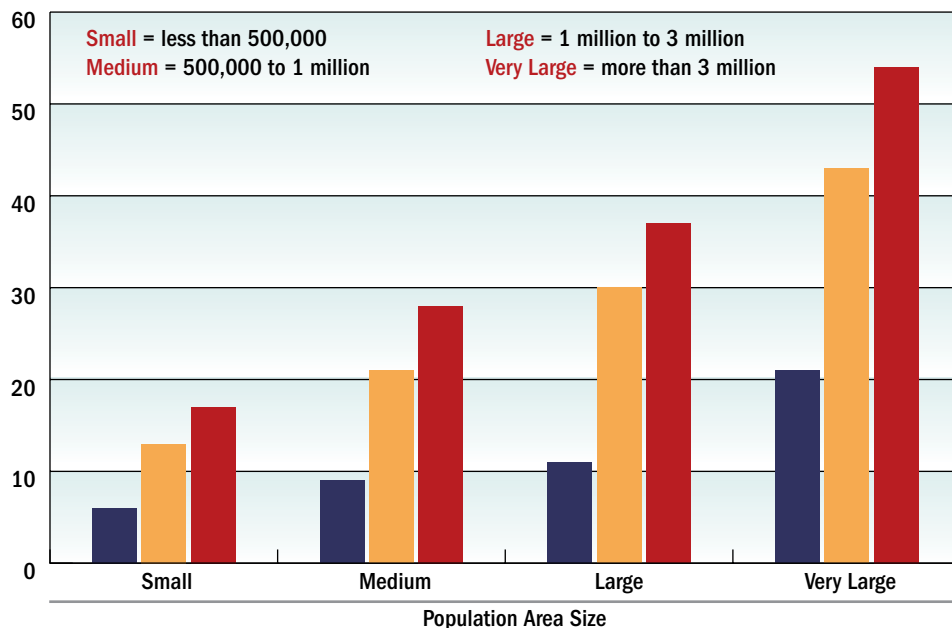
Source: American Society of Civil Engineers, 2005 Report Card for America’s Infrastructure. Washington, D.C., March 2005.

The poor performance of U.S. infrastructure is the result of two factors: a growing imbalance between supply and demand and the increasing age of the nation's infrastructure. One-half of all bridges in the nation were built before 1964, and the nation's other transportation stock is aging quickly. The median age of ferryboats is 22 years; commuter rail cars, 18 years; commercial aircraft, 11 years; transit passenger vehicles, nine years; and full-size transit buses, seven years.⁵⁴

As the system ages, congestion is growing dramatically. The Texas Transportation Institute (TTI) reported recently that congestion caused Americans living in urban areas to travel 4.2 billion hours more and to purchase an extra 2.9 billion gallons of fuel, for a congestion cost of \$78 billion in 2005. This is an increase of 72% just in the last decade. Congestion is not limited to the large metropolitan areas; it is worsening in urban areas of all sizes, as shown in Figure 4.1.⁵⁵ We cannot afford to allow congestion to cause our metropolitan areas to lose out in the increasing global competition they are facing.

Figure 4.1 Congestion Growth Trends, 1982 to 2005

Hours of Delay per Traveler



Source: David Schrank and Tim Lomax, *The 2007 Urban Mobility Report*. Texas Transportation Institute, September 2007, available at <http://mobility.tamu.edu>.

54 American Society of Civil Engineers, *2005 Report Card for America's Infrastructure*. Washington, D.C., March 2005.

55 David Schrank and Tim Lomax, *The 2007 Urban Mobility Report*. Texas Transportation Institute, September 2007, available at <http://mobility.tamu.edu>.

Freight System Performance

The freight productivity improvements gained through past investment in the Interstate Highway System and economic deregulation of the freight transportation industry in the 1980s are showing diminishing returns. Demand is now pressing the capacity of the nation's highway, rail, waterway, and port systems.

The effects of rapid growth in demand and limited growth in system capacity are reflected in increased congestion, increased freight transportation prices, and less reliable trip times. Congestion, higher transportation prices, and lower reliability, in turn, lead to increased costs for manufacturers and consumers and a need for businesses to hold more expensive inventory to prevent stockouts. The effect on individual shipments and transactions is usually modest, but over time, these costs add up to a higher cost of doing business for firms, a higher cost of living for consumers, and a less productive and competitive economy.

For trucking companies, congestion means a higher cost of terminal operations. FedEx Freight, one of the nation's largest less-than-truckload carriers, has been forced to build multiple freight-hubbing facilities around Memphis and Atlanta because of rising urban congestion in these cities, according to Doug Duncan, FedEx Freight's president. The carrier will be splitting its Houston hub into two terminals for the same reason. In Los Angeles, FedEx Freight would prefer to operate only three terminals, but must operate eight to compensate for slow travel times caused by congestion.

For third-party logistics companies (3PLs), congestion can mean getting crowded out of markets entirely. According to Pat O'Connor of the International Warehouse Logistics Association, it has been difficult to attract 3PLs to the Port of Norfolk/Hampton Roads because of congestion in that area. The Commonwealth of Virginia wants to see a 3PL hub developed in the Southeast/Mid-Atlantic area, but congestion is a major impediment to the companies that are considering investing in the region. Other critically congested areas for businesses, according to O'Connor and others interviewed for this study, include the U.S.-Canadian border between Ontario and Detroit and the U.S.-Mexican border at Laredo.

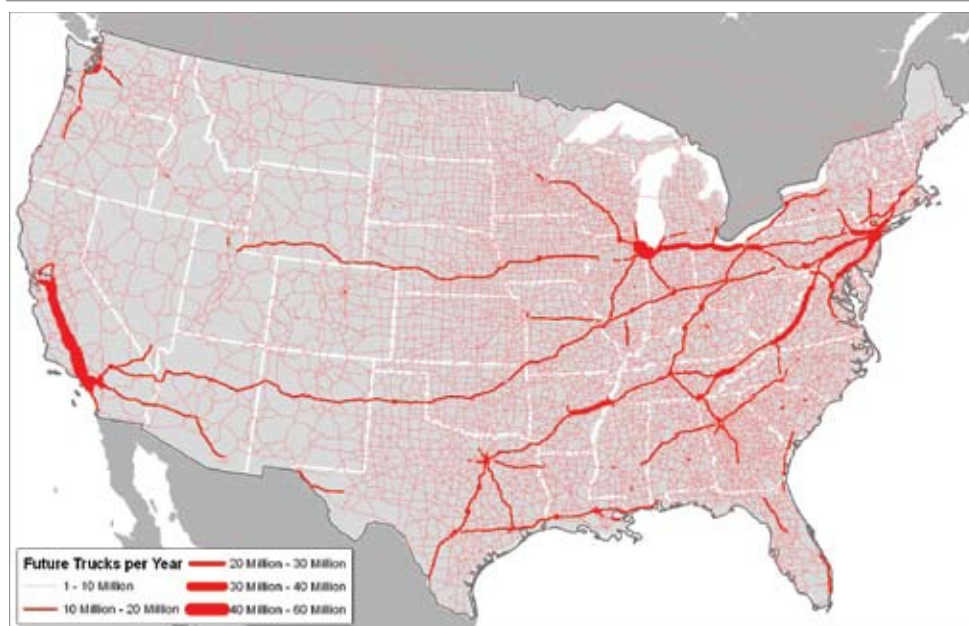
As another example of congestion impacts in and around ports, APM Terminals, which owns about 50 terminals around the world, is locating more of its terminals at inland locations. It is doing this because many of the ports APM serves have no space to absorb and store waves of containers waiting to be loaded onto ships or picked up by trucks and trains for inland distribution. To make its inland terminals work, APM must design efficient connections between the inland terminals and the ports. Without the inland terminals and efficient connections, neither APM nor other terminal operators will be able to manage the growing and fluctuating demand for container movements.

Highways

Much of the congestion occurs at bottlenecks, which are specific physical locations on highways that routinely experience recurring congestion and traffic backups because traffic volumes exceed highway capacity. A recent study for FHWA examined highway bottlenecks and estimated the direct cost of these bottlenecks to truckers at \$7.8 billion per year. Urban Interstate interchange bottlenecks accounted for most of the delay—about 124 million hours of delay at a cost to truckers of \$4 billion. Each of the top ten Interstate interchange bottlenecks causes more than a million truck-hours of delay per year.⁵⁶

Figure 4.2 shows the anticipated density of truck traffic on the National Highway System in 2035. The wider the red line, the greater the number of trucks using the road.

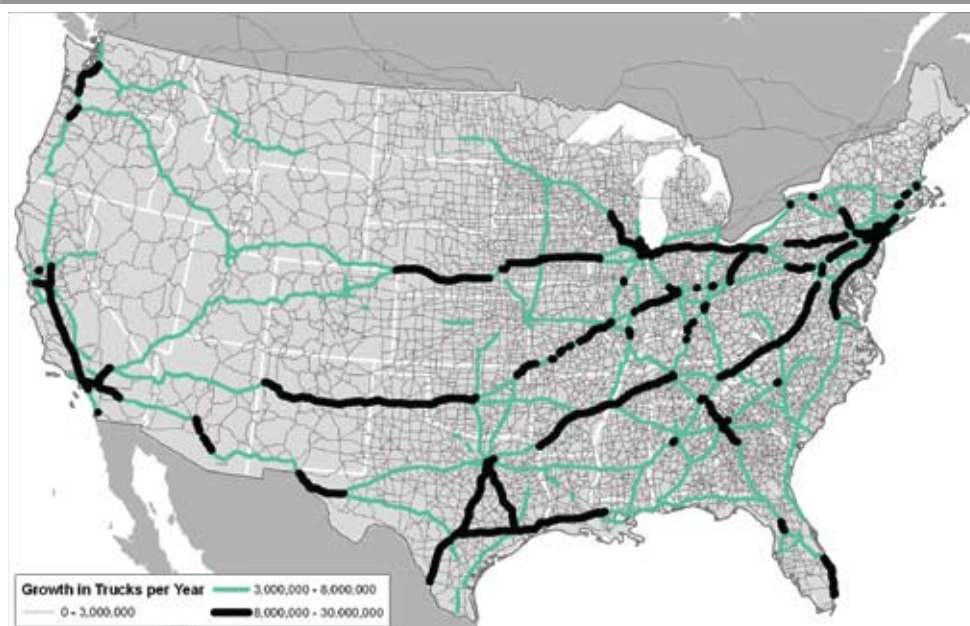
Figure 4.2 Anticipated Truck Volumes
2035



Source: AASHTO, Freight Transportation Bottom Line Reports. Cambridge Systematics, Inc., based on forecasts prepared by Global Insight, Inc.

Figure 4.3 shows the change, or growth, in truck volumes in 2035 relative to 2005.

Figure 4.3 Change in Truck Volumes
2005 to 2035



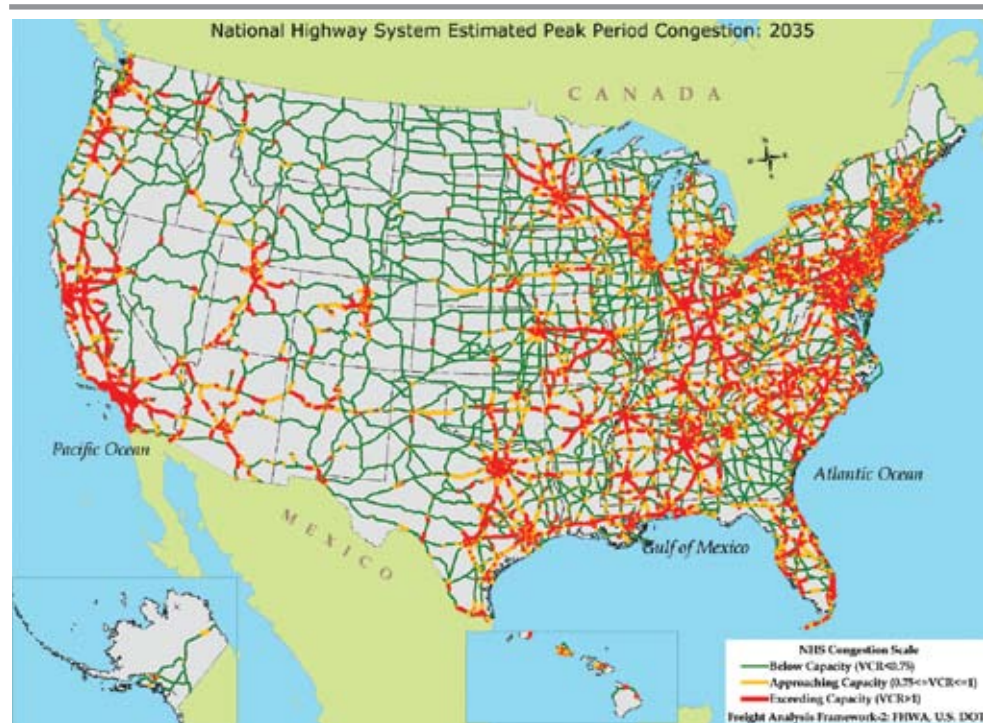
Source: AASHTO, *Freight Transportation Bottom Line Reports*. Cambridge Systematics, Inc., based on forecasts prepared by Global Insight, Inc.

Today, on average, 10,500 trucks operate each day on each mile of the Interstate Highway System. In 2035, 22,700 trucks will operate each day on each mile of the Interstate system, with the most heavily used portions of the system seeing upwards of 50,000 trucks each day.⁵⁷

The additional volume of freight trucks will add to traffic congestion. The number of automobile and local truck trips also will grow with population and the economy. The result will be more traffic and more traffic congestion nationally. Figure 4.4 shows the potential levels of congestion anticipated by 2035 on major roadways across the nation.

⁵⁷ AASHTO, *Freight Transportation Bottom Line Reports*, prepared by Cambridge Systematics, Inc. The map shows the estimated number of large freight trucks (i.e., five-axle tractor semi-trailers) on the highways; it does not account for smaller trucks such as local delivery trucks, some construction trucks, service vans, etc.

Figure 4.4 Estimated Peak Congestion on National Highway System
2035



Source: Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework (FAF-2).

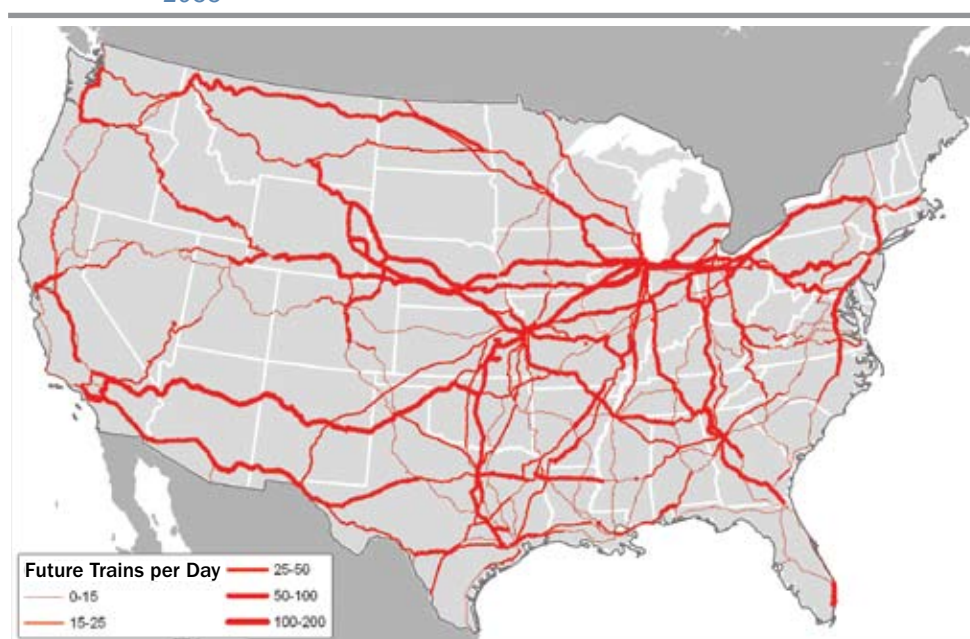
Rail

As the cost of highway freight bottlenecks and congestion has increased, public policy-makers at all levels of government have started looking to the railroads to carry more freight to relieve truck and highway congestion and help conserve energy, reduce engine emissions, and improve safety. Shippers, too, have started looking to railroads to carry more longer-distance shipments, especially as the costs of truck fuel and labor have increased. However, the growing demand for freight transportation also is pressing the capacity of the nation's rail-freight system.

Ton-miles of rail freight carried over the national rail system have doubled since 1980, and the density of train traffic—measured in ton-miles per mile of track—has tripled since 1980. The railroads have had substantial surplus capacity in the rail network for many years. This excess capacity has enabled the railroads to absorb traffic growth with relatively modest additional capital commitments to expand infrastructure. However, this surplus capacity has now largely been absorbed by two decades of growth and major increases in rail traffic volumes of the past few years. Consequently, an increasing portion of the capital investment has been devoted to building new capacity in tracks, signal systems, and structures. And with a steady growth in rail volumes expected

through 2035, increasing amounts of capital must be devoted to expansion. Figure 4.5 shows the anticipated train volumes in 2035. The estimates include Amtrak and commuter rail services currently operating over freight tracks, but do not include the impact of adding substantial new intercity and commuter rail services.

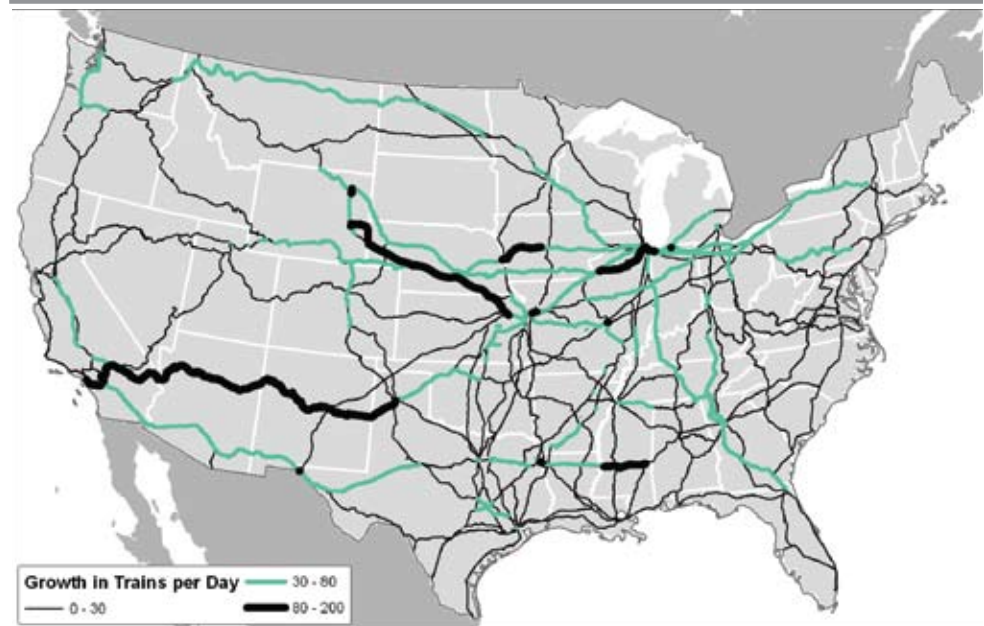
Figure 4.5 Anticipated Train Volumes on Primary Rail Corridors
2035



Source: Cambridge Systematics, *National Rail Freight Infrastructure Capacity and Investment Study*. Prepared for the Association of American Railroads, September 2007. Volumes are for the 85th percentile day.

Figure 4.6 shows the locations of the greatest change, or growth, in trains in 2035 compared to 2005.

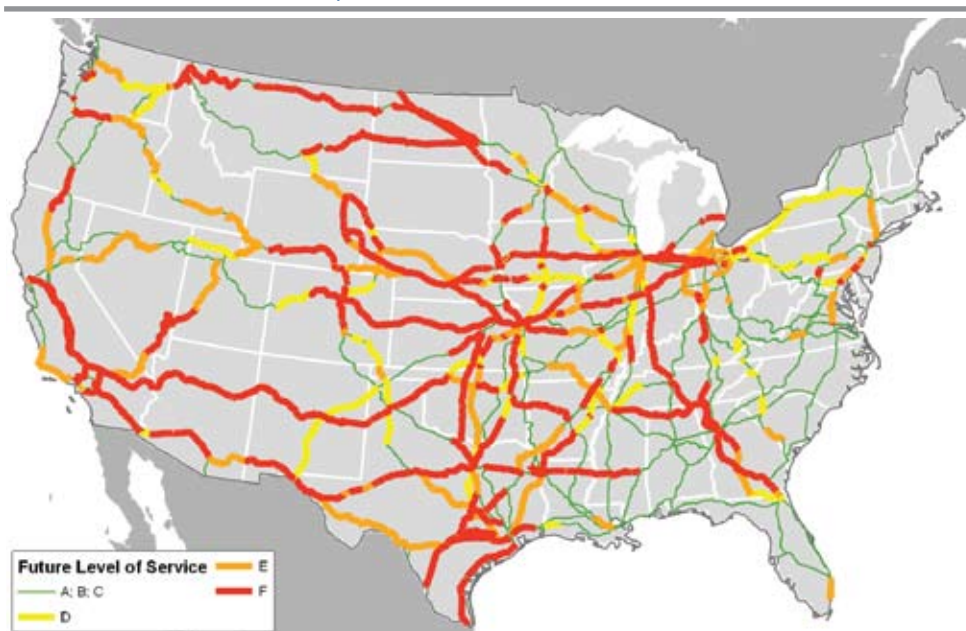
Figure 4.6 Change in Trains per Day from 2005 to 2035 by Primary Rail Corridor



Source: Cambridge Systematics, *National Rail Freight Infrastructure Capacity and Investment Study*. Prepared for the Association of American Railroads, September 2007. Volumes are for the 85th percentile day.

Figure 4.7 compares 2035 volumes in trains per day to current corridor capacity. The volume-to-capacity ratios are expressed as Level of Service (LOS) grades for each primary rail corridor. Rail corridors operating at LOS A, B, and C (where future demand remains below existing practical capacity) are mapped in green. Corridors operating at LOS D (where future demand is projected to be near existing practical capacity) are mapped in yellow, and corridors operating at LOS E (where future demand is projected to be equal to existing practical capacity) are mapped in orange. Rail corridors operating at LOS F (a condition where demand is projected to be above existing available capacity) are mapped in red.

Figure 4.7 Future Corridor Volumes Compared to Current Corridor Capacity
2035 without Improvements



Source: Cambridge Systematics, *National Rail Freight Infrastructure Capacity and Investment Study*. Prepared for the Association of American Railroads, September 2007. Volumes are for the 85th percentile day.

Figure 4.7 shows that many of the key national rail corridors supporting domestic and international trade will be facing severe capacity shortfalls in coming years. It is estimated that an investment of \$148 billion (in 2007 dollars) for rail infrastructure expansion over the next 28 years is required to keep pace with economic growth and meet the U.S. DOT's freight demand forecast.⁵⁸

Ports

Water transportation faces similar challenges. As the U.S. and world economies expand and become more intertwined through trade and multinational logistics, and as the U.S. domestic highway and rail systems become increasingly strained, the importance of water transportation increases. Waterborne trade reached record levels in 2006, and continued strong growth is forecast, with international container volumes expected to triple by 2025. Many studies have been performed—by ports, states, federal agencies, and private stakeholders—that indicate that the nation's marine terminal capacity, navigation channels, and the associated highway and rail access to ports are only marginally adequate to meet today's needs, and will not be able to meet future needs without significant levels of investment.

⁵⁸ Cambridge Systematics, *National Rail Freight Infrastructure Capacity and Investment Study*. Prepared for the Association of American Railroads, September 2007.

While a few ports have limited physical space to handle and store containers and bulk cargos, the dominant problem facing the U.S. ports is access—by water as well as by rail and highway. On the water side, access is constrained by channel depth, which limits the size of ships that can call at the port. The largest of the modern megacontainerships and tankers can be accommodated at only a limited number of U.S. ports, most of which must routinely dredge and deepen their harbor channels and pier areas to maintain access. On the land side, rail and highway access varies from congested to adequate. Some ports have on-dock rail access and direct highway connections to the Interstate Highway System, but most use trucks to haul containers and other freight from the docks over local roads to the nearest railroad loading facility or to the Interstate system. Many of these truck routes move through urban areas that already are congested with automobile traffic.

A further impact on port capacity is the Department of Homeland Security's new requirement for 100% scanning at foreign ports before containers enter the United States. This requirement will significantly narrow the options for importer supply chains because many foreign ports lack the capability for such scanning. This may further concentrate loads at major foreign ports such as Hong Kong, limiting supply chain options and potentially increasing port congestion and overall shipping times for goods moving to U.S. customers.

The National Chamber Foundation's report, *Trade and Transportation: A Study of North American Port and Intermodal Systems*, concluded that the U.S. port and intermodal freight system is operating at its maximum capacity in many areas and that any breakdowns in the system will have ripple effects through the economy.⁵⁹

Passenger Transportation Performance

Highways and transit are complementary components of our urban surface passenger transportation infrastructure and play vital roles in maintaining the vigor of the U.S. economy and quality of life for citizens. The use of private automobiles on our nation's extensive highway network provides Americans with a high degree of personal mobility, but under conditions of increasing system unreliability and declining speeds. A high-quality transit system gives people choices and expands the labor market for employers. Transit also helps those without cars take advantage of a wider range of job, educational, health, and social opportunities. Highway investments, in addition to accommodating highway users, benefit bus transit services that share the same roadway. Similarly, intercity modes of air, rail, and highways give longer-distance travelers more choices when making business and social-recreational and tourism trips.

59 National Chamber Foundation, *Trade and Transportation: A Study of North American Port and Intermodal Systems*. Washington, D.C., March 2003.

TTI reported that congestion costs Americans \$78 billion a year. This impacts commuters and their ability to access jobs, businesspeople traveling in and around metropolitan areas, and families shopping in their neighborhoods. Congestion is not limited to urban transportation systems. Aviation congestion is also worsening. Nationally, 2007 is expected to be the worst year for flight delays in aviation history. The delay problem has hit passengers hard, stranding travelers at airports or on planes for long periods. Worsening delays have revealed critical gaps in customer service, particularly for passengers with special needs, such as parents with small children, the elderly, and foreign travelers. Beyond the hardship airline passengers have to endure, the problem of flight delays imposes serious costs on the economy. Each year, Americans lose more than \$9 billion in productivity from flight delays.⁶⁰

On-time arrivals have declined significantly this year to the lowest rate recorded by the U.S. Department of Transportation. The on-time arrival rate at JFK International Airport is down to 59 percent, with the average flight delayed 65 minutes. Current estimates suggest that there are some 3.4 million passengers at JFK above and beyond what the system can handle before it breaks down, causing delays greater than the 20-minute average targeted by the FAA.

Source: Flight Delay Task Force Report, Port Authority of NY/NJ, December 2007.

The U.S. DOT's senior economist estimates that the cost of congestion across all modes of transportation could be nearly three times as high as the TTI estimates—approaching \$200 billion per year—if productivity losses, costs associated with cargo delays, and other economic impacts are included.⁶¹

To the cost of congestion must be added the cost of motor vehicle crashes and fatalities. There were nearly 45,000 fatalities in transportation crashes in the United States in 2004, of which 95% involved highway motor vehicles. This is an unacceptable national toll.⁶² Other countries such as Australia have led the way in sharply reducing fatalities on their highway system. As part of an AASHTO-led transportation futures visioning process in the summer 2006, transportation leaders set a goal of cutting highway fatalities in half by 2030.⁶³

An equally pressing challenge for transportation will be to reduce energy consumption and engine emissions. The transportation sector used 17% more energy in 2005 (28 quadrillion British thermal units [Btu]) than it did in 1995 (24 quadrillion Btu) and accounted for 67% of U.S. petroleum consumption. Highway vehicles accounted for 82% of all transportation carbon dioxide emissions in 2004.⁶⁴ With the increasing emphasis

60 Flight Delay Task Force Report. Port Authority of NY/NJ, December 2007.

61 Jack Wells presentation to National Transportation Policy and Revenue Commission, June 2006.

62 Transportation Annual Statistics 2006. Bureau of Transportation Statistics, December 2006.

63 AASHTO, *Transportation: Invest In Our Future*. Released at 2007 Annual AASHTO Meeting in Milwaukee, September 2007.

64 Transportation Annual Statistics 2006. Bureau of Transportation Statistics, December 2006.

on energy and environmental sustainability, including the avoidance of climate change, the transportation system will be called upon to improve the energy and environmental performance of its vehicle fleets and systems. Emerging national energy legislation and climate change initiatives domestically and worldwide underscore the importance of these issues to the transportation system.

4.3 Underinvestment Is Affecting Transportation System Performance

The large national backlog of needed capacity improvements and continuing underinvestment are critical factors contributing to declining transportation performance. A recent NCHRP report, *Future Financing Options to Meet Highway and Transit Needs*, estimated the annual gap between revenue and expenditures to maintain highway and transit system performance at \$58 billion per year and the gap to improve performance at \$119 billion per year over the next decade, given current revenue forecasts.⁶⁵

Ports need more investment to accommodate a near doubling of cargo volumes by 2020, with some ports facing a tripling or quadrupling of container volumes moving across their piers. ASCE estimates that \$125 billion must be invested to replace locks on our aging inland waterway system.

The Association of American Railroads (AAR) estimates that an investment of \$148 billion is needed just to keep pace with economic growth and ensure that the freight railroads can carry the volume of freight forecast for 2035.⁶⁶ A recent report on passenger rail estimates \$166 billion in investment needs through 2030.⁶⁷

The FAA estimates that \$41.2 billion of Airport Improvement Program (AIP)-eligible infrastructure development will be needed in the next five years. The Airport Council International of North America estimates that during this same period, more than \$87.5 billion will be needed for aviation infrastructure, including projects not eligible for AIP support. The nation's air traffic control system also faces a multiyear overhaul, with initial plans by the FAA showing that \$4.6 billion is needed over the next five years.

While the United States is underinvesting in its transportation infrastructure, other countries are catching up or moving ahead with massive investment programs. Europe has embarked on an ambitious infrastructure improvement program called TEN-T (the trans-European transport network), whose objectives (according to Eurostat) are to “link island, peripheral, and landlocked regions with the Union's more central regions

65 NCHRP 20-24 (49) report, *Future Financing Options to Meet Highway and Transit Needs*. 2006.

66 National Freight Infrastructure Capacity and Investment Study. Cambridge Systematics for AAR, September 2007.

67 *Vision for the Future: U.S. Intercity Passenger Rail Network through 2050*. Prepared for the National Transportation Policy and Revenue Commission, December 2007.

through interconnecting and interoperable international networks by land, air, sea, and inland waterways.” The European Commission, through TEN-T, has prioritized 30 key transportation infrastructure projects that will help achieve these objectives.

Europe is not alone in launching coordinated initiatives to improve freight and passenger transportation to support economic development. Less-developed economies also have been ramping up their investment in transportation infrastructure. Although investing less as a percentage of their GDP, developing countries have been investing dramatically in infrastructure over the last five years. China is completing a 25,000-mile highway system in 12 years and plans a 53,000-mile system by 2020. The mileage of subway in Beijing has increased from 70 to 335 miles in less than a decade.⁶⁸ Downtown Pudong and Shanghai’s international airport have been connected by an eight-minute trip on a train traveling up to 270 miles per hour. In addition, China has just completed a \$4.2 billion rail line between Beijing and Lhasa in Tibet. India is close to finishing a \$12 billion national ring road connecting major cities. Its national government has identified \$22 billion of investment needed for new ports. A \$430 million privately managed international airport is scheduled for completion in Bangalore next year, and large-scale expansions and facelifts are under way at the Mumbai (\$515 million), Delhi (\$600 million), and Hyderabad airports.⁶⁹

With mounting information about the inadequate condition and performance of the U.S. transportation system and compelling information about the willingness of U.S. trade partners and economic competitors to invest in their transportation system, the United States can no longer postpone developing and implementing its own vision, policies, and programs to ensure a strong transportation system for the 21st century.

68 Urban Land Institute and Ernst & Young, *Infrastructure 2007: A Global Perspective*. Washington, D.C., 2007. The other Asian investment examples in this section come from the same source.

69 Ibid.

5.0

Emerging Transportation Policies and Programs

The previous sections have described how the U.S. and global economies are changing, the demands that these changes are placing on intermodal transportation systems, and how present-day transportation systems are performing in response to these new demands. Two principal conclusions emerge from the review undertaken in this study. The first is that our long-term underinvestment in transportation infrastructure is having a negative effect on the ability of the United States and its industries to compete in the current and future world economy. The second is that incremental changes to current transportation legislation will not be sufficient to address fully the breadth and depth of transportation problems, and meet the mobility needs of individuals and businesses. A new vision with fundamentally new approaches to planning and investing is needed to address the nation's transportation, economic, social, and environmental objectives.

To establish a context, this section begins with a brief description of current surface transportation legislation and, as we approach reauthorization of this current legislation, reviews current reauthorization proposals and how they would affect future transportation policy and investment choices. The question is whether these proposals sufficiently address the range of problems identified in this report, or whether even more fundamental and far-reaching changes are needed to enable the United States to compete effectively in the future global economy.

5.1 Surface Transportation Programs up Through SAFETEA-LU

SAFETEA-LU refers to the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. SAFETEA-LU authorized the federal surface transportation programs for highways, highway safety, and transit for 2005 through 2009. It is the most recent attempt to enunciate new national transportation directions, building on the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 and the Transportation Equity Act for the 21st Century (TEA-21) in 1998.

Transportation systems are owned and operated by a mix of government and private interests. Highway and transit systems are predominantly owned and maintained by the public sector. Local governments own and maintain about three-quarters of the roads

in the United States. State DOTs have jurisdiction over about 20% of the roads. The federal government owns and operates relatively few roads and bridges, most of which are on federal lands. Transit systems are primarily locally owned and operated, often by specially created authorities.

In contrast, the nation's freight railroads are predominately privately owned and operated; only recently has there been discussion of public funding for some freight rail improvements. The marine and air transportation system involves a mix of public and private ownership.

Public sector funding for surface transportation is provided by a mix of federal, state, and local government sources. In 2005, a total of about \$177 billion in revenues was collected for use on surface transportation systems. States raised about 42% of these transportation revenues through state motor fuel taxes and license fees, sales taxes, and miscellaneous sources. Local governments, including transit authorities, raised about 35% of transportation revenues, primarily from property taxes, local sales taxes, and transit fares; and the federal government raised the balance of 23% through federal motor fuel taxes and various excise and sales taxes on large trucks. The federal government contribution is dedicated to capital investment, providing somewhat more than 40% of capital investment for the nation's highway and transit system. States and local governments provide the remainder of capital investment and virtually all the operating and maintenance costs.

This allocation of roles and responsibilities for ownership, funding, and maintenance largely reflects the political agreement brokered in the 1950s that created the Highway Trust Fund to support the development of the Interstate Highway System and other complementary highway programs. Notable exceptions were the increased role given to metropolitan areas with the creation and funding of metropolitan planning organizations (MPOs) in the early 1970s and the creation of a Transit Account in the Highway Trust Fund in 1982.

ISTEA in 1991 marked the completion of the originally designed Interstate Highway System, focused more attention on intermodalism, and began a period of devolution of responsibility and increased flexibility in decision-making to states and MPOs that has carried through the subsequent reauthorizations—TEA-21 in 1997 and SAFETEA-LU in 2005. This flexibility included increased authority for tolling, pricing, innovative finance, and public-private partnerships. ISTEA also provided for a National Highway System, which was subsequently developed with the states and local entities and enacted in 1995, followed by designation and addition of intermodal connectors, focusing federal resources on the most important highway routes of regional and national interest.

Program funding levels have continued to increase since ISTEA, but federal fuel tax rates have remained constant since 1993. This has resulted in a gradual drawdown of the Highway Trust Fund to the point that in 2009 there is expected to be a deficit in the Highway Account. Unless Congress takes corrective action, the highway program could face a reduction of \$16 billion in Fiscal Year 2009.

5.2 Beyond SAFETEA-LU: Public Policy Choices for the Future

Transportation has given the nation an advantage in competing in the global marketplace, offsetting significantly higher costs of labor and regulatory compliance. That advantage is eroding, however, as the performance of the freight and passenger transportation systems deteriorates from underinvestment and as competitors invest in their own air, rail, highway, and transit networks. We need to be much more strategic in investing for the future.

Florida's Strategic Intermodal System (SIS) was established in 2003 to enhance Florida's economic competitiveness by focusing limited state resources on those transportation facilities that are critical to Florida's economy and quality of life. The SIS is a statewide network of high-priority transportation facilities, including the state's largest and most significant commercial service airports, spaceport, deepwater seaports, freight rail terminals, passenger rail and intercity bus terminals, rail corridors, waterways, and highways. These facilities are the workhorses of Florida's transportation system, carrying more than 99 percent of all commercial air passengers, virtually all waterborne freight tonnage, almost all rail freight, and more than 68 percent of all truck traffic and 54 percent of total traffic on the State Highway System. Once fully developed, the SIS could be as significant to Florida's future as the construction of the Interstate highway system.

Source: <http://www.dot.state.fl.us/planning/sis/>

The National Surface Transportation Policy and Revenue Study Commission

In SAFETEA-LU, Congress charged the National Surface Transportation Policy and Revenue Study Commission (Policy Commission) with helping to set strategic transportation directions for the nation. The final report of the Policy Commission was released on January 15, 2008.⁷⁰ It concludes that the nation is at a crossroads, with its economic leadership and vitality at stake. Incremental changes to the existing federal surface transportation system are no longer acceptable. The Policy Commission envisions a new federal compact that includes the following:

1. A strong federal role in surface transportation;
2. Far greater investment at all levels of government and the private sector;

70 Report of the National Surface Transportation Policy and Revenue Study Commission: *Transportation for Tomorrow*. Report to Congress, December 2007.

3. Federal funding that is conditioned on performance measures and cost-effectiveness;
4. Major program reform that refocuses on national interest and much-improved program and project delivery; and
5. Developing a national strategic plan to guide investment.

We must settle on a new national strategy that incorporates the best ideas from the federal government, the Surface Transportation Policy Commission, and the private sector.

Source: United Parcel Service, Getting America Moving Again, December 2007.

Investing in Our Nation's Transportation Infrastructure

During interviews for this project, many industry representatives cited the need for greater investment in our multimodal transportation assets. Among the issues cited were the dual effects of underinvestment in transportation and rapid acceleration in construction costs in recent years. For example, AASHTO estimates that between 1993 and 2015 (the horizon for the next surface authorization bill), transportation construction costs will increase more than 70%. To restore the purchasing power of the highway and transit programs, revenues will need to be increased to levels that match the increase in costs. For highways, this means increasing the federal program from \$43 billion in 2009 to about \$73 billion in 2015. For transit, it means increasing the federal program from \$10.3 billion in 2009 to \$17.3 billion in 2015. Short-term solutions being considered by the Senate Finance Committee may address the Highway Trust Fund shortfall in 2009, but to sustain the highway and transit programs beyond 2009, substantial additional new revenue will be needed. AASHTO, in its recently released Vision document, has suggested that an increase of three cents per gallon in fuel taxes or its equivalent will be needed in 2009 to sustain funding levels, and an additional seven-cent increase or its equivalent will be needed between 2010 and 2015 to restore the program's purchasing power.⁷¹ The Congressional Budget Office testified recently that to maintain spending on highway programs at SAFETEA-LU levels, a gas tax increase of three cents per gallon beginning in Fiscal Year 2009 and another five cents per gallon beginning in Fiscal Year 2011 will be required.⁷²

The recently released report of the Policy Commission says, "The U.S. now has incredible economic potential and significant transportation needs. We need to invest at least \$225 billion annually from all sources for the next 50 years to upgrade our existing system to a state of good repair and create a more advanced surface transportation system to sustain and ensure strong economic growth for our families.

⁷¹ *Transportation: Invest In Our Future*. Released at 2007 Annual AASHTO Meeting in Milwaukee.

⁷² CBO testimony to House Budget Committee. October 2007.

We are spending less than 40 percent of this amount today.” Among other revenue proposals, the Policy Commission recommends that the federal fuel tax be increased from five to eight cents per gallon per year over the next five years, after which it would be indexed to inflation.⁷³

A broad range of revenue and financing tools are available at all levels of government to address the transportation challenges laid out in this report.⁷⁴ Meeting the nation’s transportation needs will require leadership and political will to build a national strategy and broad consensus for action.

As never before, the nation’s economic prospects are threatened by global competitors, all of whom have created long-range strategies for growth and competitiveness. In the face of these challenges, America is flying blind. We have no national strategy to sustain our success in the face of this competition. America’s third century urgently requires a new strategy to lay the foundation for the nation’s future competitiveness, sustainability, and quality of life.

Source: The America 2050 Strategy, Regional Plan Association.

Future of the Interstate

There is wide agreement that the Interstate system is the backbone of our intermodal system and a key element in sustaining and enhancing our nation’s prosperity. The economic rates of return realized from the investment in the Interstate system were dramatic in past decades. However, we cannot rest on that 20th century investment. According to a recent Transportation Research Board (TRB) study, the current system is aging and needs to be upgraded and expanded to serve 21st century America.⁷⁵

Today, just over 15 years after its enactment, it is clear that ISTEA, so successful in other ways, did not sufficiently fund the Interstate system to continue its vital national role. The good news is that the investment level in Interstate pavements and bridges has been sufficient to preserve the existing infrastructure. The bad news is that the investment level has not been sufficient to prevent increases in travel times and the loss of reliability that is inherent in congested operations. Further, ISTEA did not provide for the necessary expansion of the Interstate system to meet the needs of a 21st century economy. Only 36 route-miles of Interstate per year have been added since ISTEA, concentrated in only a few states.⁷⁶

The TRB study identifies a need to expand the system to improve freight logistics, address metropolitan mobility, and provide new geographic connectivity for areas not

73 Report of the National Surface Transportation Policy and Revenue Study Commission: *Transportation for Tomorrow*. Report to Congress, December 2007.

74 NCHRP 20-24 (49) report, *Future Financing Options to Meet Highway and Transit Needs*. 2006.

75 *Future Options for the National System of Interstate and Defense Highways*. NCHRP 20-24(52), Transportation Research Board, 2007.

76 Ibid.

currently served by the system. It proposes adding 88,600 lane-miles of capacity to the existing 212,000 lane-miles on the Interstate system. It further proposes expanding the existing 46,800-mile Interstate system by upgrading and converting 15,000 route-miles of the National Highway System and related corridors to Interstates, thereby adding 84,000 lane-miles of new capacity.⁷⁷

Increasing investment and application of 21st century technology to the construction and operation of the Interstate Highway System would correct bottlenecks, upgrade interchanges, and improve intermodal connections. Improvements might also include construction of exclusive truck lanes and value-priced lanes. The expanded and extended 62,000-mile Interstate system would handle almost 37% of the nation's travel (compared to about 24% on the current Interstate system) on only 1.6% of the Interstate route-miles. In addition to the economic benefits of such an investment, greater safety would be gained by accommodating a larger share of the nation's travel on the safest highway system in the world.

Freight Policies and Investment Needs

Many of the stakeholders interviewed highlighted the need for greater attention to our freight transportation system. They advocated investments to fund critical freight corridor, gateway, and connector improvements. They also suggested that we as a nation need to be much more strategic in making critical investments.

China has a national transportation investment policy that is closely linked to its trade and economic policy. It was clear in discussions with Chinese officials at all levels of government that they were aware of what the national transportation policy is and what it is intended to accomplish. China competes as a nation. National transportation investment seems to focus on two major goals (forgetting for a moment military defense)—strategies to foster “social harmony” among Chinese citizens, and strategies to support economic growth, with the second goal helping to support the first. Given where China is in its development cycle, there is little question that transportation infrastructure is viewed as a critical component of the nation's economic future and that the creation of a transportation infrastructure network was critical to and in some cases leading the economic development pattern. The United States would benefit from adopting national transportation investment policy that supports the nation's economic health. Linkage of transportation, trade and economic policies that coordinates transportation investment, especially as it relates to freight is vital.

Source: FHWA, International Scan on Freight Mobility and Intermodal Connectivity in China: Trip Summary, December 2007.

Major associations are advancing legislative proposals supporting such investment needs. The American Road and Transportation Builders Association (ARTBA) has advanced the Critical Commerce Corridors proposal, a 25-year initiative to develop a national freight system to be funded by freight-related user charges outside the existing Highway Trust Fund.

THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

AASHTO has proposed that tax credit bonds, issued by a federally chartered, nonprofit corporation, enable a \$220 billion program for transportation investment, including freight and passenger rail and other intermodal improvements. The Association of American Railroads is advocating federal investment tax credits for investments to improve the nation's rail capacity. Finally, many organizations advocate expansion of innovative finance techniques and public private partnerships to help address critical infrastructure needs.⁷⁸

The responsibility for making improvements to freight-oriented corridors across multistate freight sheds and Interstate freight corridors currently falls awkwardly between the federal government—which has largely devolved responsibility for the planning, implementation, maintenance, and operation of the nation's highway network to state DOTs and MPOs—and local governments, whose authority to finance and implement projects is limited to projects within their individual borders. This has led to an increasingly sharp mismatch between the scale of freight operations, which typically span several states, and state DOTs' ability to deliver improvements and coordinate operations across these freight sheds and along the connecting Interstate corridors. The challenge for the public and private sectors is to find effective institutional and financing approaches to deal with these major Interstate corridors and bottlenecks. Few states can afford the cost of fixing a major bottleneck alone, and no mechanism presently exists for a single state to share the benefits, costs, and risks of a major project among the three to five neighboring states that also would benefit.

The first programmatic effort to address projects of regional and national significance is Section 1301 of SAFETEA-LU, but as currently structured it is not a viable model for the future. The congressional earmarking of the initial small program distorted its intent. Some have suggested that an independent transportation commission or similar entity be set up to make cost-effective awards to nationally important projects that have clear national benefits but are constrained by complex state, local, and private institutional and financing challenges.

Multiple shippers, particularly in the agriculture and manufacturing sectors, are concerned about rail capacity, service reliability, competitiveness, and pricing. There have been recent hearings before the Surface Transportation Board (STB) and Congress on these issues. The chairman of the STB testified before Congress that the STB has held hearings related to issues of grain and energy commodity shippers, and stated that the STB has initiated a one-year study of rail competitiveness-related issues. He pledged that the STB would continue to monitor rail competitiveness issues, as well as infrastructure and capacity needs, of the nation's rail network.⁷⁹

78 Ibid.

79 Testimony of Charles Nottingham, Chairman of STB, at House Transportation and Infrastructure Committee Hearing on Rail Competition and Service. September 20, 2007.

Major shippers also highlighted problems with the nation's marine transportation system, including the need to invest in an aging inland water system, to improve throughput capacity at major seaports, and to fund vital port access projects. They cited modern ports being constructed in other parts of the world that are demonstrating the ability of 21st century technology to improve productivity and stated that similar investments in key U.S. port gateways will be critical to our international competitiveness. Government officials and stakeholder groups have begun to discuss infrastructure investment options, including container fees at major gateways to fund critical improvements. Rep. Ken Calvert (R-Calif.), for example, has proposed the On-Time Act, which would impose fees on cargo moving through ports, with the revenue dedicated to infrastructure improvements at the port gateways.

Finally, the newly released Policy Commission report supports the creation and funding of a national freight transportation program that would, consistent with a National Freight Transportation Plan, implement highway, rail, and other improvements that eliminate chokepoints and increase throughput. Among the revenue measures suggested by the Policy Commission are a imposing national freight fee such as a container fee or freight waybill surcharge and dedicating a portion of customs duties to freight improvements.

6.0 Conclusions and Next Steps

6.1 Conclusions

Two principal conclusions emerge from the review undertaken in this study. The first is that our long-term underinvestment in transportation infrastructure is having a negative effect on the ability of the United States and its industries to compete in the current and future world economy. The second is that incremental changes to current transportation legislation will not be sufficient to address fully the breadth and depth of transportation problems and meet the mobility needs of individuals and businesses. A new vision with fundamentally new approaches to planning and investing is needed to address the nation's transportation, economic, social, and environmental objectives.

Impacts on U.S. Industries

While the U.S. business community has adapted well to the changing dynamics of global economies and has achieved impressive increases in productivity, the margin of U.S. competitive advantage is shrinking in key sectors of the economy. Across all sectors, a reliable transportation system is critical to maintaining this margin.

Transportation infrastructure is vital to the success of the five major economic sectors that account for 84% of the U.S. economy: **agriculture and natural resources, manufacturing, retail, services, and transportation**. The U.S. transportation system is not keeping pace with the growing demands of these sectors, and the nation's piecemeal approach to rebuilding and improving our transportation systems is failing. As the performance of the U.S. transportation system erodes, our global competitors are investing heavily in their transportation systems, building highways, rail lines, ports, and airports that will soon provide them with transportation capacity and logistics capabilities equal to or exceeding those of the United States. If the United States continues to underinvest in its transportation systems and fails to meet the transportation needs of its key industry sectors, the U.S. economy will become less productive and less competitive.

- In the **manufacturing and retail sectors**, staying competitive in the changing global economy means moving from large inventories and consolidated shipments to lean inventories and smaller, more frequent shipments that support just-in-time (JIT) manufacturing and replenishment-on-demand retailing. It means building global supply chains to ensure competitive sourcing of materials, parts, and labor. Low-cost, reliable transportation helps manufacturers and retailers keep production costs down, increase productivity, and deliver quality products to their customers.

- In the **manufacturing sector**, congestion, deteriorating travel-time reliability, and escalating costs are draining away the benefits of global supply chains and JIT manufacturing, increasing costs for consumers, and leaving supply chains less resilient to disruptions. When the freight transportation systems fail today, they disrupt trade, production, and sales across the nation and the world. At risk is the ability of the United States to maintain its long-held position as the world's leading manufacturing power.
- In the **retail sector**, port congestion, tightening transcontinental rail and highway capacity, and mounting metropolitan congestion are making it more difficult for retailers to ensure that they have the right products on the shelves at the right time and at the lowest prices. This drives up the cost of doing business for retailers and the cost of living for consumers.
- The **agriculture and natural resources sectors** depend on efficient, reliable, and low-cost transportation to move U.S. agricultural commodities to trade gateways for export. But rail prices have been going up because the overall demand for rail services has been pressing the capacity of the U.S. rail freight system. And when domestic transportation costs go up, agriculture and natural resources producers lose markets to global competitors such as the European Union and Brazil. With increasing fuel prices, the cost of new environmental regulations, and the explosive growth of global competitors, keeping transportation costs low is a major challenge for many industries in the agriculture and natural resources sector.
- The **services industry** is the largest and fastest-growing economic sector in the United States, now accounting for one-half of the U.S. GDP. Service industries need access to large markets and big pools of skilled workers to keep costs down. But metropolitan congestion makes it difficult for service industry workers to get to work and for service industry customers to get to offices, medical facilities, schools, and other service centers. Congestion has forced many service businesses to add extra centers across metropolitan areas, to subsidize employee commuting costs, and to add drivers, equipment, and travel time to ensure delivery of their services to customers.
- Industry and household spending on transportation accounted for nearly 10% of U.S. GDP in 2006, or about \$1.3 trillion, much of it spent to purchase truck, rail, transit, air, and water transportation from the transportation services sector itself. The productivity and success of the **transportation services** sector is tied directly to the capacity and performance of the nation's transportation infrastructure. When transportation services sector productivity drops and costs go up, their clients in the manufacturing, retail, agriculture, natural resource, and service sectors feel the effects immediately. Without good transportation infrastructure and reliable and cost-effective transportation services, the productivity and competitiveness of those industries are at risk.

It is time for us to be much more strategic in planning and investing in the U.S. transportation system. If we do not, our transportation system will become a competitive disadvantage for U.S. industries, and it will be harder to sustain the growth of our regions and the national economy.

6.2 Next Steps

The conclusions of this study and other important national and international research argue strongly that it is time to act. The next surface reauthorization could be the most important transportation milestone since President Eisenhower launched the Interstate era in the 1950s. The following steps should be advanced over the next year and beyond to help shape a vision and programs for the nation's transportation systems and economy:

1. Advocate a greater emphasis on economic needs and issues in formulating national transportation policies, plans, and programs. Together with the increased importance being given to energy and the sustainability of our human and natural environment, our nation's economic sustainability and competitiveness remains a critical priority.
2. Building on recent findings and recommendations of the National Surface Transportation Policy and Revenue Commission, lead the development of a national consensus among citizens, businesses, and political leaders regarding the importance of increasing investment in transportation infrastructure to underpin our nation's economic future and quality of life. Develop and articulate transportation program reform and investment proposals for reauthorization.
3. Advocate for immediate attention to the approaching federal Highway Trust Fund deficit. The Highway Trust Fund is the backbone of our nation's intergovernmental surface transportation financing system. Reducing investment in coming years would be irresponsible.
4. Support greater emphasis on national freight transportation program investments that would implement highway, rail, and marine transportation improvements to benefit commerce.
5. Advocate for increasing overall public investment in infrastructure using all potential revenue sources, including user fees and other revenues collected at different levels of government.
6. Advocate for increased use of financing and credit options, including tax credits and public-private partnerships, to leverage private capital. Other countries have demonstrated the power of tapping private capital, including pension funds, for transportation infrastructure. It is estimated that upwards of \$200 billion of U.S. private capital is available for transportation infrastructure investment if we can successfully leverage it.⁸⁰

A. Measuring Transportation's Share of GDP, Including Household Transportation Expenditures

A.1 Summary

- Depending on the chosen definition, transportation's share of GDP estimates cited can vary between 3% and more than 10%.
- Transportation production or supply measures estimate the for-hire transportation component as equal to 2.9% of GDP and the own-account component as at least an additional 2% of GDP for a combined total of nearly 5% of GDP.⁸¹
- In addition to for-hire and own-account measures, unpriced services performed by the household sector for its own account need to be incorporated. Commuting travel time that is not directly monetized but nevertheless incurred as a cost by households would be an example of such a cost item. Based on Han et al.,⁸² the size of the household sector's unpriced services amounts to 6.6% of GDP. The household sector can be added to own-account and for-hire components, bringing the total share of supply-side transportation measures as a percentage of GDP to 11.6%.
- Alternatively, the demand side can be considered. Many researchers see transportation final demand as the most critical and accurate way to determine the size of the transportation sector and its importance for the economy. In 2006, transportation final demand was equal to 9.8% of GDP, down from 11% in 1996—without the inclusion of the component of unpriced household service for its own account.

81 Wells, J., *The Role of Transportation in the US Economy*. Presentation to the National Surface Transportation Policy and Revenue Study Commission, 2007.

82 Han, X., Fang, B., Chen, D., and Sloboda, B., Household-Provided Transportation: An Extension of the TSAs. *Journal of Transportation and Statistics*, Volume 5, Number 2/3, 2002.

- Han and Fang further estimated transportation-driven GDP as an independent concept. It contains transportation final demand plus additional intermediate goods that otherwise are not counted. The transportation-driven GDP is the most comprehensive measure of total GDP generated from all production activities to support the society's transportation function. Based on 1997 data, the size of transportation-driven GDP was estimated at 16.5% of GDP.⁸³
- On average, U.S. households spend approximately one-fifth of their income, or roughly \$8,300 per year, on transportation. Approximately 95% of that amount is spent on self-provided transportation.

A.2 Transportation Components of GDP

GDP is a broad measure of economic performance that can be used to determine the size and growth of an economy. GDP includes private consumption expenditures, business investment, government expenditures and investment, and net exports. Transportation as a sector takes up a significant share of overall GDP. However, a precise measurement of the transportation component of GDP is complicated because transportation activities do not follow simple industry boundaries. In order to get at these activities, so-called satellite accounts must be developed, incorporating the rigor of the national accounting systems but restructuring the data to represent the needed information more effectively.

GDP can be estimated from either a supply- or demand-side perspective. On the supply side, GDP is equal to the sum of all income generated from production, including labor compensation, business taxes, and corporate profits. On the demand side, GDP is equal to the sum of the values of all goods and services delivered to the final users of economy, which are consumers, government, business investment, and net exports. From the supply side, transportation can be looked at in a similar fashion by either considering it as an industry, as defined in national accounts, or in a broader sense as a set of operations. Transportation operations can be defined as consisting of three parts: for hire transactions, in-house or own-account operations, and final user operations. The demand side of transportation consists of all goods and services used for a transportation purpose and is normally referred to as transportation final demand.

Depending on which measure is used, the importance of transportation to the economy, as estimated by its share of total GDP, can vary significantly, from less than 3% of GDP, using the traditional industry concepts, to more than 10% when broader concepts of operations are considered. Following are the main measurement concepts used in the literature.

83 Han, X., and Fang, B., Four Measures of Transportation's Economic Importance. *Journal of Transportation and Statistics*, April 2000.

Measurement Concepts

Four different concepts are at times used to assess and describe transportation and its relationship to GDP and the size of the economy. Again, not all of these measures are equally well defined, and several concepts require significant statistical computations. This section outlines each concept and some brief issues with its respective methodology.

The four different measures exist because of their different applicability to economic and social analysis (Table A.1). For example, transportation industry GDP may be used for comparisons to different industries across the domestic economy. On the other end of the spectrum, transportation-driven GDP is not as widely used because of its overall complexity.

Table A.1 Transportation Measures

Measures	Usage
Transportation Industry GDP	Industry and Market Analysis; Industry Comparisons
Transportation GDP	Transportation Analysis; Intertemporal and International Comparisons
Transportation Final Demand in GDP	Functional Analysis; International Comparisons
Transportation-Driven GDP	Impact Analysis

Source: Fang, B., and Han, X., *Relating Transportation to GDP: Concepts, Measures, and Data*. December 2000.

In regard to measuring the importance of transportation to the economy, transportation final demand is the most appropriate number to be used, according to research and economic experts on this issue. This measure captures the portion of the economy's net outputs that are produced for transportation purposes. Essentially, it is a functional concept that considers the different social uses of resources, specifically the allocation of such resources to transportation. Measuring the use of these resources, and ultimately the resulting expenditures, will therefore provide the most accurate picture of the importance of transportation to the economy. When comparing measures of transportation internationally, transportation final demand most likely allows for the most accurate comparisons. Essentially, this final demand measures the relative economic function of transportation in the economy regardless of the distribution of transportation expenditures. For example, in a developing country with low car ownership, transportation demand might consist primarily of purchased transportation services, whereas in a developed country, this demand measure might consist predominantly of car-related expenditures. Transportation final demand allows for a valid cross-country comparison regardless of actual expenditure patterns.

The different measures are discussed below.

Transportation Industry GDP

Transportation industry GDP is based on the value-added generated by all transportation industries combined. **This estimate includes the for-hire component and excludes all own-account contributions by transportation.** Value-added is the difference between the value of an industry's output and the value of all of its inputs to avoid double counting. This measure includes essentially four different components:

1. The net value of transportation services sold;
2. The net value of transportation services bartered;
3. The net value of transportation services used in kind; and
4. The net value of transportation services provided by one entity to another but belonging to the same transportation company.

This measure breaks down the total transportation industry into subcomponents such as air, rail, water, road, and pipeline. In 2006, transportation industry GDP was equal to \$309 billion in 2000 dollars. As a percentage of GDP, this amounts to approximately 2.7% (Table A.2). This is basically a measure of the for-hire component of transportation activity.

Table A.2 Transportation Industry GDP
2003 to 2006 (Billions of 2000 Dollars)

	2003	2004	2005	2006
Real GDP	\$10,301	\$10,704	\$11,049	\$11,415
Transportation	\$279	\$294	\$304	\$309
Percent of GDP	2.71%	2.74%	2.75%	2.71%

Source: Howells III, T.F., and Barefoot, K.B., *Annual Industry Accounts*, SCB, May 2007.

Note: The transportation estimate for 2006 has been developed by proportionally eliminating the warehousing component based on 2005 data.

Transportation GDP

Transportation GDP is a slightly more complete measure than transportation industry GDP. **In effect, it adds the value-added of in-house transportation operations to the transportation industry GDP.** Data for this measure are somewhat difficult to obtain because the Bureau of Economic Analysis (BEA) bases its data collection on establishments and not activities. Because transportation industries are a large provider of services in the economy, they are sometimes used as a surrogate for the transportation GDP measure. National accounts systems have recognized this problem for many areas—such as tourism, research, and accounting—that do not fit easily into “industry” categories and have developed a rigorous procedure for examining these

conceptual structures without loss of validity. In transportation it is a difficult and expensive task but one that has immense value.

Using satellite accounting concepts, research has been successful at capturing the in-house component of transportation GDP. In two publications, in 1992 and 1996, the BEA, using transportation satellite accounts, estimated the extent to which transportation is used in different industry sectors. As of 1996, the total in-house component was estimated at \$199.7 billion compared to a for-hire component of \$473.1 billion, measured in 1996 dollars.⁸⁴

Transportation Final Demand

Transportation final demand captures the demand side of the GDP. **This concept includes the expenditures by end users on goods and services for transportation purposes.** It includes the transportation component of the four components of GDP: personal consumption expenditures, government expenditures and investment, business investment, and net exports. In essence, transportation final demand measures the size of transportation function in relation to GDP. Many experts regard it as the most accurate measure of the importance and size of transportation in the economy.

In 2006, total transportation-related final demand amounted to roughly \$1,114 billion in 2000 dollars, which was 9.8% of GDP (Table A.3). This percentage is down from 11% in 2002. The moderate downward trend is due primarily to two factors. One is that the “freight transportation intensity” of the economy decreased due to dematerialization of the U.S. economy. In other words, although freight transportation has grown enormously in recent years, the services sector, including information technology-related industries, has grown even faster. The other is that the U.S. demand for transportation goods, particularly automobile-related goods, has been increasingly supplied by imports.

84 Bureau of Economic Analysis, Transportation Satellite Accounts. 1996. <http://www.bea.gov/scb/pdf/national/inputout/2000/0500tsa.pdf>.

Table A.3 U.S. Gross Domestic Product Attributed to Transportation-Related Final Demand
2002 to 2006 (In Chained 2000 Dollars [Billions])

	2002	2003	2004	2005	2006
Total U.S. Gross Domestic Product (GDP)	10,048.8	10,301.0	10,675.8	11,003.4	11,319.4
Total Domestic Transportation-Related Final Demand	1,100.7	1,098.8	1,118.4	1,121.6	1,114.0
Total Transportation in GDP (percent)	11.0	10.7	10.5	10.2	9.8
Personal Consumption of Transportation, Total	891.1	905.9	921.4	938.3	927.1
Motor Vehicles and Parts	429.0	442.1	450.8	451.3	437.3
Gasoline and Oil	181.9	183.2	186.0	199.2	198.6
Transportation Services	280.2	280.6	284.6	287.8	291.2
Gross Private Domestic Investment, Total	132.1	119.4	134.6	151.1	161.7
Transportation Structures	6.1	5.6	5.8	6.0	6.5
Transportation Equipment	126.0	113.8	128.8	145.1	155.2
Exports (+), Total	170.7	164.6	178.9	143.6	153.1
Imports (-), Total	285.2	290.7	311.5	301.2	319.7
Government Transportation-Related Purchases, Total	192.0	199.6	195.0	189.7	191.8
Federal Purchases	25.0	27.1	25.4	25.4	25.6
State and Local Purchases	157.3	158.5	155.7	152.9	153.9
Defense-Related Purchases	9.7	14.0	13.9	11.4	12.3

Source: Table M-6, *Transportation Statistics Annual Report 2006*. U.S. DOT. BEA Accounts Data, 2005 to 2006.

Transportation-Driven GDP

Transportation-driven GDP essentially attempts to capture all value-added generated in production activities (including nontransportation activities) to meet the economy's transportation final demand, plus value-added generated in transportation services that are used in productions to meet the economy's nontransportation final demand. Transportation-driven GDP shows how much an economy depends on transportation as its growth engine or how important transportation is to an economy as a driving force for growth. Transportation-driven GDP is a complicated concept and can only be empirically estimated in a rigorous framework that can track down direct and indirect effects without double counting. Based on 1997 data, Han and Fang estimated transportation-driven GDP as equal to 16.5% of GDP.⁸⁵

Additional Issues—Household Sector

An issue that should receive special attention in the analysis of transportation and its relationship to GDP is the importance of the household sector. Considering only for-hire and business in-house transportation services components of GDP may understate the true extent to which transportation is a part of the economy. Han et al. contributed significantly to the methodological definition of the household sector and its potential contribution to GDP.⁸⁶

Using the standard set of transportation measures, own-account private automobile services are not included because they are out of the production boundary of the conventional national accounting systems. However, considering the large volume of such activities, for example in commuting situations, this is a significant portion of transportation which should not be ignored. Own-account household services can be monetized by using a general wage rate and included in the overall size of the measure of transportation activity as long as they contribute to a service that can be categorized as a productive activity.

It is difficult to estimate this household own-account portion of the transportation sector due to lack of data and the large amount of analysis effort involved. However, estimates have pegged share of household-provided services at approximately 6.6% of GDP in 2004.⁸⁷ Since it measures additional economic value of transportation activities from the supply (or production) side, household own-account transportation services should not simply be added to transportation final demand to come up to a larger share of transportation in GDP. The two are not additive. Also, household own-account

85 Han, X., and Fang, B., Four Measures of Transportation's Economic Importance. *Journal of Transportation and Statistics*, April 2000.

86 Han, X., Fang, B., Chen, D., and Sloboda, B., Household-Provided Transportation: An Extension of the TSAs. *Journal of Transportation and Statistics*, Volume 5, Number 2/3, 2002.

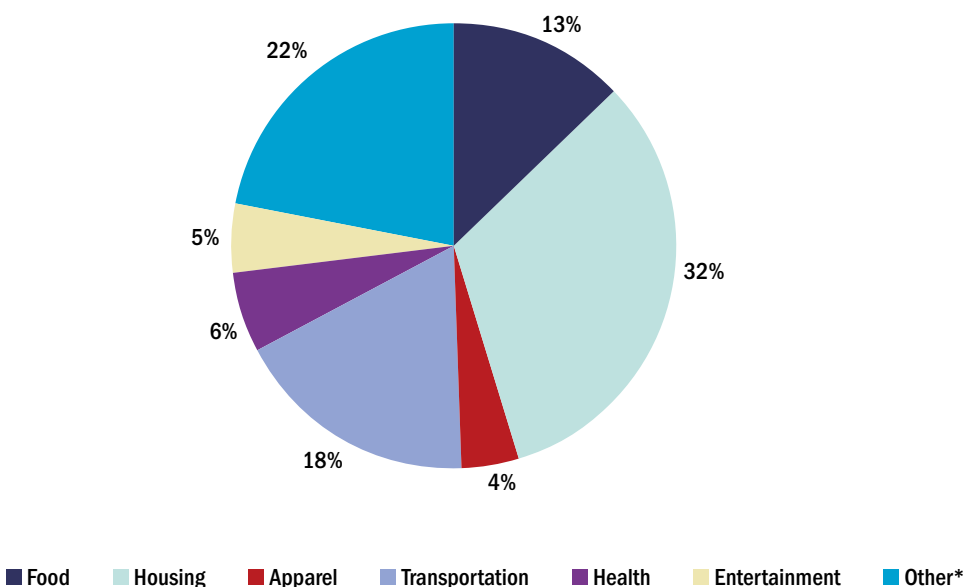
87 Ibid.

transportation services fall outside the production boundary of GDP and therefore, theoretically, it expands the definition of GDP

Household Transportation Spending Patterns and Trends

The transportation final demand component of GDP includes household spending for transportation as discussed above. This section provides further analysis of this very important component of household expenditures. Spending on transportation in the most recent data year (2005) was about \$8,300 out of total spending of \$46,400 per household, or about 18% of all spending, as shown in Figure A.1—second only to housing and roughly comparable to health and food expenditures combined. Looking back 20 years, transportation's share of spending has generally ranged between 18% to 19%, only once exceeding 20% (1986) and dropping below 18% on only three occasions in the early 1990s.

Figure A.1 Transportation Share of Spending
2005



Source: Bureau of Labor Statistics, Consumer Expenditures Survey.

Table A.4 presents the dollar amounts for the main categories of spending in average American households since the year 2000. Note that transportation spending has actually declined a bit in terms of share from the 2000 levels. A number of factors come into play in explaining this small shift, including the housing boom and declines in the levels of auto purchases as gas prices rose.

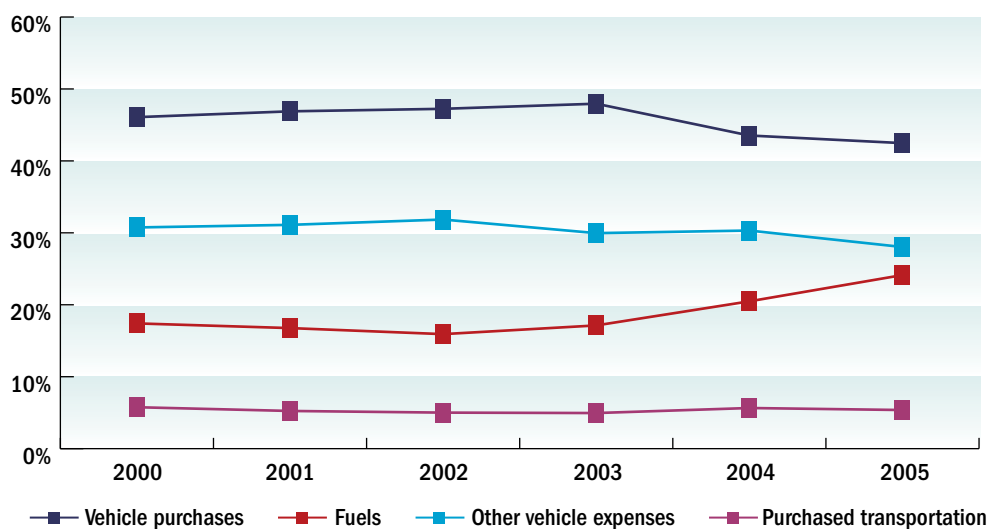
Table A.4 Spending in Average American Households Since 2000

	2000	2001	2002	2003	2004	2005
Food	5,158	5,321	5,375	5,340	5,781	5,931
Housing	12,319	13,011	13,283	13,432	13,918	15,167
Apparel	1,856	1,743	1,749	1,640	1,816	1,886
Transportation	7,417	7,633	7,759	7,781	7,801	8,344
Health	2,066	2,182	2,350	2,416	2,574	2,664
Entertainment	1,863	1,953	2,079	2,060	2,218	2,388
Other	7,393	7,737	8,111	8,155	9,215	9,982
All Expenditures	\$38,045	\$39,518	\$40,677	\$40,817	\$43,395	\$46,409
Percent Transportation	19.50%	19.32%	19.07%	19.06%	17.98%	17.98%

Source: Bureau of Labor Statistics, Consumer Expenditures Survey.

Examining what that amount of spending goes for provides further understanding. Overall, approximately 95% of household transportation spending goes to self-provided transport—the acquisition, use, and maintenance of family vehicles—as shown in Figure A.2. Only about 5% goes to purchased transportation, which includes anything one pays a fare or fee to use: air carriers, transit, taxis, intercity vehicles, cruise ships, etc.

Figure A.2 Main Transportation Spending Categories



Source: Bureau of Labor Statistics, Consumer Expenditures Survey.

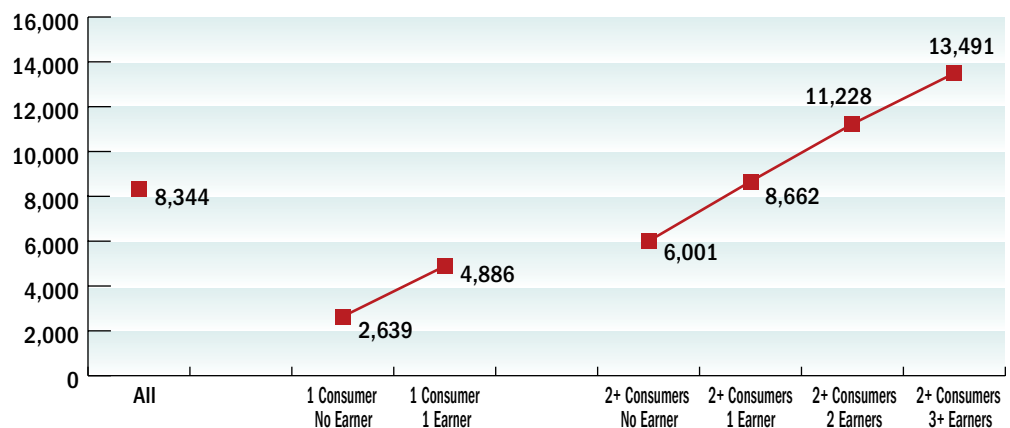
Note in the figure that vehicle purchases dropped off as fuel costs rose starting in 2003—a pattern that has occurred in the past and that may be the product of consumer restraint in buying or the purchase of lower-cost vehicles. The declines were stronger in used cars than new. If one thinks of an allotment of household funds for transportation, then rising expenditures for fuel will have to be compensated for by cuts elsewhere. Other vehicle expenses, which include insurance and repairs, dropped in concert.

Purchased transportation, which is about two-thirds air fares, is heavily related to recreational travel. Spending on air, other recreational travel, and auto rentals all dropped sharply after 9/11 but rebounded later in the period. These are household expenditures only and do not include any spending that is paid for by others, such as business or invited travel. Local transit usage accounts for about 10% of purchased transportation expenditures.

Transportation Expenditures and Earners

A key to understanding transportation expenditures is to recognize how close most spending is to being a product of the number of earners in a household. As expected, transportation expenditures rise with household income—but many do not realize that in most American households, rising income is in large part a function of the number of workers per household. Our highest-income 20% of households have four times the number of workers as our lowest-income 20%. This reality is reflected in their transportation spending. Figure A.3 divides households into one-person households and multiple-person households and then further groups them by number of workers present.

Figure A.3 Transportation Spending by Number of Earners per Household



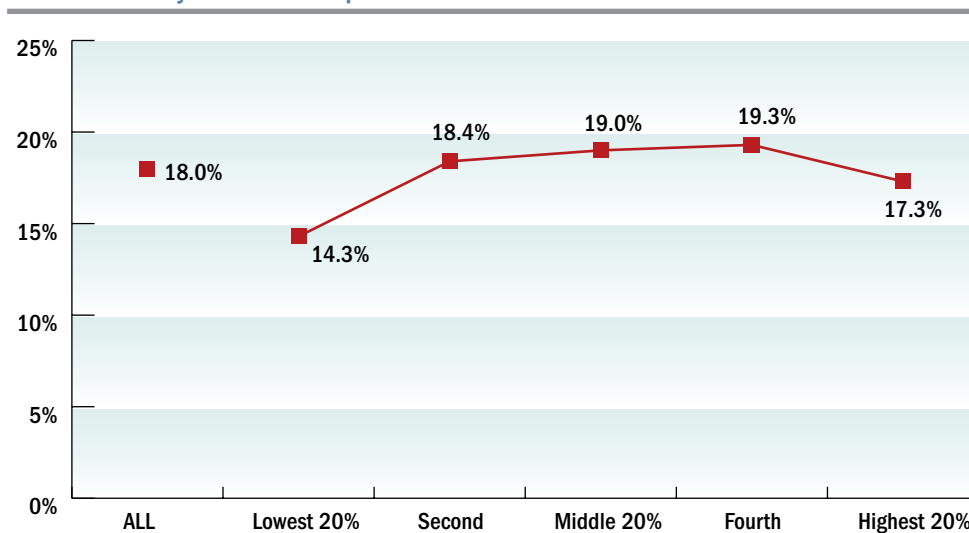
Source: Bureau of Labor Statistics, Consumer Expenditures Survey.

Spending is clearly a function of the number of persons and the number of earners in a household. In multiple-earner households, spending on transportation rises by roughly \$2,500 per year per earner. Perhaps more significant, the share of spending on transportation rises with increasing workers in the household, rising roughly one-half a percentage point with each additional worker, from 17.8% for multiple-person households with no workers to above 19.3% for those with three or more earners.

Transportation Expenditures and Incomes

It was noted earlier that incomes and number of earners were closely related in American households, so it is not surprising that absolute transportation spending and shares of spending rise with income up to the highest brackets before declining in percentage, as shown in Figure A.4. This belies the notion that Americans are somehow forced to spend money on transportation because of location—being forced to buy cars and travel long distances despite their preferences. Transportation spending is best understood, like expenditures on food, clothing, and particularly housing, as having a necessity component and a discretionary component. Certain fundamental spending is needed to sustain a reasonable living standard, but beyond that, as incomes rise, interest in spending continues to rise after the basics are achieved, whether for greater variety, quality, or quantity of foods, clothing, homes, or transportation.

Figure A.4 Percent of Transportation Spending of Total Household Expenditures by Income Group

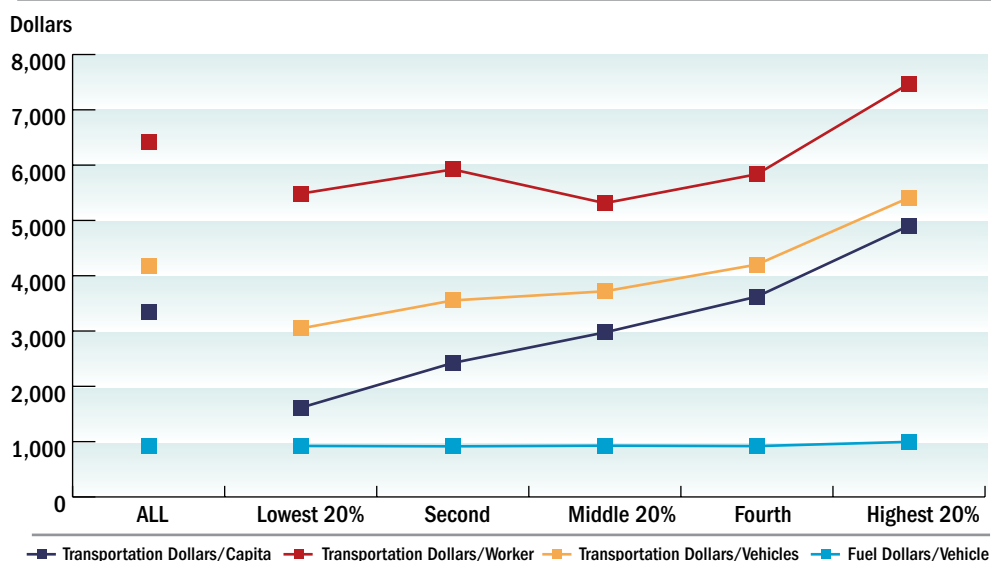


Source: Bureau of Labor Statistics, Consumer Expenditures Survey.

The average expenditure for transportation, given earlier as \$8,300 per year, is not particularly representative of any group. The range runs from about \$2,750 per year for the lowest 20% of households in income—or quintile—to almost \$15,700 in the highest—a multiple of about 5.7. That ratio is higher than the low-to-high ratio of about 4.7 for all expenditures; higher than housing and food, both at about 3.7; and about the same as entertainment, which is at 5.6. Air travel, for instance, has a ratio of 12.0 in spending between the highest and lowest quintile.

If spending by income group is controlled by major demographic factors, spending still rises, as in Figure A.5. Note that spending per capita and per vehicle rises with income, but spending per worker shows only limited increase, and there is almost no increase at all in fuel use per vehicle, with only the highest quintile about 10% above the average.

Figure A.5 Transportation Spending by Income Group



Source: Bureau of Labor Statistics, Consumer Expenditures Survey.

Transportation Expenditures and Other Factors

One of the ameliorating factors in transportation spending that is of great interest today is household location. Table A.5 compares spending and other factors for urban, suburban, and rural areas. Contrasting the central cities and rural areas reveals that city households spend about 85% as much as rural households on transportation, although their total spending is about 10% more. Although the numbers of persons and workers are about the same in all geographic areas, vehicle ownership is a dramatically different factor. One compensating factor is that rural households spend much less on transportation per vehicle—about \$3,000 on average contrasted to \$5,000 in cities, largely due to purchasing of used cars and trucks in rural areas. City dwellers spend much more per vehicle and for items such as insurance, tolls, and parking. As

expected, city dwellers spend much more on urban transit, at an average of \$102 per year compared to about \$4 for rural households. Suburban households are in between, at about \$34 per year.

Table A.5 Comparison of Spending for Urban, Suburban, and Rural Areas

	Central Cities	Suburban	Rural
Average Persons	2.4	2.5	2.5
Average Workers	1.2	1.4	1.3
Average Vehicles	1.5	2.1	2.6
Average Expenditures	\$41,687.0	\$49,748.0	\$38,486.0
Average Transportation Expenditures	\$6,935.0	\$9,038.0	\$8,150.0
Transportation Share of All Spending	16.6%	18.2%	21.2%

Source: Bureau of Labor Statistics, Consumer Expenditures Survey.

Perhaps the key to understanding the balance in spending is to compare the sum of transportation and housing expenditures for the respective areas. Although rural residents spend a much higher percentage of their expenditures on transportation, they spend a much lower percentage on housing. As a result, their total housing plus transportation spending is less than both city and suburban residents, at about 49% of spending contrasted to about 51% for both city and suburban dwellers. Because rural dwellers spend about 40% more on fuels than city dwellers, their lifestyles may be more affected by energy cost changes.

A final consideration is that of age, which will have important bearing on total national transportation expenditures and investment needs. There is substantial national interest and concern about the aging of the baby-boomer generation and its impact on the workforce and other national needs. One factor is savings and its relationship to expenditures. Those in their peak earning years, 45 to 54, spend about 78% of their incomes, the rest going to taxes and savings. In contrast, younger and older households tend to spend much more—about 97% more for those over 75 and more than 100% for those under 25. As incomes rise with age, transportation spending rises too, but not as fast, with the result that the share of spending going to transportation declines with increased age. As incomes drop with age, so does transportation spending, again with percentage declines in shares of spending. Spending doubles from the under-25 age group to the peak 45-to-55 group, but transportation spending only increases by 60% or so. Spending for transportation by those over 65 is about a one-third of spending in the peak years.

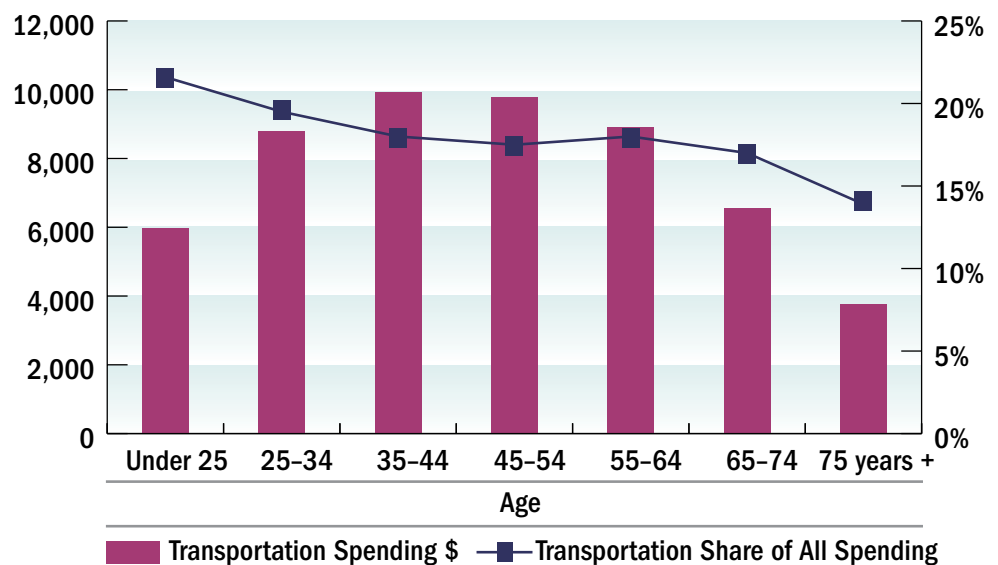
THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

Figure A.6 demonstrates this clearly, showing both the rise and fall of transportation spending with age and the continuous decline in transportation spending as a share of all spending. As discussed earlier, this is significantly related at this time to the number of earners per household, which starts at 1.4 earners per household in households under 25, rising to 1.7 in the peak earning years and declining to 0.5 in households over 65.

There already are signs that the current generation will continue to work longer than previous generations, with significant impacts on transportation spending, travel activity, and investment needs. The percentage of those over 65 at work has risen from 11.2% in 1990 to 12.7% in 2005. This will be a key factor in providing the worker pool for business and industry as well as a factor in congestion and transportation investment.

Figure A.6 Transportation Spending by Age Group
2005



Source: Bureau of Labor Statistics, Consumer Expenditures Survey.

B. Review of the Literature Assessing the Benefits of Transportation Investment

National and international transportation and economic studies, including anecdotal as well as sophisticated econometric research, have explored the benefits of transportation investments. For the macroeconomic research, analysts have formulated the national-level productivity-enhancing benefits of transportation infrastructure using complex statistical modeling.⁸⁸ Such macroeconomic models sometimes group all modes of transportation infrastructure into a single measure of public capital, including roads, rail, air, water, sewer, and seaports, while others look at single transportation modes.

Romp and De Haan (2005)⁸⁹ conducted a detailed international literature review that addressed the documented link between capital improvements in transportation and economic growth. The research found that overall there is a clear consensus on the benefits and positive impacts realized by public capital investment, but the precise magnitude of these impacts may vary by types of improvement and the maturity of a country's infrastructure.

The most notable U.S. empirical research was done by Professor Ishaq Nadiri for the FHWA.⁹⁰ His often-cited study demonstrates a statistically valid relationship between highway capital and industry productivity growth, which connects to overall growth in national productivity. The study examined the contributions of total highway capital and nonlocal highway capital to the output growth and productivity of 35 industry sectors that comprise the U.S. economy, providing empirical evidence of the positive benefits of public highway capital on private sector costs of production. For example, the study found relatively large cost reductions (associated with an increase in highway capital) in such industries as food and kindred products, trade, construction, and transportation and warehousing. In addition to a “productivity effect,” the study found an “output effect” resulting from the cost reductions. The cost reductions permit products to

88 Aschauer, D.A., Is Public Expenditure Productive? *Journal of Monetary Economics* (1989); Munnell, A.H., Why Has Productivity Growth Declined? Productivity and Public Investment. *New England Economic Review* (1990); Nadiri, I., and Mamuneas, T.P., *Contributions of Highway Capital to Industry and National Productivity Growth*. FHWA, Office of Policy Development, Washington, D.C., September 1996.

89 Romp, W., and De Haan, J., Public Capital and Economic Growth: A Critical Survey. EIB Papers, Volume 10, No. 1, 2005.

90 Nadiri, I., and Mamuneas, T.P., *Contributions of Highway Capital to Industry and National Productivity Growth*, FHWA, Office of Policy Development, Washington, D.C., September 1996.

be sold at lower prices, which, in turn, can be expected to lead to output growth. The cost-saving productivity gains from highway capital investments appear to “finance” a substantial portion of the higher total production costs associated with the output expansion effect. In essence, companies can use their budgets and available resources to produce larger quantities of output as a result of these productivity gains.

Nadiri showed that each dollar invested in the nation’s highways generated about 30 cents of production-cost savings to businesses per year over the life of the improvement—exceeding the initial investment in four years.⁹¹ Highway investments were estimated to contribute an average of 25% of total productivity growth nationwide during the Interstate era, and the average annual rate of return for highway investments was estimated at 16% nationwide, although returns were lower in later years as the network matured. Nevertheless, the overall contribution to society from national highway investment has been enormous over the life cycle of the Interstate and other nonlocal system investments.

As discussed throughout this report, good transportation is critical to the efficiency and reliability of industry supply chains and logistics operations. Recent efforts by the FHWA and U.S. DOT provide preliminary estimates of supply chain logistics effects resulting from transportation improvements. These effects represent “second order” benefits to businesses and can be measured as an additional economic benefit beyond traditional travel time and cost savings. Lower travel times and improved traffic conditions allow businesses to conduct their activities more efficiently, improve the productivity of the supply chain, and generally improve logistics and distribution. A FHWA study has estimated these additional benefits of highway-freight improvements to be 15% above direct user benefits.⁹² The U.S. DOT Freight Economic Guidebook⁹³ also provides similar calculations of the estimated supply chain benefits as a result of highway improvements. Specifically, the guidebook provides a detailed methodology for the estimation of first order and secondary benefits from large-scale freight improvements. First order benefits include the direct economic effects on shippers and receivers of goods, whereas second order benefits contain the productivity and cost advantages that may then affect entire industries or the economy overall. Estimated supply chain benefits as a result of a 10% transportation user benefits improvement, as shown in Table B.1, were generated based on a sample of real-world industry examples and vary by the type of business.

91 Nadiri, I., and Mamuneas, T.P., *Contribution of Highway Capital to Industry and National Productivity Growth*. U.S. Department of Transportation, Federal Highway Administration, Office of Policy Development, Washington, D.C., September 1996.

92 *FHWA Freight BCA Study: Summary of Phase II Results*. January 2004, http://ops.fhwa.dot.gov/freight_analysis/bca_study_phase2/index.htm.

93 *Guide to Quantifying the Economic Impacts of Federal Investments in Large-Scale Freight Transportation Projects*. Prepared for U.S. Department of Transportation, August 2006, <http://www.dot.gov/freight/guide061018/index.htm>.

Table B.1 Rough “First-Cut” Estimate of the Supply Chain Benefit from a 10% Transportation Improvement

Infrastructure Benefit	Supply Chain Impact	Supply Chain Benefit Expressed as % of Operating Costs	Supply Chain Benefit Expressed as % of Transport Costs
10% Transport Cost Reduction	Lower material cost by substituting farther cheaper sources	0.1%	1.5%
	Consolidate plants due to extended reach	0.2%	4.1%
	Switch modes and reduce shipment size, decreasing inventory	0.1%	1.2%
10% Capacity Increase	Less safety stock	0.1%	1.1%
	Rationalization of fleet and warehouse assets	0.01%	0.3%
Secondary Effects	Increasing service levels	Not quantified	Not quantified
	Converting cost savings into price reductions	Not quantified	Not quantified
	On-demand supply chains	Not quantified	Not quantified
		0.5%	8.2%

Source: Boston Logistics Group, Inc.

Note: These benefits are indicative and preliminary estimates only that are based on average companies in a broad cross section of industries, including many that have little transportation cost and do not move physical product. More precise estimates that are targeted at specific Supply Chain Types™ should be developed using the tools referenced throughout this text.

In a review for the U.K. government, Sir Rod Eddington⁹⁴ stressed the importance of transportation systems to the national economy and the threats to economic growth if the transportation infrastructure is not well maintained. Additionally, Eddington pointed out that there are significant benefits from improving transportation and reducing congestion and bottlenecks. In particular, he found that “a five percent reduction in travel time for all business travel on the roads could generate around 2.5 billion pounds of cost savings—some 0.2 percent of GDP.” The Eddington Study also highlighted that some effects are not captured at all in current project benefit/cost assessments. For some regionally significant projects, 30% to 40%, and potentially up to 50%, could be added to the benefits.⁹⁵ The research also stressed the importance of transportation networks and corridors to the productivity and success of metropolitan areas, in particular labor and product markets. Finally, it highlighted that transportation improvements are critical to trade flows and the competitiveness of a country’s exports and imports.

94 The Eddington Transport Study: The Case for Action: Sir Rod Eddington’s Advice to Government, Prepared for HM Department of the Treasury, U.K., December 2006, <http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtontstudy/>.

95 Ibid.

In related international research, Prud'homme and Lee⁹⁶ describe the link between transportation performance and the efficiency of urban areas. Economic productivity is directly linked to access to the labor force within an urban area. Transportation improvements improve the accessibility of both jobs and workers and directly benefit economic output. Specifically, a 10% increase in the size of the labor market results in a productivity and output increase of 2.4% according to the research findings. Linking this to transportation improvements, the study found that a reduction in travel time caused by an increase in travel speed of 10% leads to a 15% to 18% increase in the labor market size, thus benefiting both workers and regional economies.

In a study conducted as part of the National Cooperative Highway Research Program,⁹⁷ the cost of commuting in two urban areas, Chicago and Philadelphia, was assessed and related to access to labor in the study areas. The study showed that by reducing congestion and associated travel-time delays, business productivity can be improved. As a result of these productivity gains, labor costs could be reduced significantly. For the Greater Chicago area, these labor-cost savings were estimated to be \$350 million per year. In Philadelphia, the corresponding savings were calculated at \$200 million per year. The distribution of these benefits was not equal across each of the study areas. Rather, suburban areas with longer travel times showed a proportionally greater share of the economic benefits. In addition, the amount and distribution of productivity gains and labor-cost savings was dependent on the degree of substitutability of labor. In essence, labor that could easily be substituted, such as clerical and general service occupations, received the lowest cost savings, whereas specialized professions showed the largest cost and productivity impacts when congestion delays were eliminated.

A study⁹⁸ addressing the transportation needs of the Greater Portland, Oregon, area found that without adequate investment in infrastructure, the regional economy may lose 6,500 jobs and \$844 million in output annually by 2025. It was estimated that every dollar invested in transportation regionally provides an economic benefit of at least two dollars. In addition, the study considered the productivity impacts of transportation and how certain industries already have responded to worsening travel conditions. Some of the industry responses were as follows:

- Intel changed its chip shipment schedule in order to avoid peak-period congestion.
- Sysco Food opened a new regional food distribution center because the old central facility in Portland could not serve the entire area in a timely manner.
- OrePac increased inventory levels by 7% to 8% to account for congestion delays.

96 Prud'homme, R., and Lee, C-W, *Size, Sprawl, Speed, and the Efficiency of Cities*. November 1998.

97 NCHRP Report 463, *Economic Implications of Congestion*. 2001. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_463-a.pdf.

98 Economic Development Research Group, *The Cost of Congestion to the Economy of the Portland Region*. December 2005.

- Other companies are planning either to adopt changed delivery schedules or acquire new warehousing facilities in order to deal with the congested highway conditions.

These delays and congestion impact the cost structure of businesses and ultimately prices for consumers.

Transit Investments

Both economically and in terms of population growth, we have become an increasingly metropolitan country. By 2030, it is expected that the United States will become 90% metropolitan. Metropolitan areas are increasingly economic engines of national economies around the world. It has been estimated that the 100 largest metropolitan regions in the United States contribute 70% of the gross domestic product and have 69% of the jobs.⁹⁹ Historically, our most economically successful major metropolitan areas have been served by expansive, region-wide, high-capacity transit systems and services that have been critical to their economic success—New York, Chicago, Boston, Philadelphia, and San Francisco, to name a few. Large cities with well-established rail systems are clearly advantaged in terms of congestion costs, consumer costs, and traffic crash rates compared with cities that lack such systems.¹⁰⁰ Studies in Philadelphia, Chicago, and New York have shown that investments in transit provide a return as high as six to one to the overall regional economies.

As highlighted in the Portland study and similar international work, an important function of good transportation is expanding the effective size of a metropolitan region's labor market. Good access to workers is correlated with improved labor and business productivity.

Fortune magazine reports that “more than one-half of the nation's Fortune 500 companies, representing \$7 trillion in annual revenue, are headquartered in America's transit intensive metropolitan areas.” (Fortune 500 2006: Our Annual Ranking of America's Largest Corporations, *Fortune*, April 17, 2006.) Corporate leaders repeatedly testify to these notions:

“...the Texas Governor's Business Council estimated that solving the serious congestion problems in the State's eight largest metropolitan regions would generate \$540 billion in economic benefits.” (TTI, *Shaping the Competitive Advantage of Texas Metropolitan Regions: The Role of Transportation, Housing, and Aesthetics*, p. 19. Governor's Business Council, November 2006.)

99 U.S. Metro Economies, *Gross Metropolitan Product with Housing Update*. Prepared for the United States Conference of Mayors and The Council for the New American City by Global Insight in January 2007.

100 Litman, Todd, *Rail Transit in America A Comprehensive Evaluation of Benefits: Report Summary*. Victoria Transport Policy Institute, October 2004

THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

“Our goal is to relocate to a first-class project in a location that would be convenient for our customers and employees, with ready access to mass transit.” (Stuart A. Hall, President and CEO of Liberty Northwest, Portland, Oregon.)

The economic vitality and competitiveness of America’s metropolitan regions also is being reinforced through increasingly frequent proposals for “transit-oriented development.” It has become evident in a variety of settings that mixed uses and higher development densities around high-capacity transit services provide economic benefits as well as increased system attractiveness and use. The agglomeration of economic activity—businesses, workers, and customers—provides an impetus to economic growth by fueling business process enhancements and increased productivity, as well as raising revenues that local governments need to meet the full range of public services. New examples arise daily, including over more than 200 transit-oriented development (TOD) sites listed on the Denver Regional Council of Governments web site.

“Some of Denver’s biggest, hottest commercial real estate construction projects these days are located around new bus and rail stations. ‘I think the building right on the station will be very critical,’ said Peter Culshaw, executive vice president of Shea Properties, which is moving its Denver headquarters to a TOD location.” (Denver Business Journal, August 31, 2007.)

This realization drives the burgeoning interest of both business and political leaders to invest in high-capacity transit systems in major metropolitan areas around the country. The recent TTI State of Congestion report highlighted the importance of public transportation improvements, particularly in congested corridors and to serve major activity centers during times of the day when there are frequently no viable options to increase the capacity of the street and highway system for single-occupant vehicle travel. TTI concluded that if there had been no public transportation service and travelers used their cars, there would have been an additional 493 million hours of delay in the regions over one million population.

C. International Transportation Comparisons

C.1 Introduction

Over the last decade or so, the globalization of commerce and cultures has made the transportation industry, both freight and passenger, pivotal to most countries' economic growth—so much so that it has become respectable conversation in the mainstream of business and society. When viewed in conjunction with the value-added services that are needed to transport people and goods, the transportation sector generates \$3.5 trillion of revenue per year.¹⁰¹ The United States accounts for about 25% of that, or U.S. \$900 billion,¹⁰² but its dominance is fading. While U.S. economic growth hovers between 2% and 4% per year, China is galloping forward at 8% to 12% per year, and India, Korea, and other developing economies are not far behind. China will account for more of world consumption than the United States by 2009, and is producing an increasing amount of the world's production each year, while the U.S. share is decreasing. The rapid growth of China and other Asian countries, as well as burgeoning population and economies in other regions, are fueling demand for bigger and more sophisticated infrastructure to support transportation and logistics.

Inadequate infrastructure investment carries several undesirable side effects. The immediate effect is that the cost of logistics rises in a “rent-versus-buy” trade-off of paying now or paying later. The secondary effects are more subtle but more lasting and more dangerous. They include an erosion of a nation's long-term export competitiveness through higher costs, an inflation of the balance of payments deficit by making products less competitive and stimulating offshore manufacturing, and inequity between shippers and carriers and among carriers themselves due to a rising number of captive shipper situations.

101 Boston Logistics Group analysis of data from Datamonitor, Baird, and UPS. 2005 data.

102 Rodrigues, A., Bowersox, D., and Calantone, R., Estimation of Global and National Logistics Expenditures: 2002 Data Update. *Journal of Business Logistics*, Volume 26, November 2, 2005. The results are based on an econometric computation model that considers 29 variables capturing information regarding geographic region, income level, country size, economy level, and transportation (road, rail and air freight, and container port traffic).

The immediate effect of underinvestment is more costly transportation services. Congestion increases man-hours and fleet size requirements, and forces carriers to raise rates in order to remain profitable. However, the long-term impact of an inadequate transportation infrastructure is far more pernicious due to the secondary effects. Most significant, transportation costs can drive changes in the entire economic structure since they are involved in almost every aspect of the economy. In the words of David Canning of the Harvard School of Public Health, "Transportation infrastructure may have a profound impact on the extent of the market and the ability of producers to exploit economies of scale and specialization. Widening the market then brings benefits in terms of increased competition and contestability in markets. Transportation infrastructure also allows greater dissemination of knowledge and technology."¹⁰³

Expensive transportation also damages export competitiveness and exacerbates the already large deficit in the balance of payments. High international transport costs put a "double squeeze on domestic incomes," in the words of Andreas Kopp of the OECD/ECMT Transport Research Centre. They force exporters to reduce their product in order to offset the higher transport costs. Similarly, they make importers pay higher prices, which he likens to a 21% import tax. "Improving the transport infrastructure endowment of a country from a median position to the 25th percentile [theoretically leads] to an increase of trade volumes by 68 percent," he concludes.

Countries are becoming much more sophisticated about the importance of transportation and logistics infrastructure to their industry productivity and international competitiveness. The following section provides comparisons of transportation and logistics costs among countries based on various international sources documented at the end of this appendix.

C.2 International Comparisons of Transportation and Logistics Costs

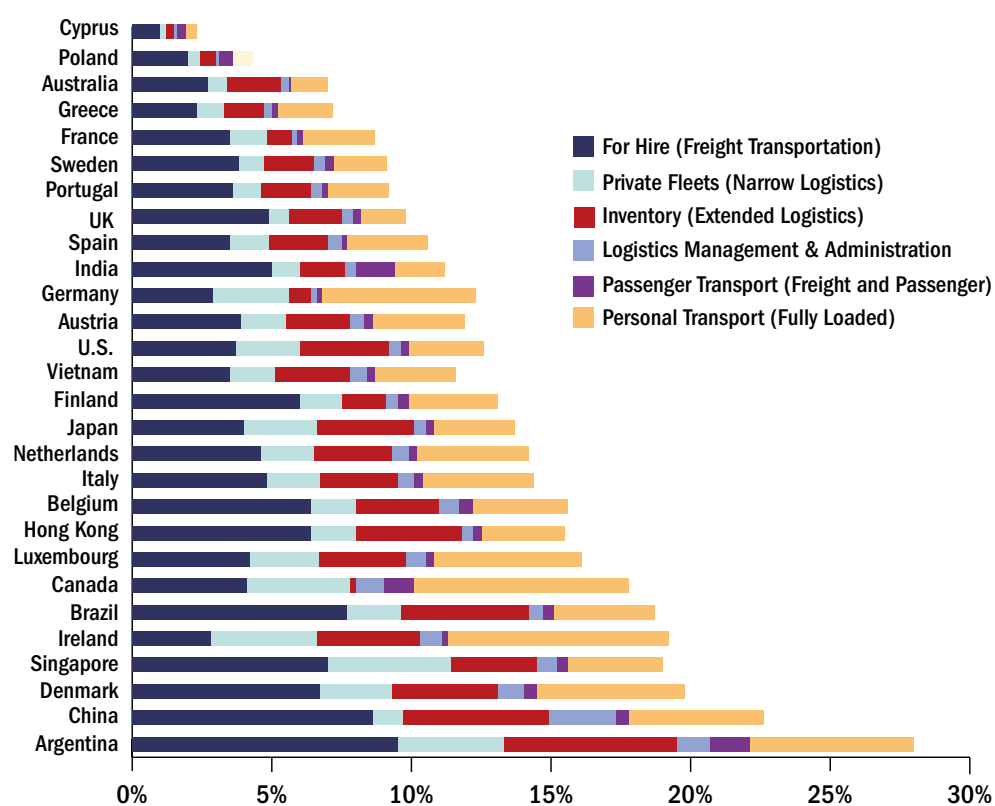
The United States spends more on transportation and logistics as a percentage of GDP¹⁰⁴ than countries such as Germany, Spain, and France. Transportation and logistics costs can be viewed as having six components: 1) for-hire transportation, which is often found in countries' national accounting data; 2) private fleets, which in the United States can now be identified through satellite accounts; 3) inventory costs, which depend on supply chain design, best practice logistics implementation, and interest rates; 4) logistics management and administration; 5) passenger transport; and 6) personal transport, which includes the expenses of individuals for their private transportation such as commuting.

103 Round Table Document No. 132.

104 Although this metric has come under some fire recently, especially when viewed over time, the United States can be compared at a point in time with other countries with similar economic structures. The Group of Eight, which regularly meets to discuss macroeconomic issues, can serve as a reasonable benchmark.

By this measure, the United States has a higher transportation and logistics cost than France and Spain in areas such as private transport costs and inventory. The United States also has a higher transportation cost than Germany, which has a similarly extensive roadway network (built around the same time as that of the United States). However, Germany's advantage relative to the United States seems to be offset by its "car culture," in which individuals spend more on personal transportation. The United States has a lower for-hire transport cost than the United Kingdom, but higher overall transportation and logistics costs, in part due to the United States' higher cost of private fleets (see Figure C.1).

Figure C.1 Transportation and Logistics Costs as a Percentage of GDP for Selected Countries



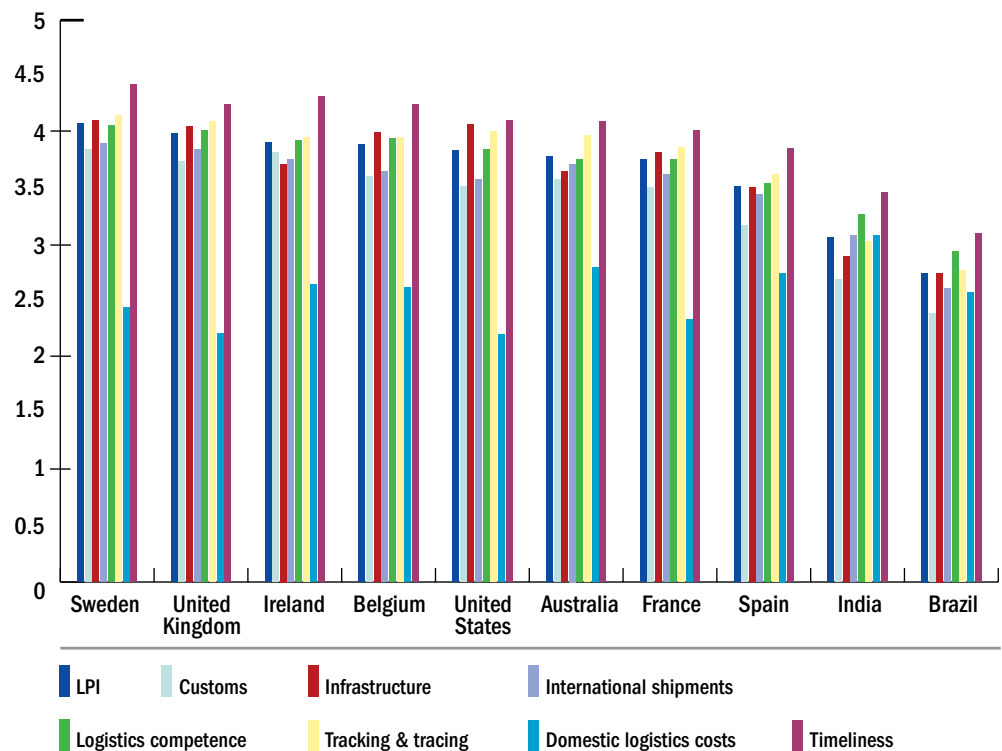
THE Transportation CHALLENGE

M O V I N G T H E U . S . E C O N O M Y

High transportation costs may “end up turning the clock back,” says Doug Duncan, President of FedEx Freight. “It is causing American businesses to become less competitive, and leading to smaller markets and smaller jobs.” Transportation costs must be seen in an international context due to today’s intense competitive pressures. Infrastructure is a competitive weapon that must be used, or it will be used against you. The consequences of having it used against you are stiff indeed.

Lest there be a myth that the United States is superior in its logistics infrastructure performance compared to other countries, look at the World Bank’s Logistics Performance Index in Figure C.2, which shows that on most indicators, the United States is just on par with many other developed countries, and it is only marginally better than Brazil.

Figure C.2 Comparative Logistics Performance Indicators



Source: World Bank.

Another measure of international comparison, referred to as the Access Index and developed under contract to FedEx, illustrates a nation's ability to compete in world markets.¹⁰⁵ The methodology considers 22 factors of physical and information access, including transportation, trade, and telecommunications. The top ten countries in the Access Index achieved an average GDP per capita growth rate of 22.6% in the last decade versus only 14.1% for the bottom ten scorers. Of concern is the fact that the United States does not even make the top ten, ranking 12th among 75 nations studied. The rankings are displayed in Table C.1.

Table C.1 **Top Access Nations**

1.	Hong Kong
2.	Singapore
3.	Denmark
4.	Switzerland
5.	Netherlands
6.	Finland
7.	Germany
8.	Sweden
9.	United Kingdom
10.	France
11.	Belgium
12.	United States
13.	Canada
14.	Austria
15.	Norway

Source: FedEx.

C.3 Other Countries Are Catching up Through Massive Infrastructure Investments

The United States historically has invested more in transportation infrastructure than other developed countries, compared to the size of their economies, because of its large physical area and transport intensity. But we should not be complacent because of past investments; other countries are charging ahead with massive investment programs. The United States currently is involved in only one of the top ten private transactions in the world (the Indiana toll road). France, Spain, and Korea each have two of the projects on the list. The rest are in South Africa, Australia, Canada, and Hungary (see Table C.2).

Europe has embarked on an ambitious infrastructure improvement program called TEN-T (the trans-European transport network), whose objectives are to “link island, peripheral, and landlocked regions with the Union’s more central regions through interconnecting and interoperable international networks by land, air, sea, and inland waterways,” according to Eurostat. The European Commission, through TEN-T, has prioritized 30 transportation infrastructure projects that will help achieve these objectives (see project list at end of this appendix).

Table C.2 Top Infrastructure Projects
Millions of U.S. Dollars

Project Name	Projected Value	Country
Abertis Acquisition of SANEF	10,000	France
APRR (Autoroutes Paris-Rhine-Rhone) Privatization	9,130	France
Indiana Toll Road	4,823	United States
Madrid Calle 30 PFI	3,709	Spain
Gautrain Rapid Rail Link	3,300	South Africa
Reliance Rail PPP	2,839	Australia
Budapest Airport Privatization	2,133	Hungary
Richmond Airport Vancouver Rapid Transit Project	1,660	Canada
South Korean Incheon Grand Bridge	1,600	South Korea
Bundang Railroad Project PFI	1,580	South Korea
Metro de Madrid PPP	1,470	Spain
Total	42,244	

Source: Infrastructure Journal database as quoted in “Infrastructure 2007” by the Urban Land Institute and Ernst and Young.

Italy is spending or budgeting about €7 billion to expand bullet train lines and freight transport capacity, according to the Urban Land Institute (ULI). Spain has allocated about \$4.4 billion to modernize and expand its ports. According to the ULI report, an additional \$7 billion will go toward improving airports, including large-scale expansions for Madrid and Barcelona, which serve many connecting international passengers. England just invested £1.6 billion to improve local transport “To put right decades of under investment,” Transport Secretary Alistair Darling announced in December 2005.¹⁰⁶ France spends 20 times more per capita on railways than the United States does, according to the ULI.¹⁰⁷

Europe is not alone. Less-developed economies have been ramping up their investment in transportation infrastructure. Although they invest less as a percentage of their GDP, developing countries have been investing dramatically in infrastructure over the last five years.

China and developing countries have gotten extensive support from the World Bank. In Shanghai, the Yangshan container port is adding major new capacity to a fast-emerging world container port city.¹⁰⁸ India and China received 39% of the World Bank’s transportation lending during the 2001 to 2006 period, while Brazil, Indonesia, Argentina, and Vietnam also were substantial recipients.¹⁰⁹ Seventy-three percent of this money funded investments in roads, and 8% percent went to railways.¹¹⁰ South Asia’s percentage of the total commitments is declining, however, as Central Asia’s (India’s) percentage rose dramatically over the period.¹¹¹

China built a 25,000-mile highway in 12 years and increased the mileage of the subway in Beijing from 70 to 335 miles in under a decade, according to the ULI report.¹¹² It has connected downtown Pudong and Shanghai’s international airport by an eight-minute trip on a train traveling up to 270 miles per hour. In addition, China has just completed a \$4.2 billion rail line between Beijing and Lhasa in Tibet. Taiwan just completed a \$15 billion high-speed line between Taipei and the southern port of Kaohsiung, reducing travel time from four hours to 90 minutes, according to the same report.

India is close to finishing a \$12 billion national ring road connecting major cities. Its government has identified \$22 billion of investment needed for new ports and is building a \$500 million container terminal in Kochi, a southwestern city. In addition, a \$430 million privately managed international airport is scheduled for completion in

106 UK Department for Transport News Release (132) via the Government News Network., December 14, 2005.

107 “Infrastructure 2007.” The Urban Land Institute (ULI) and Ernst and Young.

108 CargoNews Asia. November 6, 2007.

109 Table 3.1: IBRD/IDA Commitments for Transport (billions of dollars): Share of Top 5 and Top 10 Countries, Fiscal 1995-2000 and Fiscal 2001-2006 (World Bank: A Decade of Action in Transport).

110 Table 3.3: IBRD/IDA Commitments for Transport (billions of dollars): Distribution by Transport Mode, Fiscal 1995-2000 and Fiscal 2001-2006 (World Bank: A Decade of Action in Transport).

111 Figure 3.3: Trends in IBRD/IDA Commitments for Transport by Region (World Bank: A Decade of Action in Transport).

112 The rest of the Asian investment examples in this section come from the ULI Infrastructure 2007.

Bangalore next year, and large-scale expansions and facelifts also are under way at the Mumbai (\$515 million), Delhi (\$600 million), and Hyderabad airports.

Singapore's latest project involves construction of the airport's third terminal. Korea has ten highway projects under construction, mostly serving congested Seoul, which houses about 25% of the country's population. The government plans to build a new \$50 billion capital city 90 miles southeast of Seoul to help relieve congestion around the current capital.

Canada and Australia have lagged behind. Australia now spends one-half the amount on infrastructure it did between 1970 and today (it has decreased from 7.2% of GDP in 1970 to 3.6% today). Various levels of government in Australia collectively agree on the need for \$100 billion in new infrastructure investments. Canada's infrastructure deficit will total \$300 billion Canadian dollars through 2025, according to ULI.

C.4 Supporting Information for Transportation and Logistics Costs as a Percentage of GDP

Methodology

Boston Logistics Group researched and analyzed transportation operating expenses as a percentage of GDP for 28 countries.

For the purpose of reaching results with higher analytical value, "transportation" was divided into six categories: for-hire (freight transportation), private fleets (narrow logistics), inventory (extended logistics), logistics management and administration, passenger transport (freight and passenger), and personal transport (fully loaded).

Findings

More developed economies spend less on transportation because they operate more efficient transportation systems. On the other hand, some countries have a weaker understanding of logistic cost minimization, such as economies still under development. For example, India's spending on logistics industry is much higher than that of developed economies like the United States (9.5%) and Japan (10.5%).

Larger and underdeveloped countries tend to spend more on transportation—larger countries because distances are longer, and less-developed economies because their production facilities, which are often fixed locations such as mines, cannot be moved, so material must be transported across the rest of the country, or exports arrive in one region where better transportation infrastructure has been installed and have to be transported across regions.

Hub countries have higher transportation costs as a percentage of GDP since their economic activity largely consists of transportation-related industries. For example, Singapore is a major Asian transportation hub, strategically lying on major sea and air trade routes. Its history has been closely tied to the growth of its transportation industry since the establishment of its port. The transportation industry comprises over 10% of Singaporean GDP despite an increasingly diversified economy. The Port of Singapore, managed by port operators PSA International and Jurong Port, was the world's busiest port in 2005 in terms of shipping tonnage handled, with 1.15 billion gross tons handled, and in terms of containerized traffic, with 23.2 million 20-foot equivalent units (TEUs) handled. It was also the world's second busiest in terms of cargo tonnage, coming behind Shanghai with 423 million tons handled. In addition, Singapore is the world's busiest hub for transshipment traffic and the world's biggest ship refueling hub.¹¹³

Inventory-carrying costs are usually higher in less developed economies. Since moving goods through borders takes longer than the time warranted by the infrastructure, vehicle, or physical constraints, managing this risk either through increased inventory holdings or alternative modal choices adds to the already substantial logistics costs in developing countries. Anecdotal evidence indicates that in many less-developed countries, the business sectors (such as supermarkets) maintain high inventories (three months or more is frequent in landlocked countries) compared with their peers in advanced countries.

113 http://www.k12academics.com/singapore_transport.htm.

Sources

Argentina

- Source: Guasch, J.L. 2002. “Costos Logísticos y su Impacto y Determinantes en América Latina y el Caribe.” Banco Mundial, Washington, D.C. Procesado.
- Freight revenues include some unspecified amount of passenger transport revenue.
- For-hire, private fleets, inventory and passenger transport:
 - ◆ Assumption, based on syllabus from Universidad Argentina de la Empresa.
 - ◆ Based on the unclassified amount (9.4%).
 - ◆ Includes an unspecified amount of passenger transport revenue.

Australia

- Source: Australian Government, Department of Transport and Regional Services, Bureau of Transport and Regional Economics. Australian Transport Statistics 2007, page 5, 2007.
- Government-collected data.
- Calculation of transportation costs relates to transport-specific business, excluding transport activity performed by other businesses and the value of noncommercial transport activities.
- Transportation costs include storage costs.

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK

- Source: Diekmann, Achim. *The Impact of Transport on the EU Economy*, page 12. July 20, 2005.
- Private fleets and personal transport are considered to be “virtual,” according to Diekmann.
- “Virtual” transport was split 50/50 between private fleets and personal transportation.
- Inventory and logistic management transportation values were estimated based on overall countries average.

Brazil

- Source: COPPEAD—URFJ. *Custos Logísticos no Brasil*, page 4. 2006.
- National statistics do not appear to include private fleets, passenger transport, and personal transport.
- Private fleets, passenger transport, and personal transport values were estimated based on overall countries average.

Canada

- Source: Transportation in Canada 2002. *Transportation and the Economy*. http://www.tc.gc.ca/pol/en/Report/anre2002/2H_e.htm.
- Freight revenues include some unspecified amount of passenger transport revenue.
- Passenger and personal transport numbers in the source document were inconsistent, but we use page 6 (percentage of provincial final domestic demand). Deducts “personal expenditures on commercial transport,” which we assume to be passenger traffic.
- The logistics management and administration value was estimated based on the overall countries average.

China

- Source: Boston Logistics Group.
- Private fleets: Chinese statistics provide no itemization. We conclude that they are all-inclusive except for passenger and personal transport.
- Passenger and personal transport values were estimated based on the overall countries average.
- Private fleets: based on the assumption that 11% of Chinese third party logistics firms being privately owned is analogous to 11% of fleets being privately operated.

Cyprus

- Source: Eurostat.
- Source includes “Total General Government Expenditure”; we assume this covers both freight and passenger transportation.
- Freight revenues may include an unspecified amount of passenger transport revenue.
- Private fleets, inventory, logistics management, and personal transport values have been estimated from overall countries’ average.

Hong Kong

- Source: Hong Kong Government web site, National Income Branches (1) and (2) and Census and Statistics Department. (Enquiry Telephone No.: 2582 5077) http://www.yearbook.gov.hk/2003/english/append/app6_1.html.
- For-hire, inventory, and logistics management estimated based on Brazil.
- Private fleets, passenger transport, and personal transport values are estimated based on countries average.

India

- Source: Operations Evaluations Department, Asia Development Bank; *Transport Sector in India—Focusing on Results*, page 3, June 2007. <http://www.oecd.org/dataoecd/54/27/39066399.pdf>.
- Assumption that government expenditure found in source covers both for-hire and passenger transport.
- Source value was split between for-hire and passenger transport based on values from Eurostat countries, since Eurostat source article consisted of the same two types of transportation.
- For-hire does not differentiate between public and private.

Japan

- Source: MarketResearch.com, *Indian Logistics Industry Surface Transport*. May 5, 2007. <http://www.marketresearch.com/product/display.asp?productid=1491766&g=1>.
- Assumption: In the source article there is a comparison to U.S. logistics cost at 9.5%, so this number must include all the same elements as in the State of Logistics Report (for-hire, private fleet, inventory, and logistics management).
- Passenger transport and personal transport values were estimated based on overall countries average.

Poland

- Source: Eurostat.
- Source includes “Total General Government Expenditure”; we assume this covers both freight and passenger transportation.
- Freight revenues may include some unspecified amount of passenger transport revenue.
- Private fleets, inventory, logistics management, and personal transport values have been estimated from overall countries’ average.

Singapore

- Source: Business Monitor International, *The Singapore Freight Transport Report*. <http://www.businessmonitor.com/freight/singapore.html>.
- Not clear whether private fleets were included.
- For-hire, private fleets, and logistics management were estimated based on U.S. values.
- Inventory, passenger, and personal transport were estimated based on overall countries' average.

United States

- Source: Wilson, Rosalyn, *18th Annual State of Logistics Report*. June 6, 2007. National Press Club, Washington, D.C.
- For-hire and private fleets value split based on AASHTO Transportation and the Economy, page 14, 1998.
- Passenger and personal transport values were estimated based on overall countries' average.

Vietnam

- Source: <http://www.marketresearch.com//.asp?productid=1491766&g=1>.
- Inventory and personal transport were estimated based on overall countries' average.

TEN-T Priority Projects

1. Railway axis: Berlin-Verona/Milan-Bologna-Naples-Messina-Palermo
2. High-speed railway axis: Paris-Brussels-Cologne-Amsterdam-London
3. High-speed railway axis of southwest Europe
4. High-speed railway axis east
5. Betuwe line
6. Railway axis Lyons-Trieste-Divaca/Koper-Divaca-Ljubljana-Budapest-Ukrainian border
7. Motorway axis Igoumenitsa/Patras-Athens-Sofia-Budapest
8. Multimodal axis Portugal/Spain-rest of Europe
9. Railway axis Cork-Dublin-Belfast-Stranraer
10. Malpensa airport
11. Øresund fixed link
12. Nordic triangle railway/road axis
13. United Kingdom/Ireland/Benelux road axis
14. West Coast main line
15. Galileo
16. Freight railway axis Sines/Algeciras-Madrid-Paris
17. Railway axis Paris-Strasbourg-Stuttgart-Vienna-Bratislava
18. Rhine/Meuse-Main-Danube inland waterway axis
19. High-speed rail interoperability on the Iberian peninsula
20. Fehmarn belt railway axis
21. Motorways of the sea
22. Railway axis Athens-Sofia-Budapest-Vienna-Prague-Nuremberg/Dresden
23. Railway axis Gdansk-Warsaw-Brno/Bratislava-Vienna
24. Railway axis Lyons/Genoa-Basle-Duisburg-Rotterdam/Antwerp
25. Motorway axis Gdansk-Brno/Bratislava-Vienna
26. Railway/road axis Ireland/United Kingdom/continental Europe
27. "Rail Baltica" axis Warsaw-Kaunas-Riga-Tallinn-Helsinki
28. "Eurocaprail" on the Brussels-Luxembourg-Strasbourg railway axis
29. Railway axis of the Ionian/Adriatic intermodal corridor
30. Inland waterway Seine-Scheldt



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