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As the economy of the United States has shifted from a rural agrarian economy to an urban industrial economy, and now to a global information and services economy, the nation's transportation system has responded. The U.S. transportation system today is one of the most extensive and efficient in the world, providing a level of mobility that would have been unthinkable two generations ago. However, the current U.S. transportation system is not only showing its age, but also showing that it lacks the capacity to handle the volume of people and goods moving today. The U.S. transportation system must adapt to meet the needs of an evolving and increasingly complex 21st century global economy.

This report examines the relationships between transportation investment and long-term economic productivity, growth, and competitiveness. It highlights the manner in which the U.S. and global economies are changing, how different sectors of the economy depend on transportation, the increasing demands they are putting on intermodal transportation systems, and how present-day transportation systems are performing in response to these new demands. Finally, it reviews emerging national policies and programs directing transportation investment.

The major findings of the study are as follows:

1. The U.S. economy is experiencing a fundamental transformation that has important implications for freight and passenger transportation.

Changing National and Global Economies

The U.S. economy is experiencing a fundamental transformation. The economy has grown rapidly—from a $2.7 trillion economy in 1980 to a $13.2 trillion economy in 2006—and the size of the economy will more than double over the next 30 years.

The economy is increasingly a services-based economy, less dependent on natural resource production and manufacturing and more dependent on information, technology, and creativity. Services now account for about one-half of all jobs and more than one-half of the economic output of the U.S. economy.

The economy is becoming more global: less dependent on local and regional suppliers and markets and more dependent on national and global suppliers and markets. Historically, the U.S. economy has not been heavily dependent upon international

trade; however, the value of U.S. imports and exports is forecast to increase from the equivalent of 28% of U.S. gross domestic product (GDP) in 2006 to the equivalent of 37% by 2015, and to the equivalent of 60% by 2030.

However, even as the U.S. economy continues to grow robustly, other countries, particularly the developing parts of Asia, are seeing their economies expand more quickly and are offering formidable competition to the United States. 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.

These changes, as well as others, are reshaping freight and passenger transportation.

Changing Freight Transportation

The freight transportation system has been adapting to the new U.S. economy. Total logistics cost expressed as a percentage of GDP declined from a high of about 16% in 1980 to a low of about 8.6% in 2003, reflecting improvements in the transportation system as well as declining interest rates. However, total logistics costs rose to 9.9% of GDP in 2006. Deteriorating transportation reliability may have accounted for one-third of the increase in inventory carrying costs—a major component of total logistics costs—between 2005 and 2006.

The United States is spending more on transportation logistics as a percentage of its GDP than rapidly developing India and other developed economies such as the United Kingdom, France, and Australia. Freight shippers and carriers are worried that the productivity of U.S. freight systems may continue to drop. 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."

As we look to the future of freight transportation, we expect the following:

- The demand for freight transportation will nearly double by 2035, pressing the capacity of the nation's water, rail, highway, and air freight transportation systems.
- Businesses will continue to create on-demand supply chains, replenishing what the customer consumes as soon as it is sold. Industries that once would hold large

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inventories of products and tolerate delays in the receipt of goods are reducing inventories to keep costs down. This means new pressures on freight carriers to deliver goods reliably and cost-effectively.

- Businesses will buy from more global suppliers and sell to more global markets. 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.

- Businesses will be operating closer to the edge, becoming more dependent on carefully timed and reliable freight transportation to keep parts flowing to plants and finished goods flowing to retail stores. When the freight transportation systems fail, hundreds of shippers, carriers, and markets across the nation and the world are affected.

Changing Passenger Transportation

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."

Congestion threatens employers and area economic development. Rising housing costs continue to push workers out of central areas, increasing commute times and costs. On average, 30% of workers now leave their home counties to commute to work, compared to fewer than 24% in 1990.

As we look to the future of passenger transportation, we expect the following:

- Approximately one-half of the U.S. population is expected to be living in metropolitan areas of more than five million people by 2035.

- Regional economists expect that clusters of metropolitan areas functioning as economic "megaregions" will increasingly be the basic blocs of economic competition in the coming decades. 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 that depend critically on good transportation infrastructure. Serving the personal and public transportation needs of people in

these metropolitan areas and megaregions will be a major factor in ensuring the productivity of these areas.

- Long-distance travel for both business and personal purposes will grow dramatically. There will be greater competition between air and auto travel for intermediate-length trips (250 to 500 miles). In a few high-density corridors such as the Northeast Corridor, high-speed rail is likely to become a reality.

- Recreation and tourism will grow. The tourism industry believes that the United States could capture a larger portion of the international tourism market if the capacity and performance of U.S. aviation and ground transportation systems can be improved.

2. Transportation infrastructure capacity is more vital than ever to the success of U.S. industries.

Five major economic sectors account for 84% of the U.S. economy. Four—services, manufacturing, retail, and agriculture and natural resources—are among the largest users of transportation. The fifth—the transportation sector itself—is a provider of transportation equipment and services. Each of these sectors faces unique challenges, but the common transportation issues are as follows:

- **Congestion**—primarily on the highway network—is making it difficult and costly for businesses to reach suppliers, workers, and customers and draining the economy. 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."

- Deteriorating **reliability** poses challenges to on-demand supply chains.

- If transportation and logistics **costs** continue to rise as a percentage of GDP, U.S. producers could be less competitive in global markets.

Expanding demand and shrinking capacity for both freight and passengers across all modes of transportation are intensifying concerns about congestion, reliability, and costs in the future.

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Services Sector

The services industry is the dominant U.S. industry in terms of employment (48% of the U.S. total) and contribution to economic output (51% of the U.S. total).

In general, economic productivity is directly linked to access to the labor force within an urban area; this is especially relevant in the services sector. The benefits of centralizing services are being eroded by the costs imposed by congestion in major metropolitan areas. Traffic congestion imposes heavy costs on service industry workers and customers because service delivery is concentrated in metropolitan regions.

Service sector employers must reach farther out and pay more to attract and hold skilled workers. Businesses have to build smaller service centers and disperse them to compensate for congestion that prevents workers and clients from reaching centralized facilities. The productivity of employee business travel is at risk, whether driving within congested regional sales territories or flying long distances and being subjected to increased aviation delays.

Transportation improvements increase the accessibility of both jobs and workers and directly benefit economic output. A 10% increase in the size of the labor market results in a productivity and output increase of 2.9%, according to international 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, benefiting both workers and regional economies.

Manufacturing Sector

Despite the shift to a services economy, the United States remains the largest manufacturing country in the world, accounting for about one-quarter of total global production. Today, U.S. manufacturers produce high-value advanced electronics, medical equipment, and biopharmaceuticals that keep the United States at the forefront of cutting-edge technologies and modern production processes. This sector provides 10% of the nation's jobs while generating 12.1% of GDP.

Manufacturers are concerned that congestion, deteriorating travel-time reliability, and escalating costs are slowly but steadily offsetting the savings gained from their global supply networks.

Highway congestion in major metropolitan areas and along intercity corridors is forcing costly changes in manufacturing logistics. Shippers are adding more trucks and drivers, sending them on longer alternative routes, paying for additional night and weekend deliveries, and increasing the use of forward stockpiling just to ensure the delivery of the same volume of goods. The ability of U.S.-based manufacturers to hold onto and control the highest value-added manufacturing and assembly operations is especially at risk.

The projected growth in both international and domestic traffic also raises concerns about rail congestion and reliability along the most heavily traveled rail corridors and at major rail hubs such as Chicago. Although rail volumes were down in 2007, the rail industry spent about $10 billion in 2007 on capital projects in anticipation of future traffic growth, and an increasing portion of capital budgets is devoted to logistics hubs at inland locations, according to the *Journal of Commerce*.

In the marine transportation system, capacity constraints at major ports are forcing importers to disperse shipments through multiple ports instead of moving all their shipments through the nearest port. Many chemical and other manufacturers depend on barges operating along the nation's inland waterway system to carry heavy, bulky, and low-value-per-ton commodities. They point to the lack of maintenance on the inland waterway system and to chronic outages that slow shipments as locks are fixed and rivers are dredged. These service outages can be sudden, giving manufacturers little time to find alternatives.

Retail Sector

The retail industry is made up of establishments that sell merchandise. It is the second-largest industry in the United States, after services, when measured in terms of employment and number of establishments. Retail sales in the United States (excluding food) reached $3.9 trillion in 2006. Retail accounts for 7% of U.S. GDP and about 11% of U.S. jobs. Retail sales growth has remained relatively steady over recent decades, but the industry has undergone a significant transformation with the establishment of large national retail chains, outsourcing of manufacturing, and use of the Internet as a sales channel.

Retailers are concerned about increasing delivery times due to metropolitan congestion, which makes it more difficult to ensure that they have the right products

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on the shelves at the right time. As one of the country's largest employers, retailers also are very dependent on local public transit services to bring workers to their jobs, often to locations within the most congested downtown and suburban areas.

Nearly 40% of all U.S. containerized imports—much of it goods destined for retail stores—enter the country through the ports of Los Angeles and Long Beach in Southern California. Port congestion and the risk of interrupted supply chains are constant concerns. To mitigate risk and better reach the populous eastern U.S. market, some retailers are dividing their imports of consumer merchandise more equally between the Pacific and Atlantic Coasts. There are limits to that strategy because of longer routing and travel times as well as constraints on the size of ships that can be moved through the Panama Canal from Asia to the East Coast.

Agriculture and Natural Resources Sector

Agriculture and natural resource producers depend on efficient, reliable, and low-cost transportation to move U.S. agricultural commodities to key gateways for export. How well transportation functions in the future will determine how well the agriculture and natural resources industry competes in overseas markets.

For decades the United States has been the breadbasket to the world, exporting huge volumes of grain and meat to countries with inadequate tillable land or inefficient agricultural sectors. However, the U.S. market share has diminished as 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.

The agriculture and natural resources sector accounts for 1.9% of the nation's jobs, but generates 4.3% of GDP. 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. Industry experts fear that the United States will become a net importer of agricultural products in coming years.

Metropolitan congestion is impacting construction suppliers. Concrete and stone are critical to the construction of roads. As the movement of freight becomes less efficient due to congestion, the expense of rebuilding infrastructure goes up.

U.S. growers depend heavily on rail transportation to move heavy and bulky agricultural commodities from inland farms to coastal ports. Rail capacity is getting tighter because of increases in domestic intermodal traffic and other commodity demands on the rail networks. After decades of rate reductions following deregulation, rail rates have begun to rise, although they are 55% lower (in real dollars) on average than in 1981. Nonetheless, agriculture and natural resource producers are concerned that increased transportation prices may make them less competitive in global markets.

Port access and throughput are not improving fast enough to keep costs down and meet seasonal demands for the movement and export of agricultural commodities. Industry representatives noted, as an example, that there can be a three- to five-hour wait to access port terminals in Houston. The nation's aging lock and dam system also was mentioned as affecting system capacity and reliability.

Transportation Sector

The transportation service providers—motor carriers, railroads, air carriers, steamship operators, public transit agencies, and distributors—play an enormous role in the economy, whether carrying people to work, school, or recreation; 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 completely dependent on the connectivity, speed, throughput capacity, and reliability of the infrastructure that comprises the U.S. transportation network. 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 shippers and the people they serve.

- 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 the added time and operational expenses (e.g., fuel consumption, vehicle wear and tear, driver costs) of sitting in traffic.

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- The excess rail capacity that was available 20 years ago has been absorbed by increasing freight and passenger rail demand. The railroads are adding new capacity, using longer trains, and introducing more reliable scheduled services, but the cost of adding new tracks, signal systems, tunnels, and bridges is high, and many rail corridors and hubs are at or nearing capacity.

- Access to many ports 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 these ports must routinely dredge and deepen their harbor channels and pier areas to maintain access.

- Nearly 50% of the 257 locks on the more than 12,000 miles of inland waterways operated by the U.S. Army Corps of Engineers are functionally obsolete. Reliability is becoming an increasing problem for users; chronic outages slow shipments as locks are repaired and rivers are dredged.

- The U.S. aviation system was once the envy of the world, but today severe congestion at major airports such as Atlanta, Chicago, Philadelphia, and all three major New York City–area airports causes backups that ripple across the national air system.

It is not surprising that the transportation services industry echoes many of the concerns mentioned by the industries that use them.

3. A well-designed, interconnected transportation network with adequate capacity and efficient management has significant economic and social benefits.

Investments in transportation have clear, measurable benefits to the economy and society. Both international and domestic studies find that public investment in regionally and nationally significant transportation projects offers rates of return equal to or exceeding private rates of return. Moreover, studies suggest that we are underestimating the industry logistics and trade benefits of these investments.

The Eddington Study in the United Kingdom, probably the largest single study ever undertaken on this topic, reports that on average a 10% increase in public capital infrastructure stock increases overall GDP by about 2%. The study concludes

that the case for transport investment is compelling, even after taking account of environmental effects. The study further concludes that investments targeted at 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.

U.S. studies make the case as well. Research on the relationship between investment in highways and industry economic growth rates done by Professor Ishaq Nadiri of New York University for the Federal Highway Administration found that each dollar invested in the nation's highways generated about 30 cents of production cost savings per year to businesses over the life of the improvement—generally exceeding the initial investment in four years. 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, with lower returns in later years as the network matured.

In a study conducted as part of the National Cooperative Highway Research Program (NCHRP), the cost of commuting in two urban areas, Chicago and Philadelphia, was assessed and related to the 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.

A study 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. 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.

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4. It is time to end business as usual.

The United States as a nation must stop underinvesting in transportation infrastructure and operations.

Continued underinvestment and business-as-usual transportation infrastructure policy and planning will have a detrimental impact on the ability of the United States to compete in the current and future world economy. The large national backlog of needed capacity improvements is a critical factor affecting declining transportation performance.

The recent Transportation Research Board (TRB) report, Future Financing Options to Meet Highway and Transit Needs, estimates that the annual gap across all levels of government between the current level of spending on transportation and the level needed to maintain highway and transit system performance is $58 billion per year. The gap to improve performance is $119 billion per year. A related TRB study highlights the need to maintain and invest in a 21st century Interstate system as the backbone of the nation's intermodal system.

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. The Association of American Railroads estimates that an investment of $148 billion in expansion of rail freight infrastructure is needed just to keep pace with economic growth and ensure that the freight railroads can carry the volume of freight forecast for 2035. The nation's air traffic control system faces a multiyear overhaul; the Federal Aviation Administration plans to invest $4.6 billion over the next five years alone, and estimates that at least $41 billion must be invested in airport infrastructure over the same period. A comprehensive modernization of the inland waterway system to increase reliability and efficiency would require billions in infrastructure investments over the next 20 years.

Postponing investment is increasing the cost of transportation investments. The American Association of State Highway and Transportation Officials (AASHTO) estimates that between 1993 and 2015, construction costs will increase more than 70%. To restore the purchasing power of the highway and transit programs, revenues must be increased to match the increase in costs. For highways, AASHTO estimates 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 that could address the anticipated shortfall in Highway Trust Fund revenue in 2009 are being considered by the Senate Finance Committee, but to sustain the highway and transit programs beyond 2009, substantial additional new revenue will be needed. AASHTO estimates that an increase of three cents in fuel taxes or its equivalent will be needed in 2009 to sustain funding levels, and an additional seven-cent increase will be needed between 2010 and 2015 just to restore the program's purchasing power.

The just-released report of the National Surface Transportation Policy and Revenue Study 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. We are spending less than 40% of this amount today." Among other revenue proposals, the 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.

Freight and passenger transportation infrastructure management and investment must evolve to support the changing economy.

Freight Transportation System

Freight shippers and carriers are worried that deteriorating freight system performance is putting the productivity of the nation's freight systems at risk. Logistics costs are rising and reliability is declining, undermining future domestic economic productivity, international competitiveness, and economic growth.

Whether the need is for improved freight corridors, expanded capacity at international trade gateways, more efficient intermodal transfer facilities, or better intermodal connections to ports and railroads, new sources of revenue for surface transportation systems are needed in addition to the Highway Trust Fund. Some organizations have advanced funding and financing proposals to address the capacity needs. The American Road and Transportation Builders Association has advanced Critical Commerce Corridors, a 25-year initiative to develop a national freight system, funded from freight-related user charges. AASHTO has proposed tax credit bonds, issued by

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a federally chartered nonprofit corporation, that could enable a $220 billion program for intermodal transportation investments outside the core Federal-aid Highway Program. Enactment of federal investment tax credits also would improve the nation's rail capacity. Finally, expansion of innovative finance techniques and public-private partnerships can help address critical freight system needs. Further, the newly released Commission report supports the creation and funding of a national freight transportation program that, consistent with a National Freight Transportation Plan, would implement highway, rail, and other improvements that eliminate chokepoints and increase throughput. Among the revenue measures suggested by the Commission are implementing a national freight fee, such as a container fee or freight waybill surcharge, and dedicating a portion of Customs duties to freight improvements.

Passenger Transportation System

The Texas Transportation Institute (TTI) reports that, "Traffic congestion continues to worsen in American cities of all sizes, creating a $78 billion annual drain on the U.S. economy in the form of 4.2 billion lost hours and 2.9 billion gallons of wasted fuel—that's 105 million weeks of vacation and 58 fully-loaded supertankers." 2007 mobility report notes that "congestion causes the average peak period traveler to spend an extra 38 hours of travel time and consume an additional 26 gallons of fuel, amounting to a cost of $710 per traveler."

Flight delays in 2007 were the worst since the federal government began tracking them in 1995. Nationwide, only 72% of flights arrived on time from January through August 2007. Beyond the hardship airline passengers have to endure, the problem of flight delays imposes serious costs on the economy. Each year, Americans lose over $9 billion in productivity from flight delays.

The U.S. Department of Transportation's senior economist estimates that the cost of congestion across all modes of transportation could be approaching $200 billion per year if productivity losses, costs associated with cargo delays, and other economic impacts are included. To these costs must be added the painful cost of the nearly 45,000 fatalities in transportation crashes in the United States in 2004. Finally, congestion is contributing to wasted energy consumption and increased emissions.

Many revenue and financing tools are available at all levels of government to address these transportation challenges. But leadership and political will are needed to build a national strategy and broad consensus for action and investment. At risk, if we do not invest, are the nation's personal and freight mobility, economic competitiveness, and quality of life.

Prioritizing investments matters.

We need a new plan for identifying, selecting, and investing in projects of national and regional significance. We need strategic investment criteria and improved institutional processes for selecting the most beneficial projects for national economic growth and competitiveness. The Commission's new federal surface transportation program proposals are intended to be performance driven, outcome and cost-benefit based, generally mode-neutral, and refocused to pursue activities of genuine national interest. For the freight system, the Commission recommends development of a National Freight Transportation Plan to guide strategic intermodal investments.

Canada's Asia-Pacific Gateway and Corridor Initiative is an example of how a neighboring country has developed a shared intergovernmental and private sector vision of an intermodal gateway and critical corridor program that carefully targets investments at strategic international trade transportation needs. China also has a national transportation investment policy that is closely linked to its trade and economic policies; transportation infrastructure is viewed as a critical component of the nation's economic future. If we do not strategically invest in our transportation system for the future as other countries do, our failure will become a competitive disadvantage to U.S. industries.