The Role of Highways and Transit

The Nation's Transportation System

America's transportation system is the essential element facilitating the movement of goods and people within the country. It forms the backbone of local, regional, national, and international trade, making most economic activity critically dependent upon this resource.

The Role of Highway Transportation

The use of private automobiles on the Nation's large highway network provides Americans with a high degree of personal mobility. Automobile transportation allows people to travel where, when, and with whom they want. In 2001, 87 percent of daily trips involved the use of personal vehicles.

Highways are also a key conduit for freight movement in the United States, accounting for 71 percent of total freight transport by weight (and 80 percent by value) in 1998.

The Role of Transit

Transit plays a vital role in enhancing the productivity and the quality of life in the United States. It provides basic mobility and expanded opportunities to people without the use of a car; it provides broader transportation choices to people with cars, as well as reduced travel times and road congestion in major transportation corridors. It also facilitates economic growth and development and supports environmentally sustainable and safe communities.

Transit is particularly important to people with limited incomes and without cars, especially older adults and people with disabilities. Transit enables them to take advantage of a wider range of job and educational opportunities, to obtain the health care that they require, to be more active members of their communities and to build and maintain social relationships.

The Complementary Roles of Highways and Transit

Highways and transit serve distinct but overlapping markets. Highway and transit investments expand the travel options available to people. While highways provide the highest degree of mobility, transit is essential for those who do not have access to a private vehicle and is often preferable for certain types of trips. Highway investments can also encourage transit usage by improving access to transit facilities; well-maintained highways improve the operating efficiency of transit modes that use highways. Transit can help mitigate highway congestion by offering an alternative during peak travel times. (Note that the analytical models used to develop the investment analyses later in this report do not quantify the potential for highway or transit investments to serve as complements or substitutes.)

The Evolving Federal Role in Surface Transportation

The Federal government has played a key role throughout the country's history in shaping the transportation system. This role has evolved over time to meet changing needs and priorities.

The Federal-aid highway program is administered by the States with assistance from the Federal government. In recent years, Congress has increased statutory authority for States to assume certain Federal-aid highway project oversight responsibilities, where appropriate. FTA works with grantees eligible or receiving funds for New Starts capital investment projects to choose the best projects, and facilitate the most effective design and implementation.

Highways and transit are closely linked in their function and funding sources. FHWA and FTA work closely with each other and other Federal, State, and local agencies, and other partners to maximize the benefits of the public investment in highways and transit, and to prepare to meet America's future transportation needs.

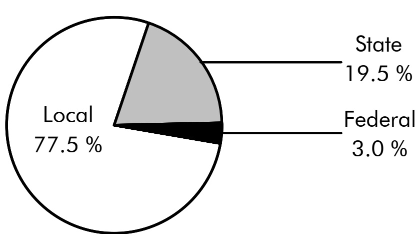
System Characteristics: Highways

There were almost 3.98 million miles of public roads in the United States in 2002. **This mileage was overwhelmingly rural and locally owned.** About 3.08 million miles were in rural areas in 2002, or 77 percent of total mileage. The remaining 901,000 miles were in urban communities. There are 591,707 bridges in the United States.

Numerous trends are changing the extent and use of the American highway network. **While total road mileage increased between 1993 and 2002, total rural mileage has decreased.** This has been an ongoing trend, partly reflecting the reclassification of Federal roads and the growth of metropolitan areas throughout the United States.

In 2002 about 77.5 percent of the highway miles were locally owned, States owned 19.5 percent, and 3.0 percent were owned by the Federal Government.

Highway Mileage by Jurisdiction, 2002



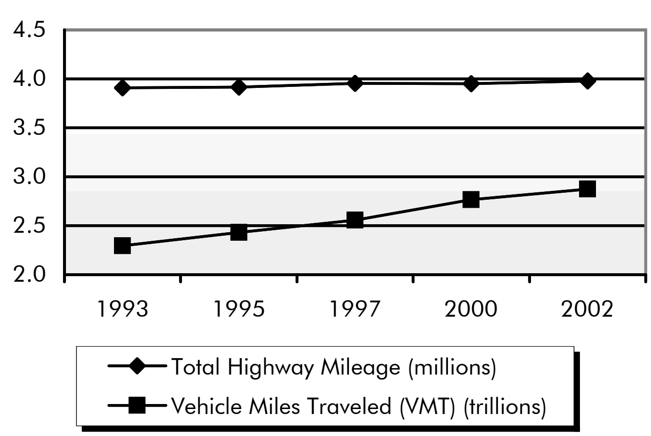
Americans traveled nearly 2.9 trillion vehicle miles in 2002. While highway mileage is mostly rural, a majority of highway travel (over 60 percent) occurred in urban areas in 2002. From 2000 to 2002, however, **rural travel grew at a slightly faster average annual rate** (2.8 percent) than urban travel (2.4 percent). This continues the trend noted in the 2002 C&P report. In the decade prior to 1993, urban travel growth rates were greater than rural. Vehicle miles traveled (VMT) nevertheless increased on every highway functional system from 2000 to 2002.

Percentage of Highway Miles, Lane Miles, and Vehicle Miles Traveled by Functional System, 2002

Functional System	Miles	Lane Miles	Vehicle Miles Traveled
Rural Areas			
Interstate	0.8%	1.6%	9.8%
Other Principal Arterials	2.5%	3.1%	9.0%
Minor Arterial	3.5%	3.5%	6.2%
Major Collector	10.8%	10.4%	7.5%
Minor Collector	6.8%	6.5%	2.2%
Local	52.9%	50.6%	4.9%
Subtotal Rural	**77.3%**	**75.7%**	**39.4%**
Urban Areas			
Interstate	0.3%	0.9%	14.3%
Other Freeway and Expressway	0.2%	0.5%	6.6%
Other Principal Arterial	1.3%	2.3%	14.3%
Minor Arterial	2.3%	2.8%	11.9%
Collector	2.3%	2.3%	5.0%
Local	16.2%	15.5%	8.4%
Subtotal Urban	**22.7%**	**24.3%**	**60.6%**
Total	100.0%	100.0%	100.0%

In recent years, growth in VMT has exceeded the increase in highway lane miles. **Between 1993 and 2002, lane miles grew by 0.2 percent annually, while VMT increased by 2.5 percent annually**. VMT for trucks grew faster between 2000 and 2002 than did VMT for passenger vehicles.

Highway Mileage and Travel, 1993–2002



System Characteristics: Transit

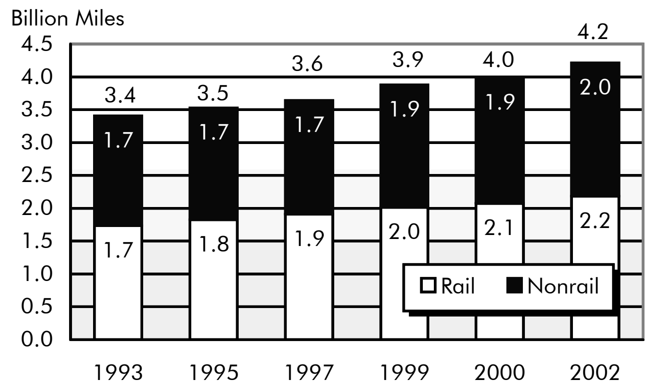
Transit system coverage, capacity, and use in the United States continued to increase between 2000 and 2002. In 2002, there were 610 transit operators serving urbanized areas, of which 538 were public agencies. A public transit provider may be a unit of a regional transportation agency, a State, a county, or a city government or it may be independent. In 2000, the most recent year for which information is available, there were 1,215 operators serving rural areas; and in spring 2004, it was estimated that there were 4,836 providers of special services to older adults and persons with disabilities receiving Federal Transit Administration (FTA) funds.

In 2002, transit agencies in urban areas operated 114,564 vehicles, of which 87,295 were in areas of more than 1 million people. Rail systems comprised 10,722 miles of track and 2,862 stations. There were 769 bus and rail maintenance facilities in urban areas, compared with 729 in 2000. The most recent surveys of rural operators in 2000 estimated that 19,185 transit vehicles operated in rural areas. The FTA estimates that in 2002 there were 37,720 special service transit vehicles for older adults and persons with disabilities of which 16,219 were funded by FTA.

In 2002, transit systems operated 235.3 billion directional route miles, of which 225.8 billion were nonrail and 9.5 billion were rail route miles. Total route miles increased by 14.2 percent between 2000 and 2002. Nonrail route miles increased by 14.7 percent and rail route miles increased by 2.8 percent during this period.

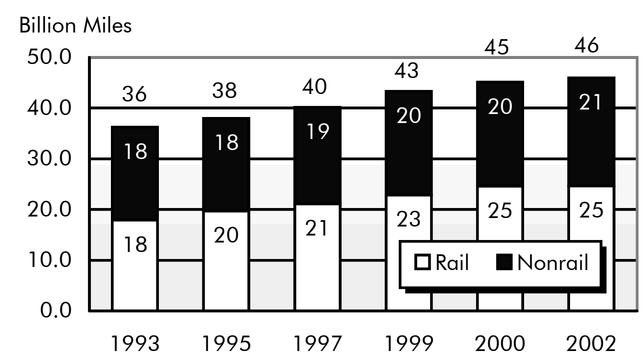
Transit system capacity, as measured by available seating and standing capacity, increased by 18.7 percent between 2000 and 2002. Rail capacity increased by 19.7 percent and nonrail capacity by 17.7 percent. The capacities of rail and nonrail modes were similar in 2002, 2.2 and 2.0 billion capacity-equivalent miles, respectively, for a total of 4.2 billion miles.

Urban Capacity-Equivalent Revenue Vehicle Miles (Billions)



Transit passenger miles traveled (PMT) increased by 1.9 percent between 2000 and 2002, from 45.1 billion to 45.9 billion. PMT traveled on nonrail modes increased from 20.5 billion in 2000 to 21.3 billion in 2002, or by 4.0 percent. PMT on rail transit modes increased from 45,101 million in 2000 to 45,944 million in 2002. The growth in rail PMT was affected by a decline in heavy rail PMT in New York after the September 11 terrorist attacks destroyed parts of the subway system.

Urban Passenger Transit Miles (Billions)

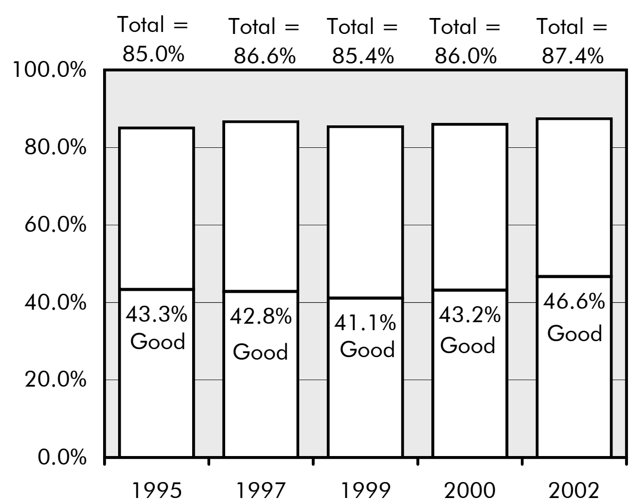


In 2002, vehicle occupancy was 10.9 persons compared with 11.3 persons in 2000. Vehicle occupancy of transit vehicles, adjusted to the capacity of a bus, fluctuated between 10.6 persons and 11.3 persons per vehicle between 1993 and 2002.

System Conditions: Highway and Bridges

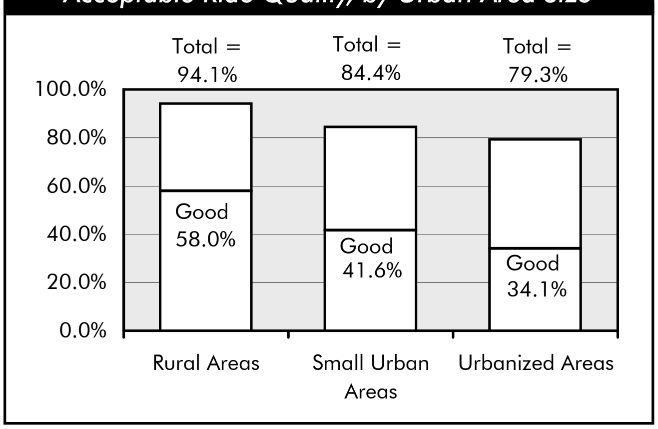
The ride quality of 87.4 percent of the Nation's total road mileage was rated "Acceptable" in 2002, up from 86.0 percent in 2000. Ride quality is defined based on pavement roughness. Pavements with roughness below 170 inches per mile are considered to have "acceptable" ride quality. Pavements with "good" ride quality comprised 46.6 percent of total highway mileage in 2002.

Percentage of Pavement Mileage with Acceptable Ride Quality



Pavement ride quality is generally better on higher functional class roads, and is better in rural areas (where 94.1 percent of travel is on pavements with acceptable ride quality) than in urbanized areas.

Percentage of VMT on Pavement with Acceptable Ride Quality, by Urban Area Size



Information on ride quality on the National Highway System (the basis of the pavement performance measures in DOT's *Strategic Plan*) is located in Chapter 17.

The number of deficient bridges is widely used by policymakers to describe bridge quality nationwide. Deficient bridges include those characterized both as *structurally deficient* (deteriorated condition and the reduced load-carrying capacity) and as *functionally obsolete* (based appraisals of clearance adequacy, deck geometry, and alignment). Of the 591,707 bridges in the inventory, 162,869 (27.5 percent) were deficient in 2002. Of these, 81,304 (13.7 percent) were classified as structurally deficient and 81,565 (13.8 percent) were classified as functionally obsolete.

The percentage of bridges classified as deficient declined from 28.5 percent in 2000 to 27.5 percent in 2002. This reduction is mostly due to work done to correct problems on structurally deficient bridges. The percentage of functionally obsolete bridges has not changed significantly.

Percentage of Rural and Urban Bridge Deficiencies, by Number of Bridges

Year	1998	2000	2002
Rural Bridges			
Structurally Deficient	17.4%	16.2%	15.1%
Functionally Obsolete	11.4%	11.4%	11.4%
Total Deficiencies	**28.8%**	**27.6%**	**26.5%**
Urban Bridges			
Structurally Deficient	11.0%	9.9%	9.2%
Functionally Obsolete	21.5%	22.0%	21.9%
Total Deficiencies	**32.5%**	**31.9%**	**31.2%**
All Bridges			
Structurally Deficient	16.0%	14.8%	13.7%
Functionally Obsolete	13.6%	13.8%	13.8%
Total Deficiencies	**29.6%**	**28.5%**	**27.5%**

Other indicators of bridge conditions, including the traffic carried on deficient bridges and the deck area on deficient bridges, are described in the body of Chapter 3 and in Chapter 15.

System Conditions: Transit

U.S. transit system conditions depend on the quantity, age, and physical condition of the assets that make up the Nation's transit infrastructure. This infrastructure includes vehicles in service, maintenance facilities, the equipment they contain, and other supporting infrastructure such as guideways, power systems, rail yards, stations, and structures (bridges and tunnels).

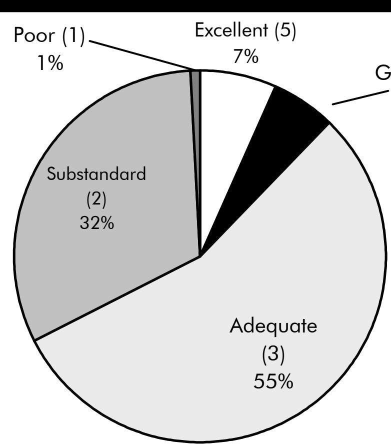
The Federal Transit Administration (FTA) has undertaken extensive engineering surveys and collected a considerable amount of data on the U.S. transit infrastructure to evaluate transit asset conditions. FTA uses a rating system of 1 "poor" to 5 "excellent" to describe asset conditions.

Definitions of Transit Asset Condition

Rating	Condition	Description
Excellent	5	No visible defects, near new condition.
Good	4	Some slightly defective or deteriorated components.
Fair	3	Moderately defective or deteriorated components
Marginal	2	Defective or deteriorated components in need of replacement.
Poor	1	Seriously damaged components in need of immediate repair.

The average condition of urban bus vehicles increased from 3.05 in 2000 to 3.19 in 2002. The average condition of bus maintenance facilities increased from 3.23 in 2000 to 3.34 in 2002. In 2002, 68 percent of bus maintenance facilities were in adequate or better condition.

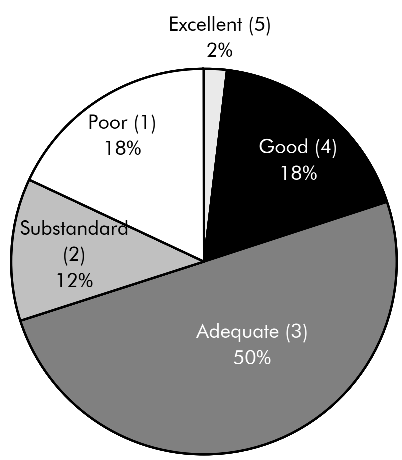
Condition of Bus Maintenance Facilities, 2002



The average condition of rail vehicles increased from 3.38 in 2000 to 3.47 in 2002. The average age of rail vehicles declined from 21.8 years in 2000 to 20.4 years in 2002. Commuter rail vehicle conditions have been revised using new deterioration schedules based on engineering surveys undertaken in 2002. As a result, the commuter rail conditions in this edition of the report are about 15 percent lower than those reported in earlier editions.

Additional data collected by FTA since the last edition of this report revealed that the percentage of rail maintenance facilities that are less than 10 years old is higher than previously estimated. This new information has led to an upward revision in the condition estimate of rail maintenance facilities from 3.18 in 2000 to 3.56 in 2002. In 2002, 80 percent of rail maintenance facilities were estimated to be in adequate or better condition.

Condition of Rail Maintenance Facilities, 2002



From 2000 to 2002, the conditions of track, substations, structures and third rail improved. The conditions of rail yards, overhead wire and stations declined. Station conditions fell from 3.4 in 2000 to 3.0 in 2002. This decrease was largely the result of new information collected directly from transit agencies rather than an actual change. Rail station conditions are, on average, considerably lower than bus station conditions.

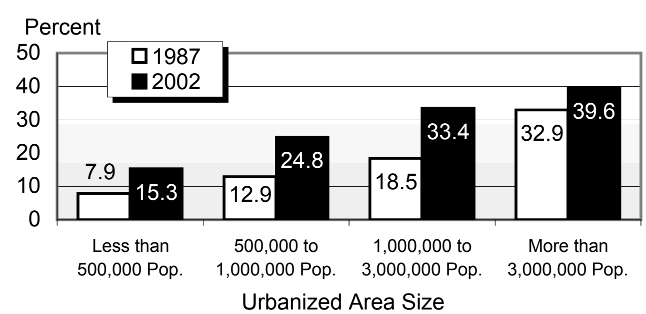
Operational Performance: Highways

Three measures of congestion developed by the Texas Transportation Institute (TTI) clearly show con¬gestion is getting worse throughout the Nation. (Note that the values shown in this report are based on data for all urbanized areas. The values shown for these same measures in TTI's annual *Urban Mobility Study* are different, since that study is based on a subset of urbanized areas that is weighted towards the most heavily populated areas.)

Percent of Travel Under Congested Conditions:

Percent of Travel Under Congested Conditions is an indicator of the portion of traffic on freeways and other principal arterials in an urbanized area that moves at less than free-flow speeds. Congested travel increased from 21.1 percent in 1987 to 30.4 percent in 2002. The length of the average congested period, or "rush hour," increased from 5.4 to 6.6 hours per day over these 15 years. For urban areas with populations greater than 3 million, 39.6 percent of daily travel in 2002 occurred under congested conditions.

Percent of Travel Under Congested Conditions, 1987 Versus 2002

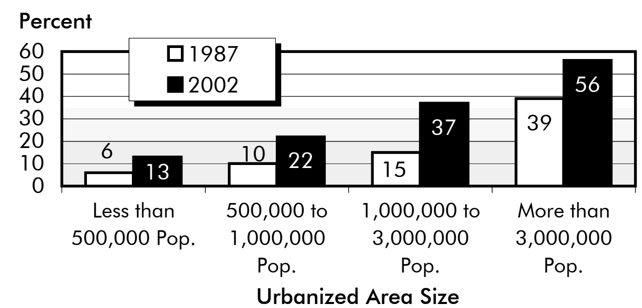


Percent of Additional Travel Time:

Percent of Additional Travel Time is an indicator of the additional time required to make a trip during the congested peak travel period rather than at other times of the day. In 2002, an average peak period trip required 37.0 percent more time than the same trip under nonpeak, noncongested conditions. In 1987, a 20-minute trip during noncongested periods required 24.4 minutes under congested conditions. The same trip in 2002 required 27.4 minutes, or an additional 3 minutes.

Between 1987 and 2002, the percent of additional travel time grew fastest in urbanized areas with a population between 1 million and 3 million.

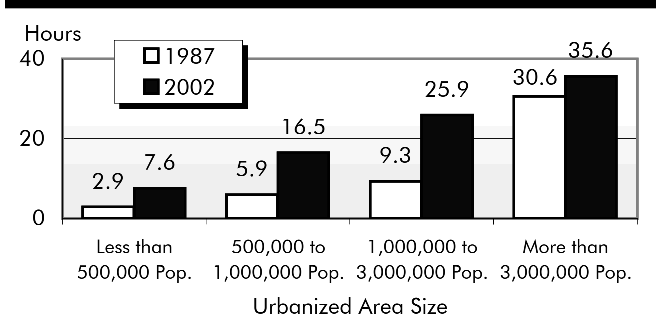
Percent of Additional Travel Time, 1987 Versus 2002



Annual Hours of Traveler Delay:

Annual Hours of Traveler Delay is an indicator of the total time an individual loses due to traveling under congested conditions. Cities with populations between 500,000 and 1 million experienced the greatest percentage growth in the average annual delay experienced by drivers, from 5.9 hours in 1987 to 16.5 hours in 2002—an increase of nearly 180 percent.

Annual Hours of Traveler Delay, 1987 Versus 2002

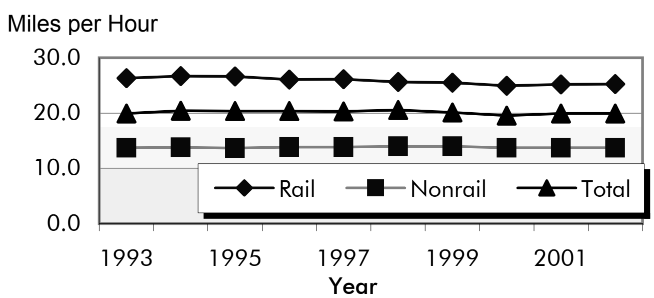


Operational Performance: Transit

Average operating speed in 2002 was higher than in 2000, but below its 10-year average. Average vehicle utilization levels were lower in 2002 than in 2000, but the utilization of rail vehicle modes remained high in 2002 relative to the 10-year averages. Buses had the smallest decline in vehicle utilization from 2000 to 2002.

Average operating speed is the average speed that a passenger will travel on transit rather than the pure operational speed of transit vehicles. In 2002, the **average operating speed** for all transit modes was 19.9 miles per hour, up from 19.6 in 2000, but below the 10-year average of 20.1. The average speed for rail was 25.3 miles per hour in 2002, up from 24.9 in 2000, most likely due to a decline in vehicle utilization and shorter vehicle dwell times. The average speed of nonrail modes was 13.7 miles per hour in both 2000 and 2002.

Transit Operating Speeds, 1993–2002



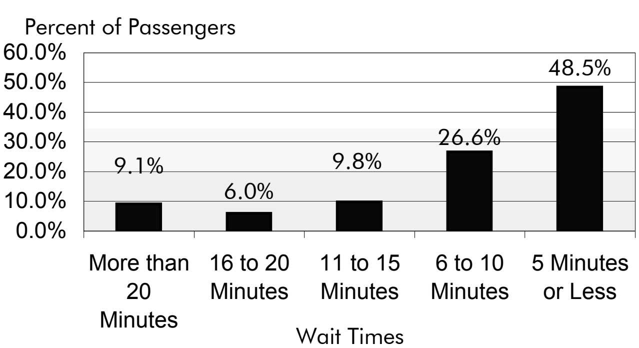
Most passengers who ride transit wait in areas that have frequent service. The 2001 National Household Travel Survey found that 49 percent of all passengers who ride transit wait for 5 minutes or less for a vehicle to arrive, and 75 percent wait 10 minutes or less. Nine percent of passengers wait for more than 20 minutes. To some extent, waiting times are correlated with incomes. Passengers with annual incomes above $65,000 are more likely to wait less time for a transit vehicle than passengers with incomes lower than $30,000. Higher-income passengers are more likely to be choice riders; passengers with lower incomes are more likely to use transit for basic mobility and to have more limited alternative means of travel.

Vehicle utilization is measured as passenger miles per vehicle adjusted to reflect differences in the passenger-carrying capacities of transit vehicles. Capacity-adjusted vehicle utilization levels in this edition of the report are based on revised capacity-equivalent factors, and, with the exception of buses, are not comparable to utilization levels reported in earlier editions. The revisions to capacity-equivalent factors did not affect year-to-year changes in utilization rates. On average, rail vehicles operate at a higher level of utilization than nonrail vehicles. Commuter rail has consistently had the highest vehicle utilization rate, and demand response the lowest.

Vehicle Utilization: Passenger Miles per Capacity-Equivalent Vehicle

Mode	Utilization 2000	Utilization 2002
Heavy Rail	697	675
Commuter Rail	863	831
Light Rail	546	528
Vanpool	577	539
Bus	393	390
Ferryboat	305	294
Trolleybus	257	246
Demand Response	188	178

Passengers by Waiting Times

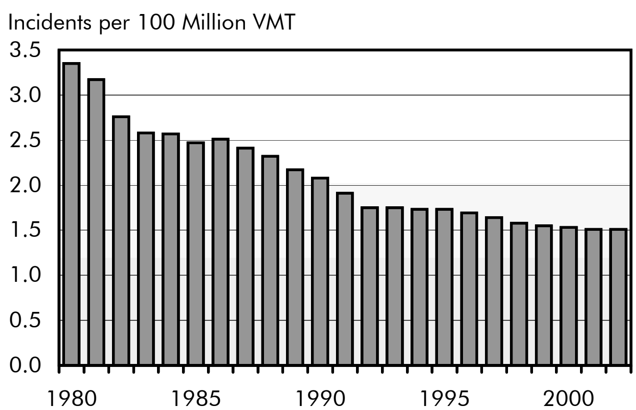


Safety Performance: Highways

The U.S. Department of Transportation has established the goal of reducing the highway fatality rate to 1.00 per 100 million VMT by 2008. Federal safety initiatives intended to support the achievement of this goal are discussed in Chapter 11, while this chapter focuses on safety statistics.

Highway fatalities increased slightly between 1997 (42,013) and 2002 (43,005). Although the number of fatalities has fallen sharply since 1966, when Federal legislation first addressed highway safety, there has been a steady increase in the annual number of fatalities between 1994 and 2002.

Fatality Rate, 1980–2002

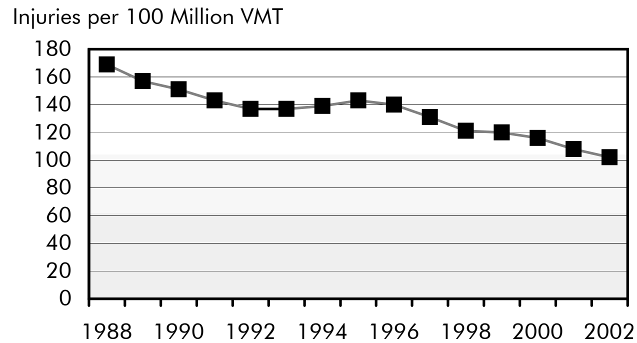


Source: Fatality Analysis Reporting System.

The fatality rate per 100 million VMT dropped from 1.64 in 1997 to 1.51 in 2002. This drop coincided with a significant increase in the number of VMT. Similarly, the fatality rate per 100,000 population was 14.93, a decrease from the 1997 fatality rate of 15.69.

The number of injuries declined from about 3.35 million in 1997 to 2.89 million in 2002. The injury rate per 100,000 people declined from 1,250 in 1997 to 1,016 in 2002, and the injury rate per 100 million VMT dropped from 131 in 1997 to 102 in 2002.

Injury Rate, 1988–2002



Source: Fatality Analysis Reporting System.

Alcohol-impaired driving is a serious public safety problem in the United States. The National Highway Traffic Safety Administration (NHTSA) estimates that alcohol was involved in 41 percent of fatal crashes and 6 percent of all crashes in 2002. The 17,524 fatalities in 2002 represent an average of one alcohol-related fatality every 30 minutes.

The number of alcohol-related fatalities dropped from 17,908 in 1993 to 17,524 in 2002, although the pattern of alcohol-related fatalities has been uneven—declining between 1996 and 1999, then increasing between 1999 and 2002.

Alcohol-Related Fatalities, 1993–2002

1993	1995	1997	1999	2000	2002
17,908	17,732	16,711	16,572	17,380	17,524

Source: Fatality Analysis Reporting System / National Center for Statistics & Analysis, NHTSA.

The most common types of fatalities are those related to alcohol-impaired driving, single-vehicle run-off-the-road crashes, and speeding. There is a correlation between speeding, age, and alcohol consumption in fatal crashes. The NHTSA estimates that in 2002, 27 percent of underage **speeding** drivers involved in fatal crashes were intoxicated, while only 12 percent of underage **nonspeeding** drivers involved in fatal crashes were intoxicated.

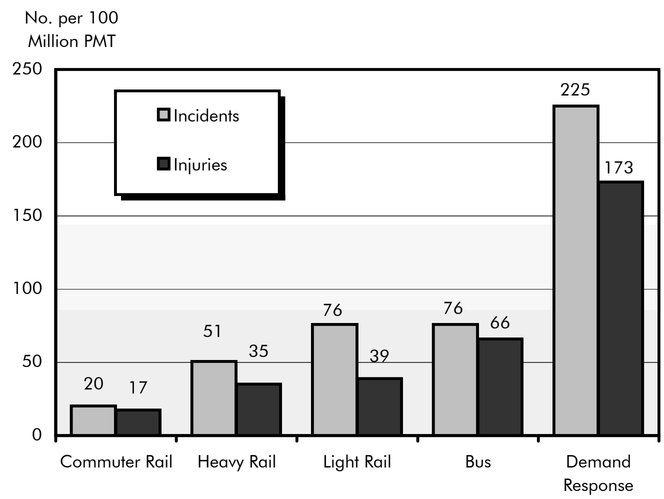
Safety Performance: Transit

Public transit in the United States has been and continues to be a highly safe mode of transportation, as evidenced by statistics on incidents, injuries, and fatalities reported by transit agencies for the vehicles they operate directly. Reportable safety incidents include collisions and any other type of occurrence (e.g., derailment) that result in injury or death, or fire or property damage in excess of a threshold. Injuries and fatalities include those suffered by riders as well as by pedestrians, bicyclists, and people in other vehicles. Injuries and fatalities may occur while traveling or while boarding, alighting, or waiting for a transit vehicle.

In 2002, the definitions of an incident and an injury were revised. The threshold for a reportable safety incident was raised from $1,000 to $7,500. An injury was redefined to be an occurrence that required immediate transportation for medical care away from the scene of the incident. Before 2002, any event for which the FTA received a report was classified as an injury. These adjustments to incident and injury definitions led to a decrease in reported incidents and injuries in 2002. These adjustments preclude the direct comparison of 2002 incident and injury statistics with those for earlier years. The definition of fatalities has remained the same. **Fatalities decreased from 292 in 2000 to 282 in 2002,** and fell from 0.69 per 100 million PMT in 2000, to 0.66 per 100 million PMT in 2002.

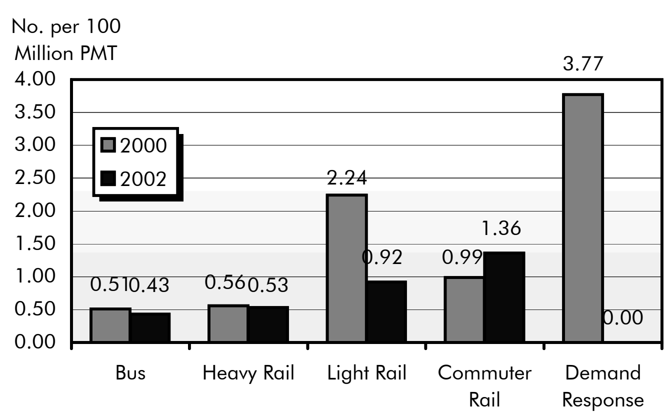
Transit vehicles that travel on roads have higher incident and injury rates than those that travel on fixed guideways. Incidents and injuries, when adjusted for PMT, are consistently the lowest for commuter rail and highest for demand response systems. Buses and demand response vehicles experienced the greatest fall in reported incidents and injuries from 2000 to 2002 as a result of the changes in definitions. While buses historically have had more incidents per PMT than light rail, the number of incidents reported by each of these modes was the same in 2002 under the new higher incident reporting threshold.

Incidents and Injuries per 100 Million PMT, 2002



Fatalities, adjusted for PMT, are lowest for buses and heavy rail systems. Fatality rates for commuter and light rail have, on average, been higher than fatality rates for heavy rail. Demand response vehicles have widely fluctuating fatality rates, well above those for other types of transit services. There were, however, no fatalities on demand response vehicles operated directly by public transit agencies in 2002.

Fatalities per 100 Million PMT, 2000 and 2002



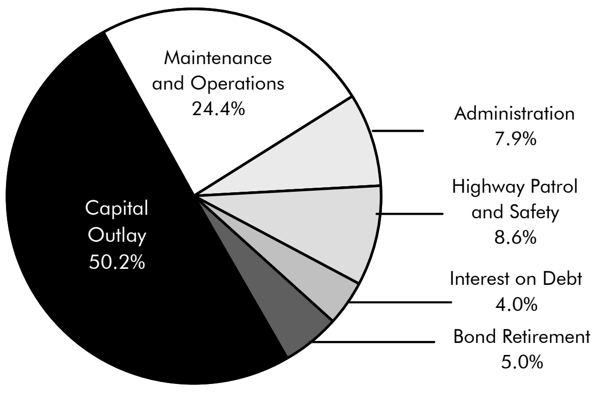
Finance: Highways

Taken together, all levels of government spent $135.9 billion for highways in 2002. The Federal government funded $32.8 billion (24.1 percent). This figure reflects cash outlays by all Federal agencies combined for highway-related purposes, including amounts transferred to State and local governments for use on highways. States funded $69.0 billion (50.8 percent). Counties, cities, and other local government entities funded $34.1 billion (25.1 percent).

Total highway expenditures by all levels of government increased 33.3 percent between 1997 and 2002. Highway spending rose faster than inflation over this period, growing 18.4 percent in constant dollar terms.

Of the total $135.9 billion spent for highways in 2002, $68.2 billion (50.2 percent) went for capital outlay. 2001 was the first year since 1975 that this percentage exceeded 50 percent.

Highway Expenditures by Type, 2002



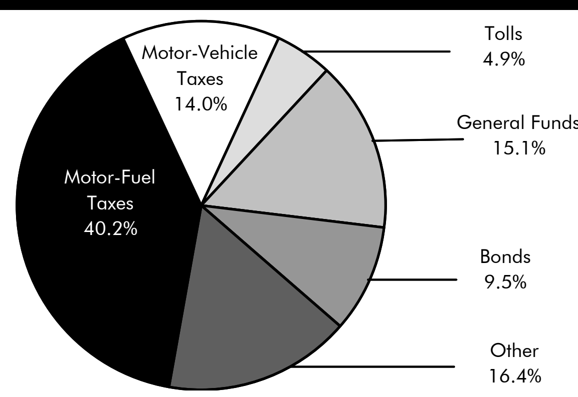
Capital outlay grew by 41.0 percent between 1997 and 2002. Federal cash expenditures for capital purposes rose 56.3 percent, while State and local capital investment increased by 29.7 percent.

From 1987 to 1997, the portion of total capital outlay funded by the Federal government varied within a range of 41 to 46 percent. This share dropped down to 37.1 percent in 1998, but has subsequently rebounded sharply to 46.1 percent in 2002, as the full effects of increased investment levels under the Transportation Equity Act for the 21st Century (TEA-21) have begun to take hold.

State and local governments devoted more than half of their capital spending to the preservation of their existing roads and bridges in 2002. All levels of government spent a combined $35.8 billion (52.6 percent) of capital funds for system preservation in 2002; $12.9 billion (18.9 percent) went for new roads and bridges; $13.6 billion (19.9 percent) went for adding new lanes to existing roads; and $5.9 billion (8.6 percent) went for system enhancements, such as safety, operational, or environmental enhancements.

Highway-user revenues—the total amount generated from motor-fuel taxes, motor-vehicle fees, and tolls—were $100.5 billion in 2002. Of this, $79.6 billion (79.2 percent) was spent on highways. This represented 59.1 percent of the total revenues generated by all levels of government in 2002 for use on highways.

Revenue Sources for Highways, 2002



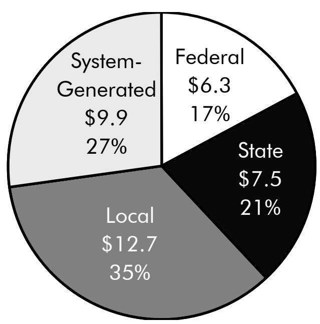
States are increasingly looking to the private sector as another potential source of highway and transit funding, either in addition to or in concert with new credit and financing tools. A number of States have taken legislative action to permit greater use of public-private partnerships.

CHAPTER 6: Executive Summary

Finance: Transit

In 2002, $36.5 billion was available from all sources to finance transit capital investments and operations. Transit funding comes from: *public funds* allocated by Federal, State, and local governments; and *system-generated revenues* earned by transit agencies from the provision of transit services. In 2002, Federal funds accounted for 17 percent of all transit revenue sources, State funds for 21 percent, local funds for 35 percent, and system-generated funds for 27 percent.

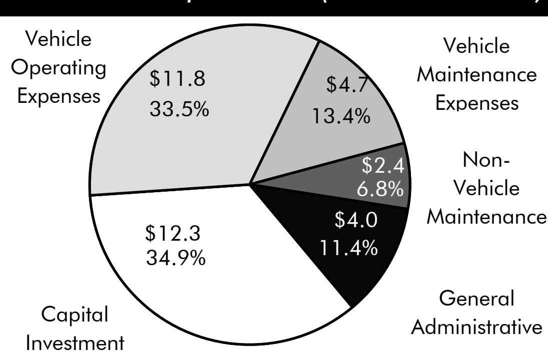
2002 Transit Revenue Sources (Billions of Dollars)



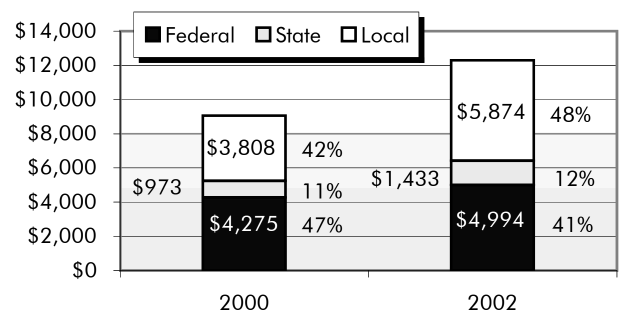
Eighty percent of the Federal funds allocated to transit are from a dedicated portion of the Federal motor-fuel tax receipts, and 20 percent are from general revenues. Federal funding for transit increased from $5.3 billion in 2000 to $6.3 billion in 2002, and State and local funding increased from $15.7 billion in 2000 to $20.3 billion in 2002.

In 2002, $12.3 billion, or 34.9 percent of total available transit funds, was spent on capital investment. Federal capital funding was $5.0 billion, or 40.6 percent of total capital expenditures; State capital funding was $1.4 billion, or 11.6 percent of total capital expenditures; and local capital funding was $5.8 billion, or 47.8 percent of total capital expenditures. Between 2000 and 2002, Federal capital funding increased by 17 percent and State and local capital funding by 53 percent.

2002 Transit Expenditures (Billions of Dollars)



Sources of Transit Capital Investment Funding, 2000 and 2002 (Millions of Dollars)



In 2002, $4.1 billion, or 33 percent of total capital expenditures, was for rolling stock; $3.2 billion, or 26 percent, was for guideway; $2.2 billion, or 18 percent of capital spending, was for facilities; and $1.0 billion, or 8 percent, was for other capital.

In 2002, $24.2 billion was available for operating expenses and accounted for 65.1 percent of total available funds. System-generated revenues provided $9.9 billion, or 41.0 percent of the total amount available for operating expenses; local governments provided $6.9 billion (28.4 percent), State governments provided $6.1 billion (25.3 percent), and the Federal government provided $1.3 billion (5.4 percent). Actual operating expenditures were $22.9 billion, slightly below the amount available. Vehicle operating expenses were $11.8 billion, or 51.5 percent of total operating expenses; vehicle maintenance expenses were $4.7 billion, or 20.3 percent of total operating expenses, nonvehicle maintenance expenses were $2.4 billion, or 10.6 percent of total operating expenses; and general administrative expenses were $4.0 billion, or 17.6 percent of total operating expenses.

Investment/Performance Analysis

Chapters 7 through 10 present and analyze estimates of future capital investment requirements for highways, bridges, and transit.

The 20-year investment requirement projections identified in this report are the product of complex technical analyses that attempt to predict the impact that alternative levels of future capital investment may have on the future conditions and performance of the transportation system.

Separate estimates of investment requirements for highways, bridges, and transit are generated independently by separate models and techniques. **Cost to Maintain** and **Cost to Improve** scenarios are presented for each, but these represent only two points on a continuum of alternative investment levels. **The Department does not endorse either of these scenarios as a target level of investment;** and, where practical, supplemental information has been included to describe the impacts of other possible investment levels. The highway, bridge, and transit scenarios are defined differently, based on the data available for analysis and the analytical model used.

The **Highway Economic Requirements System (HERS),** introduced in the 1995 C&P report, was used to generate estimates of investment requirements for highway preservation and highway/bridge capacity expansion. Recent changes to HERS are documented in Appendix A.

The **National Bridge Investment Analysis System (NBIAS)** was introduced in the 2002 C&P report, adding economic analysis into the bridge preservation modeling for the first time. The NBIAS is described in more detail in Appendix B.

The **Transit Economic Requirements Model (TERM)** has been used since the 1997 C&P report to generate estimates of investment requirements for transit. The TERM is discussed in Appendix C.

The HERS, NBIAS, and TERM models all have a broader focus than traditional engineering-based models, looking beyond transportation agency costs to consider the benefits that transportation provides to its users and some of the impacts that transportation investment has on nonusers. From an economic perspective, the cost of an investment in transportation infrastructure is simply the straightforward cost of implementing an improvement project. The benefits of transportation capital investments are generally characterized as the attendant reductions in costs faced by (1) transportation agencies (such as for maintenance), (2) users of the transportation system (such as savings in travel time and vehicle operating costs), and (3) others who are affected by the operation of the transportation system (such as reductions in health or property damage costs).

While the **Cost to Maintain** and **Cost to Improve** scenarios both assume that transportation improvements are selected for implementation based solely on their benefit-cost ratios, this is unlikely to be the case in reality. Other factors influence Federal, State, and local decisionmaking that may result in a different outcome. Consequently, increasing spending to the **Cost to Maintain** level would not guarantee that conditions and performance of the system would actually be maintained; additional funding could be required to the extent that some transportation improvements with lower benefit-cost ratios were implemented instead of ones with higher benefit-cost ratios. Similarly, while the HERS, NBIAS, and TERM models all screen out potential improvements that are not cost-beneficial, simply increasing spending to the **Cost to Improve** level would not guarantee that the full estimated benefits of that scenario would be attained. That result could be achieved only by modifying Federal program requirements and State and local government practices to ensure that no project would be implemented unless its estimated benefits exceeded its estimated costs.

Investment/Performance Analysis

These 20-year investment requirement estimates also reflect the total capital investment required from **all sources**—Federal, State, local, and private—to achieve certain levels of performance. The analyses do not directly address which revenue sources might be used to finance the investment required by each scenario, nor do they identify how much might be contributed by each level of government. **This report makes no recommendations concerning future levels of Federal investment.**

It is important to recognize that the use of different revenue mechanisms to support transportation investments can have an impact on future investment requirements. For example, if investment in urban freeways were to be increased dramatically, more drivers would tend to use the newly improved routes. However, if fuel taxes were simultaneously increased to pay for the improvements, this would raise the cost of driving generally, causing some marginal trips to be deterred. If tolls were simultaneously imposed on urban freeways to pay for the improvements, this would likely discourage additional trips and encourage some drivers to switch to non-tolled routes.

Congestion Pricing—Some of the congestion problems facing the Nation's road network can be traced to imbalances between highway travel demand and supply, due to the "underpricing" of highway use. Under normal conditions, each individual driver's use of a road will not have an appreciable effect on the implicit costs (such as travel time and safety risks) faced by other users. As traffic volumes rise and a facility becomes congested, travel times for all users begin to rise, with each additional vehicle making the situation progressively worse. However, since individual travelers do not bear any of these costs that they impose on other drivers, their individual economically rational decisions can collectively result in an inefficiently high level of use of congested facilities.

In an ideal world, users of congested facilities would be levied charges precisely corresponding to the economic cost of the delay they impose on one another. This would reduce peak traffic volumes (but not necessarily eliminate all congestion delay) and increase total net benefits to highway users. While perfectly efficient pricing (which requires comprehensive knowledge of user demand and the ability to continuously adjust the fees that motorists are charged) may not be practical, it would be possible to make the current system more efficient through some form of variable road pricing on selected highways. Significant advances in tolling technology have reduced both the operating costs of toll collection and the delays experienced by users as a result of having to stop or slow down at collection points. Technology also has made it possible to charge different toll rates during different time periods, in some cases even varying the price dynamically with real-time traffic conditions.

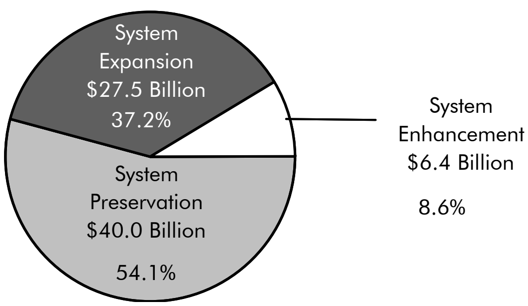
The implications of inefficient pricing for the highway investment requirements estimated in this report are difficult to quantify precisely. The Maximum Economic Investment (Cost to Improve) scenario reflects all economically efficient improvements given the current real-world highway financing structure, reflecting the costs that are currently borne by highway users. However, if efficient road pricing were widespread, the required level of investment would be reduced, with a stronger impact on capacity investment than on preservation improvements. Part V of this report includes a discussion of ongoing research relating to alternative financing mechanisms that should be available for use in the 2006 edition of this report.

Uncertainty—As in any modeling process, simplifying assumptions have been made to make analysis practical and to meet the limitations of available data. Chapter 10 examines the sensitivity of the estimates to changes in some of the key parameters underlying the analytical models.

Capital Investment Requirements: Highway and Bridge

The **Cost to Maintain Highways and Bridges represents the investment required by all levels of government so that critical indicators of overall conditions and performance in the year 2022 will match their year 2002 values**. For bridge preservation, it represents the level of investment required to maintain the existing level of bridge deficiencies in constant dollar terms. For system expansion and pavement preservation, it represents the investment required to prevent average highway user costs (including travel time costs, vehicle operating costs, and crash costs) from rising in the future.

Cost to Maintain Highways and Bridges Distribution by Improvement Type



Agency costs, such as maintenance, and societal costs, such as emissions, are also considered in the analysis, but are not included in the calculation of the maintain user cost performance goal.

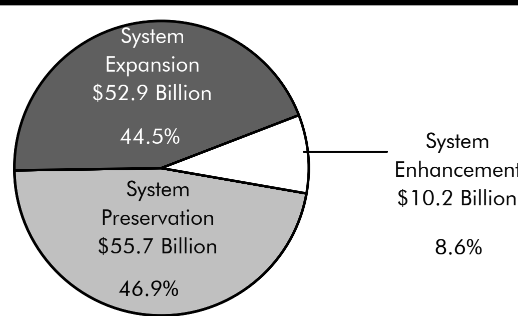
The average annual investment required over the 20-year period 2003–2022 for the Cost to Maintain Highways and Bridges is projected to be $73.8 billion. The two investment scenarios take into account the impact of existing trends in the deployment of operations strategies and technologies, including certain types of intelligent transportation systems investments. This has the primary effect of reducing the estimated level of investment required to reach a given performance target, such as maintaining user costs. As is noted on the previous page, the investment analyses do not account for the impact that broader adoption of congestion pricing could have on delaying or reducing future investment requirements.

The Maximum Economic Investment (Cost to Improve) scenario represents the investment by all levels of government required to implement all cost-beneficial improvements on highways and bridges. The average annual cost of this scenario is projected to be $118.9 billion. This level of investment would address the existing backlog of highway ($398 billion) and bridge ($63 billion) deficiencies, as well as new deficiencies as they arise during the 20-year period, when it is cost-beneficial to do so. Note that this projection implicitly assumes the continuation of current tax and fee structures. As pointed out on the preceding page, shifts in financing mechanisms could impact these results.

System preservation improvements make up 46.9 percent of the Maximum Economic Investment scenario. This includes all **capital** investment aimed at preserving the existing pavement and bridge infrastructure, such as resurfacing, rehabilitation, and reconstruction. This does not include the costs of routine maintenance.

Investment requirements for system expansion make up 44.5 percent of the Maximum Economic Investment scenario. The remaining 8.6 percent is not directly modeled; this represents the current share of capital spending on system enhancements such as safety, traffic control, and environmental investments.

Maximum Economic Investment for Highways and Bridges Distribution by Improvement Type



Capital Investment Requirements: Transit

Transit capital investment requirements to maintain conditions and performance and to improve conditions and performance are 5 percent and 16 percent higher, respectively, than in the 2002 report, principally as a result of new information collected on assets and asset prices. Current estimates are for the period 2003-2022 for four scenarios. The "Maintain Conditions" scenario projects the level of capital investment necessary to maintain current average asset conditions over the 20-year period, and the "Improve Conditions" scenario projects the investment necessary to raise the average condition of each major transit asset type to at least a level of "good." The "Maintain Performance" scenario assumes investment in new capacity to maintain current vehicle occupancy levels as transit passenger travel increases, and the "Improve Performance" scenario assumes that additional investment will be undertaken to reduce average vehicle occupancy rates and increase average vehicle speeds. The "Improve Conditions and Performance" scenario is an upper limit of the economically justifiable level of transit investment.

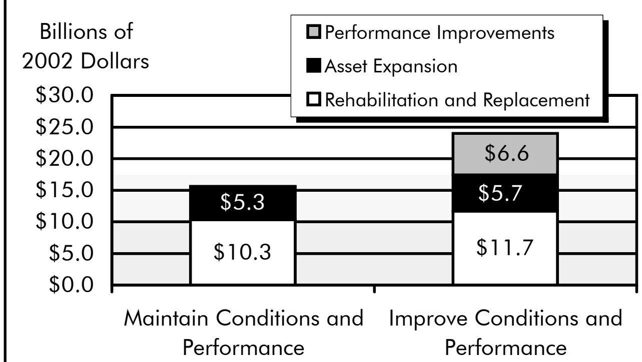
Transit Average Annual Investment Requirements, 2001–2020 and 2003–2022

(Billions of Dollars)

Conditions	Performance	Average Annual Cost 2001-2020 2000 Dollars	2003-2022 2002 Dollars
Maintain	Maintain	$14.8	$15.6
Improve	Maintain	$16.0	$17.1
Maintain	Improve	$19.5	$22.5
Improve	Improve	$20.6	$24.0

Average annual investment requirements are estimated to be $15.6 billion to maintain conditions and performance ($14.8 billion in 2000) and $24.0 billion to improve conditions and performance ($20.6 billion in 2000). Under the "Maintain" scenario, $10.3 billion annually would be needed for asset rehabilitation and replacement and $5.3 billion for asset expansion. Under the "Improve" scenario, $11.7 billion would be needed annually for replacement and rehabilitation, $5.7 billion for asset expansion, and $6.6 billion for performance improvements.

Annual Cost to Maintain and Improve Conditions and Performance by Investment Type, 2003–2022



Vehicles account for the 45 percent of the investment required to maintain conditions and performance, $6.9 billion annually, and 39 percent of the investment needed to improve conditions and performance, $9.3 billion annually; guideway elements account for 17 percent of the investment to maintain conditions and performance, $2.7 billion annually, and 39 percent of the investment amount needed to improve conditions and performance, $4.3 billion annually. Facilities and stations each account for 10 to 15 percent of total investment requirements, systems for 7 to 8 percent, and other project costs for 6 to 12 percent.

Average Annual Transit Investment Requirements by Asset Type, 2003–2022

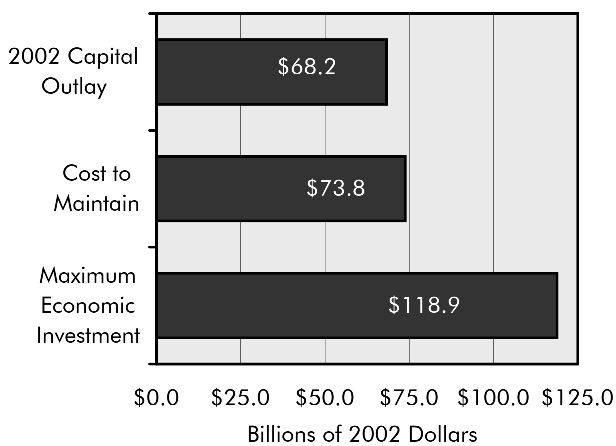
(Billions of 2002 Dollars)

	Maintain	Improve
Vehicles	$6.9	$9.3
Guideway Elements	$2.7	$4.3
Facilities	$1.9	$2.3
Stations	$1.8	$3.5
Systems	$1.3	$1.7
Other Project Costs	$0.9	$2.9

Comparison of Spending and Investment Requirements: Highway and Bridge

While this report **does not recommend any specific level of investment**, a comparison of the investment requirement scenarios with current and projected spending levels provides some insights into the likelihood that the level of performance implied by the scenarios will be achieved.

2002 Capital Outlay by All Levels of Government Versus Highway and Bridge Investment Requirements

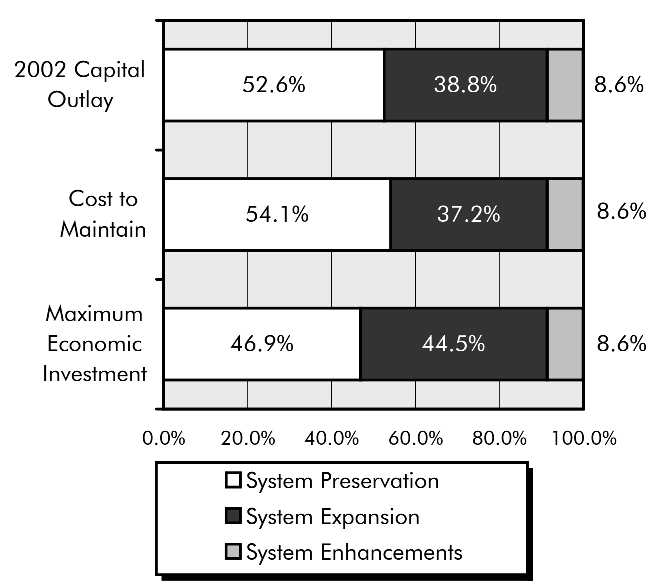


Federal, State, and local capital expenditures for highways and bridges totaled $68.2 billion in 2002. **Capital outlay by all levels of government would have to increase by 8.3 percent above this level to reach the projected $73.8 billion Cost to Maintain Highways and Bridges level**. The percentage gap is greatest for the highway pavement preservation component of the Cost to Maintain. Capital expenditures for bridge preservation were 21 percent higher than the estimated annual cost to maintain the current economic backlog of bridge improvements in constant dollar terms (though significant progress remains to be made in reducing the number of deficient bridges). **An increase in highway capital outlay of 74.3 percent above current levels would be required to reach the projected $118.9 billion Maximum Economic Investment (Cost to Improve Highways and Bridges) level**.

The distribution of funding by investment type suggested by the investment requirement scenarios developed using the HERS and NBIAS models depends on the level of available funding. In 2002, 38.8 percent of highway capital outlay went for system expansion, including the construction of new roads and bridges and the widening of existing facilities.

For the Cost to Maintain Highways and Bridges, 37.2 percent of the projected 20-year investment requirements is for system expansion, slightly lower than its share of current capital spending. The analysis indicates that modest increases in funding over current levels might best be directed more toward system preservation than is currently the case. However, if funding were to rise significantly above this level, the analysis suggests that even more cost-beneficial system expansion expenditures would be found, so that at the Maximum Economic Investment level, 44.5 percent of total investment requirements are for system expansion.

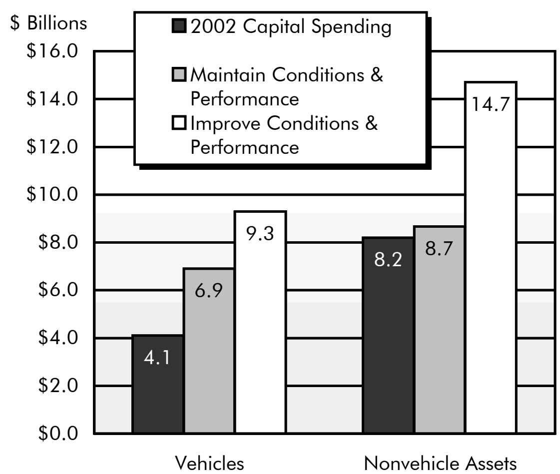
Investment Requirements and 2002 Capital Outlay Distribution by Improvement Type



Comparison of Spending and Investment Requirements: Transit

Transit capital expenditures from Federal, State, and local governments totaled $12.3 billion in 2002. **The annual capital investment necessary to maintain conditions and performance for the 20 year period from 2003–2022 is estimated to be $15.6 billion, 27 percent above actual spending in 2002**; and the annual capital investment required to improve conditions and performance is estimated to be $24.0 billion, 95 percent above actual 2002 capital spending.

A Comparison of 2002 Capital Investment Requirements with Average Annual Investment Requirements (Billions of Dollars)



The difference between estimated requirements and actual expenditures in this report is smaller than reported in earlier editions. This decrease reflects an average annual growth of 16.5 percent in transit capital investment between 2000 and 2002, with total capital investment rising from $9.1 billion in 2000 to $12.3 billion in 2002. It also reflects a lower projected ridership growth of 1.5 percent compared with 1.6 percent in the 2002 report and the application of a more rigorous benefit-cost test.

The annual amount estimated to be required to maintain the conditions and performance of the Nation's transit vehicle assets is $6.9 billion, 68 percent above actual spending of $4.1 billion in 2002. To improve conditions and performance, investment in vehicles would need to be $9.3 billion, 127 percent above the 2002 investment.

Due to their natural rate of deterioration, the entire bus fleet and a considerable number of rail vehicles will need to be replaced at least once during the period 2003 to 2022. Furthermore, in 2002, approximately 16,500 bus vehicles and 6,980 rail vehicles were overage compared with 16,200 bus vehicles and 6,780 rail vehicles in 2000. In 2002, 68 percent of commuter rail self-propelled passenger coaches, 36 percent of heavy rail vehicles, and 34 percent of commuter rail passenger coaches were overage.

The annual amount estimated to be needed to maintain the conditions and performance of the Nation's nonvehicle transit infrastructure is $8.7 billion, 6 percent above the $8.2 billion spent in 2002. The annual amount estimated to be needed to improve the conditions and performance of the nonvehicle infrastructure is $14.7 billion, 79 percent above actual spending in 2002. In addition to meeting future needs as these assets deteriorate, 14 percent of all maintenance facilities, 20 percent of all yards, 6 percent of all substations, 19 percent of all overhead wire, 14 percent of third rail, 15 percent of track, 9 percent of elevated structures, 17 percent of underground tunnels, and 56 percent of stations were estimated to be in poor or substandard condition in 2002.

In addition to the continual replacement of existing transit assets, annual investment requirements will need to meet projected passenger growth by expanding the asset base. The passenger bus fleet will need to increase by almost 42,000 vehicles from 2002 to 2022, or by about 45 percent, and the rail fleet will need to increase by nearly 5,000 vehicles, or by about 26 percent.

Impacts of Investment: Highway and Bridge

Linkage Between Recent Condition and Performance Trends and Recent Spending Trends

Spending by all levels of government on system preservation increased by 56 percent between 1997 and 2002, from $23.0 to $35.8 billion. This increased investment in roadway and bridge rehabilitation and resurfacing is reflected in the improvements in pavement ride quality and reductions in bridge deficiencies that are described elsewhere in this report.

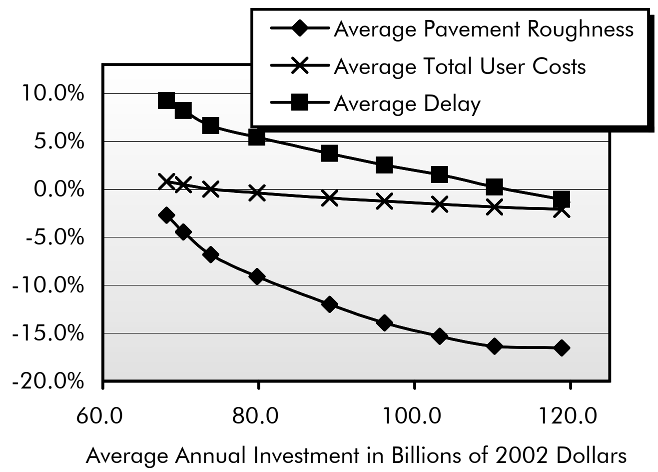
Investment in system expansion has also increased, but at a much lower rate relative to outlays for system preservation. While the rate of deterioration in various measures of operational performance has decreased, the level of investment has not stopped the overall growth in congestion levels.

Impact of Future Investment on Highway Conditions and Performance

If average annual highway capital investment from 2003 to 2022 reaches the projected $118.9 billion Maximum Economic Investment level and is applied in the manner suggested by the analysis, shifting more investment toward system expansion to address increasing congestion problems, average pavement quality is projected to improve by 16.7 percent relative to year 2002 levels. Improvements in highway operational performance would cause average delay to decrease by 1.0 percent, while average highway user costs would decline by 2.1 percent. [Note these delay figures reflect average delay per vehicle miles traveled (VMT); total delay would be expected to increase as total VMT rises over time.]

If all levels of government combined invested at the Cost To Maintain projected level of $73.8 billion, and slightly increased the share of investment devoted to system preservation as suggested by the analysis, average pavement roughness would improve by 6.8 percent, while average delay would worsen by 6.6 percent. By definition, average highway user costs would remain at year 2002 levels.

Projected Changes in 2022 Highway Condition and Performance Measures Compared to 2002 Levels, at Different Possible Funding Levels



Impact of Investment on Travel Growth

The amount of travel growth on a highway segment may be affected by the level of investment on that segment. Investments that reduce the economic cost of using the facility will tend to encourage additional use, while increasing congestion on an unimproved roadway can cause travel growth to be lower than it otherwise would be. The travel growth forecasts used in the analysis of highway investment requirements in this report are dynamic, in the sense that they allow feedback between the level of future investment and future VMT growth.

If highway-user costs are maintained at current levels as they would be under the Cost to Maintain scenario, the analysis projects that urban VMT would grow by an average annual rate of 1.97 percent. If highway-user costs decline, as they would under the Maximum Economic Investment scenario, this rate would increase to 2.12 percent per year.

Impacts of Investment: Transit

Current capital spending reached its highest level relative to estimated rehabilitation and replacement needs in urban areas in 2002 ($12.3 billion in spending compared with $10.3 billion estimated for rehabilitation and replacement), 19 percent higher. Since 1993, capital investment in transit assets has been equal to or slightly higher than the replacement and rehabilitation levels necessary to maintain conditions. Rehabilitation and replacement expenditures are always lower than total capital investment because a portion of the amount allocated to capital investment in each year is invested in new system capacity.

Current Transit Capital Spending Levels Versus Rehabilitation and Replacement Needs, 1993 – 2002

Analysis Year	Current Capital Spending (Billions of Current Dollars)	Estimated Replacement and Rehabilitation Needs (Billions of Current Dollars)
1993	$5.7	$5.1
1995	$7.0	$7.0
1997	$7.6	$7.0
2000	$9.1	$9.2
2002	$12.3	$10.3

Based on FTA's budget history, about half of FTA's capital assistance has been allocated to rehabilitation and replacement expenditures and about half has gone to asset expansion, i.e., new capacity, which also contributes to higher average condition levels through the purchase of new assets.

Funding levels between 2000 and 2002 have been sufficient to maintain conditions. If the amount spent is 10 percent lower than the amount estimated to be needed to maintain conditions in urban areas ($8.72 billion annually instead of $9.69 billion annually), the average condition of transit assets is estimated to fall from 3.7 in 2002 to 3.6 in 2022. If this amount is lowered by 30 percent to $6.78 billion annually, average asset conditions are estimated to fall to 3.4 in 2022.

Effect of Capital Spending Constraints on Transit Conditions

	2002 Condition	Percent of Recommended Rehabilitation and Replacement Expenditures to Maintain Conditions			
Asset Type		**100%**	**90%**	**80%**	**70%**
Guideway Elements	4.3	4.0	3.9	3.9	3.9
Facilities	3.4	3.3	3.1	3.1	3.1
Systems	4.1	4.0	3.8	3.7	3.6
Stations	3.0	3.6	3.6	3.6	2.9
Vehicles	3.4	3.4	3.3	3.1	3.0
All Assets	**3.7**	**3.7**	**3.6**	**3.5**	**3.4**
Rehabilitation and Replacement Expenditure Scenarios [1]		$9.69	$8.72	$7.75	$6.78

[1] *Excludes rural vehicles and facilities.*

Funding levels between 2000 and 2002 have also been sufficient to maintain performance as measured by passenger travel time and vehicle occupancy. TERM estimates that for urban areas $5.3 billion annually will be needed to maintain current performance if PMT increases annually at the projected rate of 1.5 percent, or about 158 million new passengers per year.

TERM considers, in its benefit-cost analysis, the effect of capital investment on transit user costs and the effect of change in these costs on transit ridership. Transit user costs are comprised of two components: the out-of-pocket transit fare cost and the time spent making the trip or "travel-time cost." Travel-time savings are realized by adding or expanding an existing rail or BRT service or by adding vehicles to reduce crowding.

TERM estimates that $6.52 billion annually is required to improve transit performance in urban areas, $1.65 billion annually for asset expansion in new rail or BRT service to increase speed and $4.87 billion annually for asset expansion in new vehicles to reduce occupancy levels. The average ridership estimated to result from increasing speed is 22.2 million passengers annually; the average annual ridership estimated to result from decreasing occupancy levels is 36.7 million passengers annually.

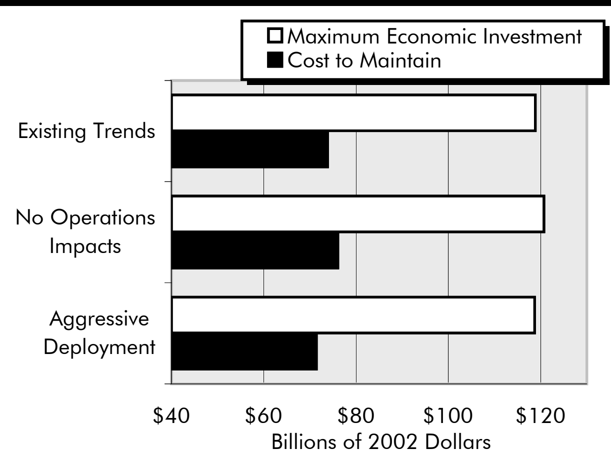
Sensitivity Analysis: Highway and Bridge

The usefulness of any investment requirements analysis depends on the validity of the underlying assumptions used to develop the analysis. Since there may be a range of appropriate values for several of the model parameters used in these analyses, this report includes an analysis of the sensitivity of the estimated Maximum Economic Investment (Cost to Improve Highways and Bridges) and Cost to Maintain Highways and Bridges to changes in these assumptions. [See also "Congestion Pricing" on page ES-13.]

Operations Improvements

The baseline estimates of future investment requirements reflect the impacts of existing trends in the deployment of operations strategies and intelligent transportation systems technologies on highway performance. Had such impacts not been considered, the Cost to Maintain conditions and performance on highways would have been 3.0 percent higher. If the deployment of operations improvements were to accelerate significantly in future years, the projected Cost to Maintain Highways and Bridges might decrease by 3.3 percent.

Impact of Operations Improvements on Average Annual Investment Requirements



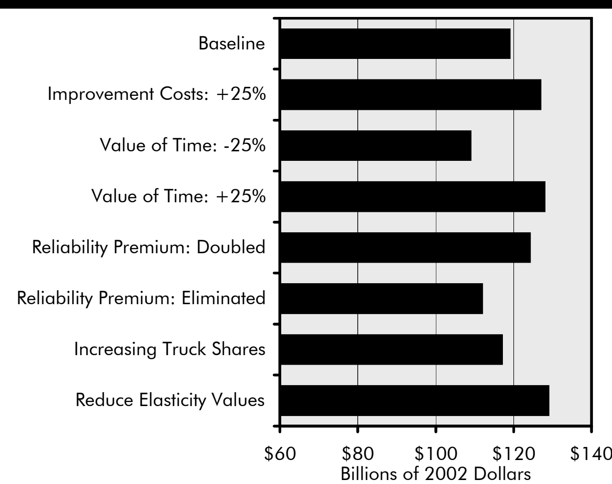
Value of Time

The value of time in the Highway Economic Requirements System (HERS) was developed using a standard methodology adopted by the Department, but other values are used inside and outside the Federal government. Increasing the value of time by 25 percent would increase the Maximum Economic Investment level by 7.6 percent. Cutting it by the same margin would reduce the Maximum Economic Investment level by 8.4 percent.

Construction Costs

If currently unforeseen circumstances were to cause future highway construction costs to unexpectedly rise by 25 percent in constant dollar terms, this would increase the Maximum Economic Investment level by 6.6 percent. The increased cost of individual projects would be partially offset in this scenario by some projects that would no longer be cost-beneficial.

Individual Impact of Alternate Assumptions on the Average Annual Maximum Economic Investment for Highways and Bridges



Note:

The impacts of alternative model parameters and procedures shown above for the Maximum Economic Investment scenario are more ambiguous for the Cost to Maintain, as many of these parameters are used in the calculation of baseline user costs. By changing these parameters, the target user cost level being maintained under the scenario is also changed, so in essence, the definition of what is being "maintained" would be different.

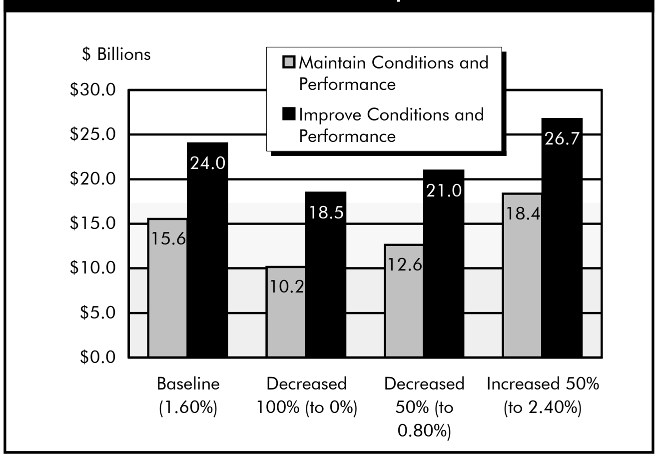
Sensitivity Analysis: Transit

Chapter 10 examines the sensitivity of projected transit investment requirements to variations in the values of the following exogenously determined model inputs: passenger miles traveled (PMT), capital costs, the value of time, and user cost elasticities.

Sensitivity to Changes in Passenger Miles Traveled

The Transit Economic Requirements Model (TERM) relies on forecasts of PMT in large urbanized areas to determine the amount of investment that will be needed by the Nation's transit systems to maintain performance (i.e., current levels of passenger travel speeds and vehicle utilization rates) as ridership increases, and to improve these performance indicators.

The Effect of Variations in PMT Growth on Transit Annual Investment Requirements



PMT forecasts are generally made by metropolitan planning organizations (MPOs) in conjunction with projections of vehicle miles traveled (VMT). The average annual growth rate in PMT of 1.5 percent used in this report is a weighted average of the most recent MPO forecasts available from 76 of the Nation's largest metropolitan areas. Investment requirements in the 2002 report were based on a projected PMT growth rate of 1.6 percent, based on projections from 33 MPOs. (PMT increased at an average annual rate of 2.7 percent between 1993 and 2002, and by 0.9 percent between 2000 and 2002.)

Varying the assumed rate of growth in PMT affects estimated transit investment requirements. A 50 percent increase/decrease in growth will increase/decrease the cost to maintain conditions and performance by 18 to 19 percent and the cost to improve conditions and performance by 12 to 13 percent. Investment requirements decrease significantly if PMT remains constant.

Sensitivity to a 25 Percent Increase in Capital Costs

Given the uncertainty of capital costs, a sensitivity analysis was performed to examine the effect of higher capital costs on the cost of projected transit investment requirements. A 25 percent increase in capital costs increases the amount necessary to maintain conditions and performance by 14 percent and increases the amount necessary to improve conditions and performance by 9 percent.

Sensitivity to Changes in the Value of Time

The value of time is used to determine the total benefits accruing to transit users from transit investments that reduce passenger travel time. Variations in the value of time were found to have a limited effect on investment requirements, since changes in the value of time have inverse effects on the demand for transit services.

Sensitivity to Changes in the User Cost Elasticities

TERM uses user cost elasticities to estimate the changes in ridership that will result from changes in fare and travel time costs, resulting from infrastructure investment to increase speeds, decrease vehicle occupancy levels and increase frequency. A doubling or halving of these elasticities has almost no effect on projected investment requirements.

Federal Safety Initiatives

Safety remains the U.S. Department of Transportation's (DOT's) highest priority. The Federal Highway Administration (FHWA), National Highway Traffic Safety Administration (NHTSA), Federal Motor Carrier Safety Administration (FMCSA) and the Federal Transit Administration (FTA) are sponsoring a variety of initiatives to address highway and transit safety issues.

The DOT has established a goal to reduce the national highway fatality rate from the 2002 level of 1.5 deaths per 100 million vehicle miles traveled to 1.0 deaths per 100 million vehicle miles traveled by the year 2008.

Major improvements in highway safety require a comprehensive and coordinated approach that addresses driver behavior, vehicle design, and the roadway. Many of the safety-related activities currently being carried out by DOT are a result of a national Strategic Highway Safety Plan. This plan includes 22 emphasis areas and 90 strategies to improve highway safety.

Rather than adopting a single policy to improve safety, DOT partners with both the public and private sectors in using a variety of strategies and approaches.

The FHWA addresses roadway infrastructure improvements in three high fatality crash areas (roadway departure crashes—59 percent of all fatalities, intersection crashes—21 percent, pedestrian related crashes—11 percent) by providing roadway improvement programs and working with States to implement these programs to prevent crashes and save lives.

The NHTSA has worked to improve safety through regulatory action, by implementing Federal laws that cover safety belt and child safety seat performance requirements, air bags, and intoxicated driving standards. These efforts are estimated to have saved thousands of lives.

Estimated Number of Lives Saved by Restraint Systems, 1993 and 2002

Restraint Type	1993	2002
Safety Belts	7,773	14,164
Air Bags	190	2,248
Child Restraints	313	376

Source: *Fatality Analysis Reporting System (FARS).*

The NHTSA's public awareness campaigns such as "Drunk Driving Prevention" and "Click it or Ticket" have helped shape public opinion on the critical issues of drunk driving and safety belt use.

The DOT partners with industries and public interest groups on safety-related issues. Such a partnership has helped reduce the number of alcohol-related driving fatalities. The DOT also works to improve safety through engineering and technological research.

FMCSA's enforcement authority extends to interstate motor carriers and motor coaches. FMCSA enforcement operations help ensure compliance with the Federal Motor Carrier Safety Regulations, and their proven effectiveness in reducing crashes and fatalities on the highways has been borne out in the findings of the Roadside Inspection and Traffic Enforcement Intervention Model and Compliance Review Impact Assessment Model.

The FTA has six programs designed to improve the safety and security of the Nation's transit systems. They address modal safety, information sharing and technical assistance, training education, substance abuse, security, and data collection and analysis. Additionally, FTA works to improve safety through the DOT's Intelligent Vehicle Initiative.

As part of these programs, FTA demonstrates, evaluates, and deploys innovative safety technologies; shares technical guidance; and issues regulations stating the safety operational requirements for public transportation systems.

Operations Strategies

Highways are traditionally viewed as transportation facilities with fixed capacity, carrying traffic that peaks with commuters twice each weekday. However, increased traffic demand does not occur just twice daily or on a predictable schedule. It can occur several times during the day and can be driven by temporary and less predictable events.

Reductions in maximum capacity caused by crashes, work zones, bad weather, and other incidents create at least as much delay as the recurring overload of traffic from commuting. This situation is especially costly to the freight transportation community and affects the economy and the American consumer.

To overcome constraints on maximum capacity and temporary capacity losses, operations strategies are a critical tool. For freeways and other major arterials, strategies include monitoring roadway conditions; detecting, verifying, responding to, and clearing incidents quickly; identifying recurring and nonrecurring traffic bottlenecks; implementing lane management strategies; controlling flows onto freeways with ramp meters; and restricting some facilities to high occupancy vehicles. On minor arterials and major collectors, the timing and coordination of traffic signals are essential to facilitate the flow of traffic. [See also "Congestion Pricing" on page ES-13.]

Without greater attention to operations, travelers and goods moving on our Nation's highways will continue to waste many hours as a result of delay caused by recurring congestion, incidents, work zones, weather, and poor traffic control. Lives will be ruined or lost because unsafe conditions and crashes are not detected and countered in a timely fashion.

Through the effective implementation of correct operations strategies, transportation system reliability, safety, and security can be improved and productivity increased.

Freight

Freight transportation enables economic activity, and trucking is a key element of freight transportation. **The condition and performance of the highway system are crucial to the efficiency and effectiveness of trucking.** Recent growth in truck traffic is placing greater burdens on the highway system.

The economic vitality of the Nation relies on the U.S. transportation network. It supports local businesses, interstate commerce, and international trade. At the same time, the American public relies on freight transportation to provide access to goods and services produced by businesses both here and abroad.

Although commercial vehicles currently account for less than 10 percent of all vehicle-miles of travel, **truck traffic is growing faster than passenger vehicle traffic and is having major effects on intercity highways.** Trucks already account for more than 30 percent of traffic on about 20 percent of Interstate System mileage. This share is projected to significantly increase based on a projection that the demand for freight transportation will double over the next 20 years. This growth in trucking is stimulated by economic growth as well as factors such as increased demand for just-in-time deliveries, major reductions in railroad track mileage and decentralization of business establishments.

Trucking may be seen by the traveling public as an unwanted competitor for space on congested highways, but that same public depends on trucking to meet the logistics needs of businesses and households. Highway condition and performance, including congestion, have a significant effect on the costs and efficiency of trucking. The importance of freight transportation in general and trucking in particular is increasingly recognized by agencies at all levels of government and will be the subject of extensive analyses and policy considerations in the years ahead.

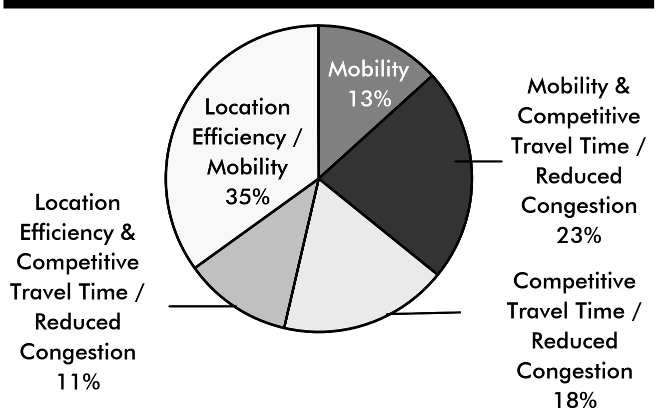
CHAPTER 14: Executive Summary	CHAPTER 15: Executive Summary

The Importance of Transit

Transit enhances the quality of life of the American people. It offers basic mobility to people who either do not own or have access to a car, convenient and efficient mobility to people who live and work in densely populated areas where travel by car does not make sense, and competitive travel times and reduced road congestion for people traveling to and from work along major transportation corridors in large metropolitan areas. Chapter 14 draws on two surveys of transit riders— The National Household Travel Survey (NHTS), a national survey, and the Transit Performance Monitoring System (TPMS) a snapshot of smaller systems with more transit-dependent riders.

The NHTS found that 44 percent of nationwide transit riders come from households without cars; TPMS found that 70 percent of trips were made by riders from households without cars. Getting to and from work accounts for the highest percentage of transit trips. Transit also is used to obtain educational, medical, personal business, and recreational services. The following pie chart shows shares of mobility, location efficiency, competitive travel time, and reduced congestion benefits provided by transit to TPMS riders. In many cases, trips provide more than one benefit. Transit also provides environmental and other benefits not captured by onboard passenger surveys.

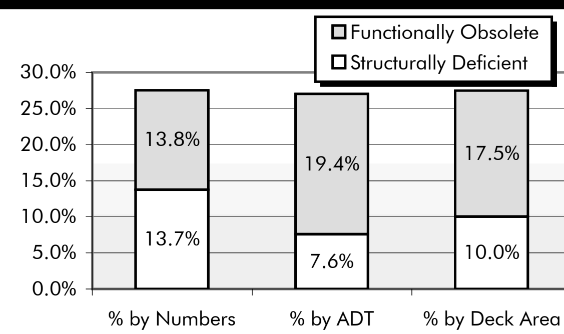
The Benefits of Transit



Bridges

Bridges are critical elements within the highway transportation network, supporting commerce, economic vitality, and personal mobility. There are 591,707 bridges over 20 feet in length located on public roads in the United States, carrying nearly 4 billion vehicles per day. Of this total, 27.5 percent are classified as structurally deficient or functionally obsolete. Structural deficiencies result primarily from deteriorated conditions on the primary components of a bridge. These structures typically require significant maintenance and repair to remain in service. While 13.7 percent of bridges are structurally deficient, these bridges constitute only 10.0 percent of total bridge deck area and carry only 7.6 percent of bridge traffic. A functionally obsolete bridge generally is one that no longer meets current geometric and structural standards for the highway on which it is located.

Bridge Deficiencies by Numbers, by ADT, and by Deck Area



Source: National Bridge Inventory.

The Nation's highway bridges have remained safe as a result of the development of the National Bridge Inspection Standards and associated funding programs of the bridge programs, and progress has been made in reducing deficiencies. However, with an ever-aging population of highway structures and increasing traffic demands, it is important to examine transportation system preservation strategies, such as preventative maintenance, and improved bridge inspection and management techniques to continue to ensure the safety of the motoring public and effective stewardship of the public trust.

Interstate System

The Interstate System serves as the backbone of transportation and commerce in the United States. Interstate route miles increased from 46,675 in 2000 to 46,747 in 2002. About 70.8 percent were in rural areas, 3.9 percent were in small urban areas, and 25.3 percent were in urbanized areas. In 2002 the Interstate System included 55,245 bridges, 27,316 rural bridges, and 27,929 urban bridges.

In 2002, Americans traveled approximately 282 billion vehicle miles on rural Interstates, 23 billion vehicle miles on small urban Interstates, and in excess of 389 billion vehicle miles on urban Interstates. Interstate vehicle miles traveled (VMT) grew at an average annual rate of approximately 3.1 percent between 1993 and 2002.

About 26.3 percent of all urban Interstate bridges were deficient in 2002, and 15.8 percent of all rural interstate bridges were deficient. In 2002, 97.8 percent of rural Interstate pavements met the standard for "Acceptable" ride quality, compared to 95.3 percent for Interstates in small urban areas and 91.7 for Interstates in urbanized areas.

To maintain the current level of user costs on urban Interstates, an average annual investment level of $10.96 billion would be required. For all Interstates, an average annual investment in bridge preservation of $2.13 billion would be required so that the bridge investment backlog would not increase above its current level.

The 2002 level of rural and urban Interstate bridge preservation investment would be adequate to address the economic backlog of bridge deficiencies if that level of investment could be sustained. However, 2002 appears to have been an unusually high year for rural Interstate capital spending, especially for rural bridges. On urban Interstates, significant increases in funding for preservation and expansion above current levels would be required to prevent both average physical conditions and operational performance from becoming degraded.

National Highway System

The National Highway System (NHS) consists of the most important routes for commerce and trade in the United States and includes the Interstate System and the Strategic Highway Network (STRAHNET), as well as critical intermodal connectors to passenger and freight facilities. The NHS includes 84.0 percent of rural other principal arterials and 87.1 percent of urban other freeways and expressways. Only 4.1 percent of the Nation's total road mileage is on the NHS, but it carries 44.4 percent of the total VMT.

In 2002, 93.7 percent of NHS route miles had acceptable ride quality, while 90.6 of VMT on the NHS was on pavements classified as acceptable. Since 1997, the percent of rural NHS route miles with acceptable ride quality has risen from 94.5 percent to 97.1 percent. The comparable percentages for the urban NHS have remained relatively flat, rising from 83.9 to 84.1 percent.

Between 2000 and 2002, daily vehicle miles traveled per lane mile grew by 3.0 percent on the rural NHS and 2.1 percent on the urban NHS.

The 114,587 structures on the NHS constitute 19.4 percent of all bridges in terms of numbers, but carry 71.0 percent of the total daily traffic volume serviced by the total bridge inventory. Of the total NHS bridges, 23.0 percent were deficient in 2002.

Rural NHS average ride quality could be maintained at 2002 levels at a sustained funding level of $6.33 billion annually. For the urban NHS, this would be between $12.82 and $13.42 billion annually. An average annual investment in bridge preservation of $3.79 billion would be needed so the NHS bridge investment backlog would not increase.

On the urban portion of the NHS, current funding levels for preservation and expansion can be expected to provide improved pavement quality, but a loss in overall operational performance.

Strategic Highway Network

The Strategic Highway Network (STRAHNET) is a 62,791-mile system of roads deemed necessary for emergency mobilization and peacetime movement of heavy armor, fuel, ammunition, repair parts, food, and other commodities to support U.S. military operations. STRAHNET Connectors (about 1,700 miles) are additional highway routes linking over 200 important military installations and ports to STRAHNET. These routes are typically used when moving personnel and equipment during a mobilization or deployment.

STRAHNET Mileage, 2002

Interstate	46,749
Non-Interstate	16,042
Total	**62,791**

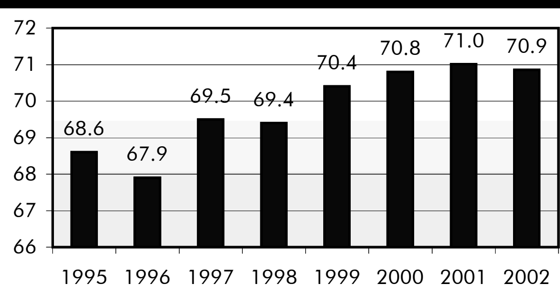
Source: Highway Performance Monitoring System

In 2002, 96.1 percent of all mileage in STRAHNET had a measured pavement roughness that met the standard for acceptable ride quality on the National Highway System cited in the FHWA Performance Plan.

There were 79,852 bridges on STRAHNET in 2002. About 20.6 percent of STRAHNET bridges were considered deficient.

In 2002, about 70.9 percent of bridges over STRAHNET routes had vertical clearances greater than 16 feet, up from 68.6 percent in 1995. This measure is important because military convoys and emergency response vehicles need to be able to clear structures on the STRAHNET system.

Percent of STRAHNET Routes Under Bridges With Clearance Greater Than 16 Feet, 1995–2002

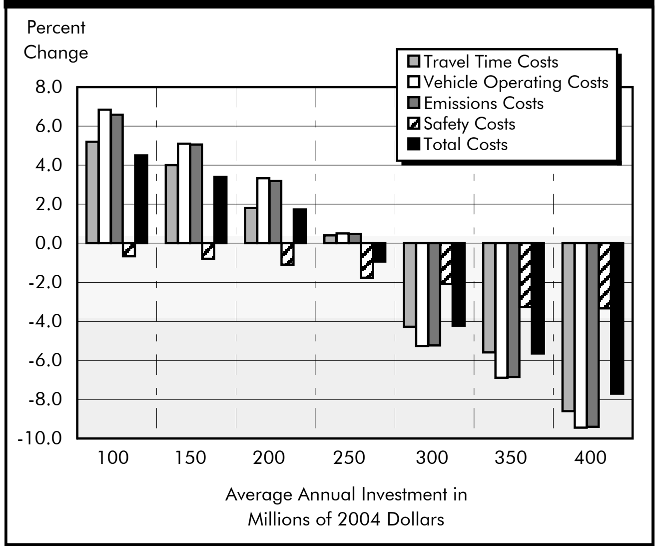


Source: FY 2003 FHWA Performance Plan.

Highway-Rail Grade Crossings

An analysis of highway-rail grade crossings on the Federal-aid highway system by the Federal Railroad Administration finds that **all categories of highway users could face delay costs of up to $8.8 billion at grade crossings over the next 20 years.** Auto users could spend 86.5 million more hours delayed at crossings and truckers could log an additional 10.7 million hours behind closed gates in 2024, compared with 2004. Bus delay could increase by 8.9 million hours over the next 20 years.

Costs Compared to 2004 Levels for Different Possible Funding Levels



An estimated $250 million annual investment in grade separation over the next 20 years could maintain highway user costs at grade crossings at 2004 levels. A projected annual investment of $400 million would be sufficient to separate all grade crossings on the Federal-aid highway system where estimated highway user costs exceed capital investment requirements.

These two investment levels are comparable to the "Maintain User Costs" and "Maximum Economic Investment" scenarios for highways discussed in Chapter 7. Some grade separation improvements also are reflected in the estimates of the "Cost to Maintain Highways and Bridges" and "Cost to Improve Highways and Bridges" scenarios presented in Chapter 7.

Transit on Federal Lands

Federal lands account for approximately 27 percent of the land area of the United States, principally in the western part of the country. These lands are composed of the National Park Service (NPS), the Bureau of Land Management (BLM), and the U.S. Fish and Wildlife Service (USFWS), which are part of the Department of the Interior (DOI), and the U.S. Forest Service (USFS), which is part of the Department of Agriculture. Transit services are already in place in more heavily visited Federal land areas. As it becomes more difficult to expand roads and parking lots at a reasonable cost and without harming the environment in these areas, transit investment could help accommodate increases in recreational visits to these areas.

In 2004, a joint FTA and FHWA study was completed, which estimated transit and transit enhancement investment needs—or alternative transportation systems (ATS)—on USFS lands. This study was under-taken to expand the results of a 2001 study of ATS needs on DOI lands. The 2004 study identified 30 USFS sites that would benefit from new or supplemental ATS investments. Six of these sites are located in Alaska and the rest in the lower 48 States. The report estimates that, between 2003 and 2022, these ATS needs will total approximately $698 million in 2003 dollars ($687 million or $34.35 million per year in 2002 dollars). Seventy-five percent of this investment is estimated to be required for surface transit, 17 percent for water transit, and 8 percent for transit enhancements. Twenty-six percent of this investment will be needed for existing systems and 74 percent for new systems.

Total ATS needs for the 20-year period (2001 to 2020) for DOI lands from the 2001 FTA and FHWA study were estimated to be $1.71 billion in 1999 dollars ($1.82 billion in 2002 dollars). Ninety-one percent of these needs were estimated to be for the NPS, 7 percent for the USFWS, and 2 percent for the BLM. (See Chapter 27 of the 2002 C&P report.)

Afterword: A View to the Future

The data and analyses presented in this report are based on tools and techniques that have been refined over time, evolving to reflect changing priorities and incorporating the latest relevant surface transportation research to the extent possible. At the same time, there is considerable room for improvement in our understanding of the physical conditions, operational performance, and investment requirements for the Nation's surface transportation infrastructure.

This Afterword is intended to discuss the gap between the current state of knowledge and the type of information that would be necessary and desirable to make significant leaps forward in the comprehensiveness of the C&P report analyses. In some cases, significant improvements to the analysis would have to be predicated on changes or improvements in data collection, recognizing that such changes would need to be balanced against the costs of collecting such data. This section also describes some ongoing research initiatives to bridge some of the knowledge gaps described.

Highway operational performance is currently modeled rather than measured, but advances in ITS technology might make it feasible to collect speed information directly. Improved data and modeling would assist analyses of highway and transit physical conditions, safety issues, and environmental impacts.

At its core, transportation investment involves balancing the demand for transportation services with the supply of those services. Areas in need of further exploration include the full social costs of adding capacity, the modeling of transportation demand, the impact of ITS on increasing effective capacity, linkages between financing mechanisms and investment requirements, and the impact of congestion pricing on bringing demand into closer balance with supply. Multimodal analysis, lifecycle cost analysis, and the impacts of investment on productivity also warrant further study.