## The Role of Highways and Transit

America's transportation system facilitates the movement of goods and people within and between cities and regions, linking the Nation together through a wide variety of modes. The surface transportation system serving the United States today reflects investment and location decisions made by both governments and private enterprise over many years.

The Federal government has played a key role throughout the country's history in shaping the transportation system, both in regulating interstate commerce and in funding and facilitating transportation improvements.

### *The Role of Highway Transportation*

America's highways connect all regions and States to one another. They are striking in their versatility, having been engineered to allow for a wide array of users and vehicles simultaneously. Highway transportation depends on both public and private inputs and investment.

Highway transportation in the United States plays a significant role in two major areas:

Personal Mobility. 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.

Freight Movement. Highways are a key conduit for freight movement in the United States, accounting for 54 percent of total freight transport by weight (and 83 percent by value) in 1998. Highways can be used for hauls of virtually any length, from coast-to-coast shipments to short mail and parcel deliveries.

### *The Role of Public Transportation*

Transit provides the following benefits to passengers, communities, and the Nation:

Access, Choice and Opportunity. More Americans are choosing to ride transit, whether to reduce travel time, ease the stress of a daily commute, or contribute to a healthier environment. For those with no access to personal forms of transportation, public transportation provides access to community resources and job opportunities.

Economic Growth and Development. Transit spurs economic activity, creates jobs, boosts property values and tax earnings, and connects employers and workers.

Safe and Healthy Communities. Public transportation helps to protect the environment, conserve energy, and ensure the safety and security of our citizens.

### *The Complementary Roles of Highways and Transit*

Highways and transit serve distinct but overlapping markets. Highway and transit investments expand the choices available to people by increasing their travel options. While highways provide the highest degree of mobility, transit is essential for those that do not have access to a private vehicle. Highway investments can also encourage transit usage by improving access to transit stations and facilities, and improve operating efficiency for transit modes that use highways. Alternatively, transit can help mitigate highway congestion by offering faster and more reliable transportation than private vehicles on some highways during peak travel times.

## System and Use Characteristics: Highway and Bridge

There were over 3.95 million miles of public roads in the United States in 2000. **This mileage was overwhelmingly rural and locally-owned**. About 3.09 million miles were in rural areas in 2000, or 78 percent of total mileage. The remaining 860,000 miles were in urban communities. There were 586,930 bridges in the United States in 2000.

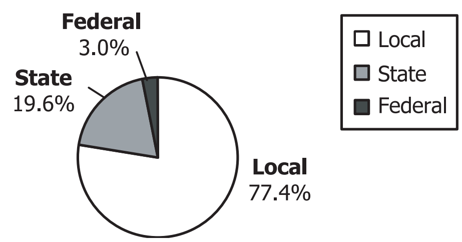
Numerous trends are changing the extent and use of the American highway network. **While locally-owned road mileage increased between 1993 and 2000, rural mileage decreased during that period**. This has been an ongoing trend, partly reflecting the reclassification of Federal roads and the growth of metropolitan areas throughout the United States.

**Percentage of Highway Miles, Lane Miles, and Vehicle Miles Traveled by Functional System, 2000**

| FUNCTIONAL SYSTEM | MILES | LANE-MILES | VEHICLE-MILES TRAVELED |
|---|---|---|---|
| **Rural Areas** | | | |
| Interstate | 0.8% | 1.6% | 9.8% |
| Other Principal Arterial | 2.5% | 3.1% | 9.0% |
| Minor Arterial | 3.5% | 3.5% | 6.2% |
| Major Collector | 11.0% | 10.6% | 7.6% |
| Minor Collector | 6.9% | 6.6% | 2.1% |
| Local | 53.5% | 51.3% | 4.6% |
| **Subtotal Rural** | **78.2%** | **76.6%** | **39.4%** |
| **Urban Areas** | | | |
| Interstate | 0.6% | 0.9% | 14.4% |
| Other Freeway and Expressway | 0.4% | 0.5% | 6.4% |
| Other Principal Arterial | 1.4% | 2.3% | 14.5% |
| Minor Arterial | 2.3% | 2.8% | 11.8% |
| Collector | 2.2% | 2.3% | 5.0% |
| Local | 15.3% | 14.6% | 8.6% |
| **Subtotal Urban** | **22.2%** | **23.4%** | **60.6%** |
| **Total** | **100.0%** | **100.0%** | **100.0%** |

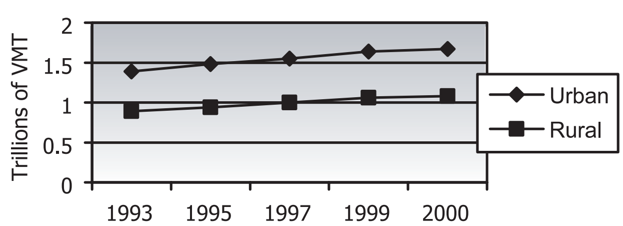
In terms of ownership, about 77 percent of miles were locally-controlled, 19 percent were controlled by States, and the remaining 3 percent were controlled by the Federal Government. **The share of locally-owned roads has steadily increased, while the shares of State and Federal roads have decreased.** Much of the change in Federal ownership has occurred as Federal land management agencies reclassified some of their mileage.

**Highway Mileage by Jurisdiction, 2000**




Americans traveled 2.7 trillion vehicle miles in 2000. While highway mileage is mostly rural, a majority of highway travel (61 percent) occurred in urban areas in 2000. Since 1997, however, **rural travel has grown at a faster average annual rate** (2.8 percent) than urban travel (2.6 percent). This represents a change from the last Conditions and Performance Report, when urban travel growth rates were greater than the preceding decade. Still, vehicle miles traveled (VMT) increased on every highway functional system between 1997 and 2000.

**Highway Vehicle Travel, 1993 to 2000**




The growth in VMT has exceeded the increase in highway lane miles. **Between 1993 and 2000, lane miles grew by 0.2 percent annually, while VMT increased by 2.7 percent annually.** VMT for combination trucks grew faster between 1997 and 2000 than VMT for single-unit vehicles and passenger vehicles.

## System and Use Characteristics: Transit

### *Transit system coverage, capacity, and use in the United States increased during the 1990s.*

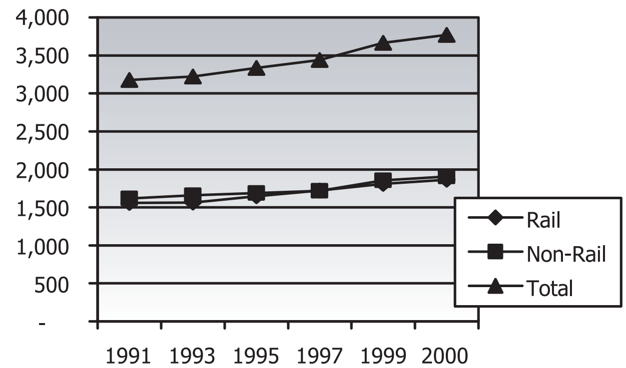
The ownership and operation of public transportation services in the United States was transferred from private companies to publicly-owned and operated entities with the passage of the Urban Mass Transportation Act of 1964. Since that time, metropolitan planning agencies have taken on more responsibility for public transportation policy.

In 2000, public transportation agencies in urban areas operated 106,395 vehicles, of which 82,545 were in areas of more than 1 million people. Rail systems covered 10,572 miles of track with 2,825 stations. Rail and non-rail public transportation systems combined operated 1,269 vehicle maintenance facilities. In addition, an estimated 19,185 public transportation vehicles operated in rural areas and 28,664 special service vehicles serving the disabled and elderly were operated by agencies receiving Federal Transit Administration (FTA) funds.

Public transportation systems operated 9,221 route miles of rail service in 2000, an absolute increase of 31.7 percent since 1991. Non-rail route miles were 163,303 in 2000, an increase of 9.4 percent over the same time period.

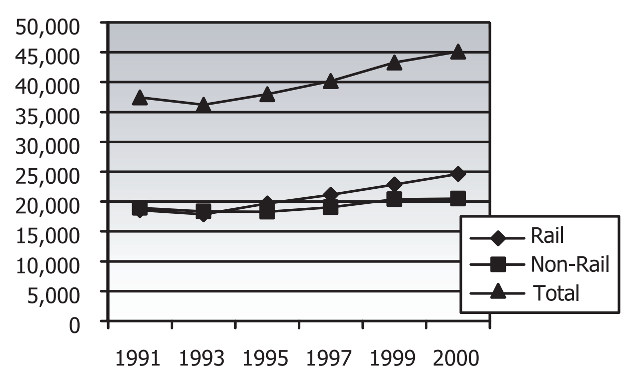
**Public transportation system capacity as measured in vehicle revenue miles, and adjusted for vehicle capacity, increased by 18.7 percent from 1991 to 2000.** Rail capacity increased 19.7 percent, and non-rail capacity by 17.7 percent. Capacity for rail and non-rail in 2000 was almost identical, approximately 1.9 billion capacity equivalent miles each, for a total of 3.8 billion.

**Public Transportation Capacity, 1991-2000 (millions of capacity equivalent miles)**




**Transit passenger miles increased by 24.5 percent between 1993 and 2000, from 36.2 billion to 45.1 billion.** Growth in passenger miles was most pronounced for rail transit modes, increasing 37.7 percent, from 17.9 billion in 1993 to 24.6 billion in 2000.

**Urban Passenger Transit Miles (millions)**

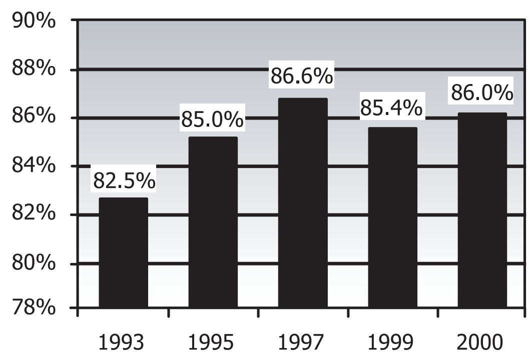



Public transportation vehicle occupancy remained relatively stable between 1993 and 2000, at an average of between 11 to 12 passengers per vehicle, adjusted for capacity. Vehicle occupancy increased for rail vehicles from 11.4 to 13.2 passengers and decreased for non-rail vehicles from 11.1 to 10.8 passengers.

## System Conditions: Highway and Bridge

**The ride quality of 86.0 percent of the total road mileage is rated "Acceptable" for 2000, up from 85.4 percent in 1999.** Of the total rural road miles, 89.0 percent are rated as having acceptable ride quality, while 79.8 percent of total small urban road miles and 76.6 percent of the total road miles in urbanized areas are rated as having acceptable ride quality.

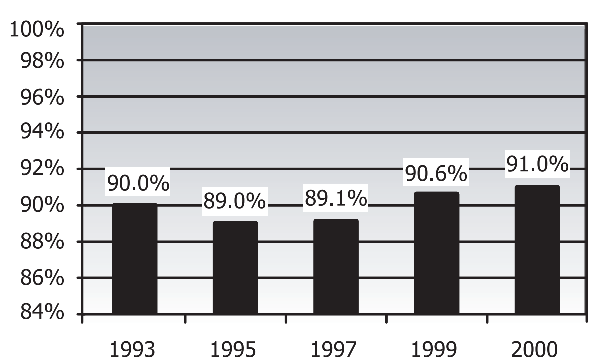
**Miles with "Acceptable" Ride Quality**




On the National Highway System (NHS), 93.0 percent of the pavements meet or exceed standards for acceptable ride quality. **Of all vehicle miles traveled (VMT) on the NHS, 91.0 percent were on pavements with acceptable ride quality.**

The condition of higher order roads improved, while those of the lower order roads declined.

**VMT on NHS Acceptable Pavements**




Three indicators are commonly used to describe bridge condition. Bridge component ratings provide a detailed description of elements, but these are more widely used within the engineering community. The number of deficient bridges is widely used by policymakers to describe bridge quality nationwide, but this indicator fails to provide a specific description of bridge elements. The Federal Highway Administration has developed a new indicator that will provide a better measure of bridges impact on mobility: the amount of deck area on deficient bridges.

In 2000, 27.9 percent of the Nation's bridge deck area was on bridges that were classified as structurally deficient or functionally obsolete. This percentage decreased on every functional system from 1996 to 2000. Rural Interstate bridges had the smallest amount in 2000 (about 15 percent), while urban collector bridges had the largest amount (39.6 percent).

**Deficient Bridge Deck Area by Functional System, 2000**

| FUNCTIONAL SYSTEM | |
|---|---|
| **Rural** | |
| Interstate | 15.0% |
| Other Principal Arterial | 17.6% |
| Minor Arterial | 22.9% |
| Major Collector | 22.7% |
| Minor Collector | 22.5% |
| Local | 29.1% |
| **Subtotal** | **21.8%** |
| **Urban** | |
| Interstate | 31.6% |
| Other Freeway and Expressway | 28.9% |
| Other Principal Arterial | 36.4% |
| Minor Arterial | 37.3% |
| Collector | 39.6% |
| Local | 36.4% |
| **Subtotal** | **33.6%** |
| **Bridge Total** | **27.9%** |

## System Conditions: Transit

U.S. transit system conditions are determined by the aggregate number and type of transit vehicles in service, their average age and condition, the physical conditions and ages of bus and rail maintenance facilities, and the conditions of transit rail infrastructure components such as track, power systems, stations, and structures.

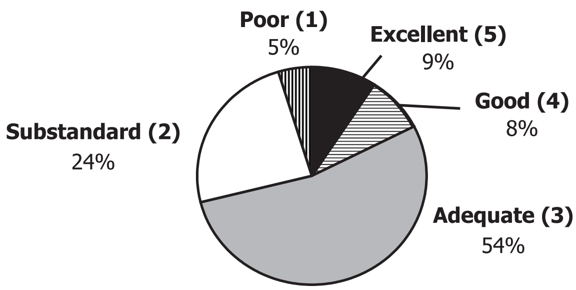
The Federal Transit Administration has undertaken extensive engineering surveys and collected a considerable amount of data on the U.S. transit infrastructure to evaluate transit asset conditions. A rating system of 1 to 5 is used to describe asset conditions.

**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. |

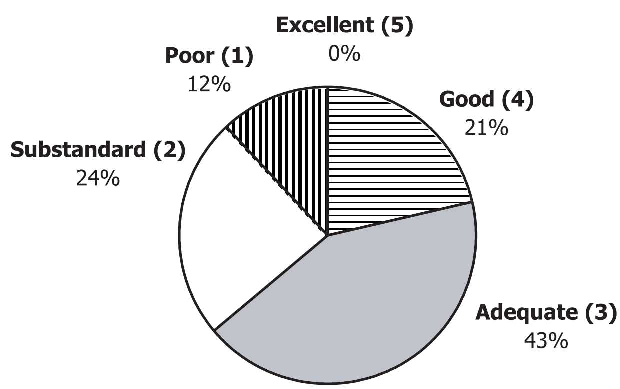
**In 2000, the average condition of urban bus vehicles was 3.07, compared with 2.96 in 1997.** The percentage of bus maintenance facilities in adequate or better condition decreased from 77 to 71 percent during this same period.

**Distribution of Condition of Urban Bus Maintenance Facilities, 2000**




**The average condition of rail vehicles declined gradually throughout the 1990s. In 2000, all rail vehicles were estimated to have an average condition level of 3.55, down marginally from a re-estimated condition level of 3.61 in 1997.** The average conditions of rail vehicles and rail facilities, except those for commuter rail, have been re-estimated to be lower than was reported in the last edition of this report based on additional information collected by engineering surveys between 1999-2001. This does not reflect a true decline in condition in earlier years for which the condition levels have also been revised. Urban rail maintenance facilities continue to age and their condition continues to decline. In 2000, 64 percent of all urban rail maintenance facilities were in good or better condition compared with 77 percent in the 1997. About 75 percent of this decline was due to methodological revisions.

**Distribution of Condition of Urban Rail Maintenance Facilities, 2000**




**The average condition of the remaining non-vehicle transit infrastructure in 2000 is estimated to be similar to the average condition which existed in 1997, as reported in the 1999 C&P Report.**

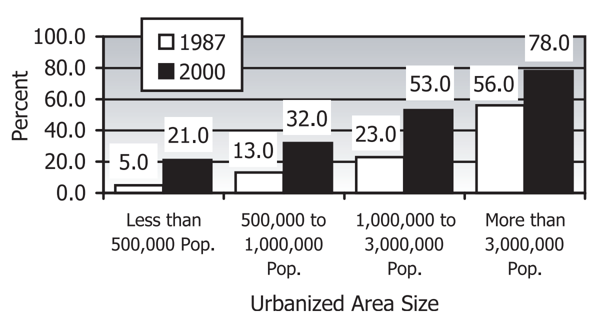
## Operational Performance: Highway

Since the last edition of the C&P Report, FHWA has adopted three new measures of operational performance. **These measures clearly show congestion is increasing throughout the Nation.**

### *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 2000, an average peak period trip required 51.0 percent more time than the same trip under non-peak, non-congested conditions. In 1987, a 20-minute trip during non-congested periods required 25.8 minutes under congested conditions. The same trip in 2000 required 30.2 minutes, or an additional 4.4 minutes. Between 1987 and 2000, 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 vs 2000**

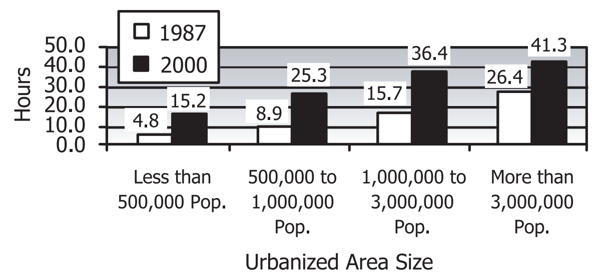



### *Annual Hours of Delay:*

Annual Hours of Traveler Delay is an indicator of the total time an individual loses due to traveling under congested conditions. Cities with less than 500,000 population experienced the greatest percentage growth in the average annual delay experienced by drivers, from 4.8 hours in 1987 to 15.2 hours in 2000—an increase of 217 percent.

Drivers in cities with populations under 500,000 were experiencing close to the same delays in 2000 as communities with populations between 1 million and 3 million in 1987.

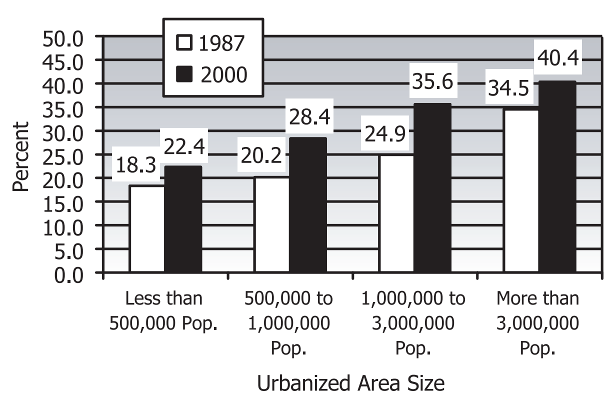
**Annual Hours of Traveler Delay, 1987 vs 2000**




### *Percent of Travel Under Congested Conditions:*

Percent of Travel Under Congested Conditions is defined as the percentage of traffic on freeways and principal arterial streets in an urbanized area moving at less than free flow speeds. Congested travel increased from 31.7 percent in 1992 to 33.1 percent in 2000. Based on this measure, the congested period, or "Rush Hour," increased from 5 to 5.3 hours per day over this period—approximately 18 minutes. For urban areas with populations greater than 3 million, 40.4 percent of daily travel in 2000 was under congested conditions.

**Percent of Travel Under Congested Conditions, 1987 vs 2000**

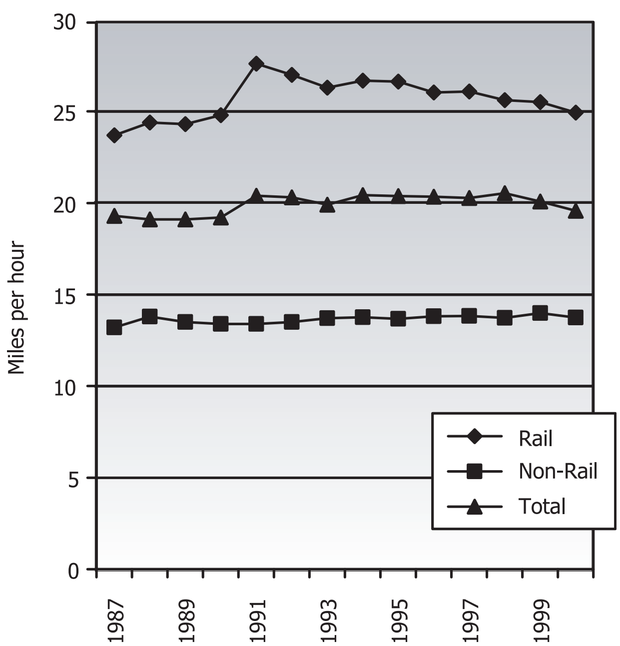


## Operational Performance: Transit

**Average bus speed has remained relatively constant over the past decade, while rail speeds have declined very slightly from their peak in 1991, reflecting growth in the utilization of systems with heavy use and slower speeds**.

**Travel Speed:** The average operating speed of all transit modes in 2000 was 19.6 miles per hour, down from 20.3 in 1997. The average speed for rail modes was 24.9 miles per hour, and the average of non-rail modes, 13.7 miles per hour compared with 26.1 and 13.8, respectively, in 1997.

**Transit Operating Speeds, 1987-2000**

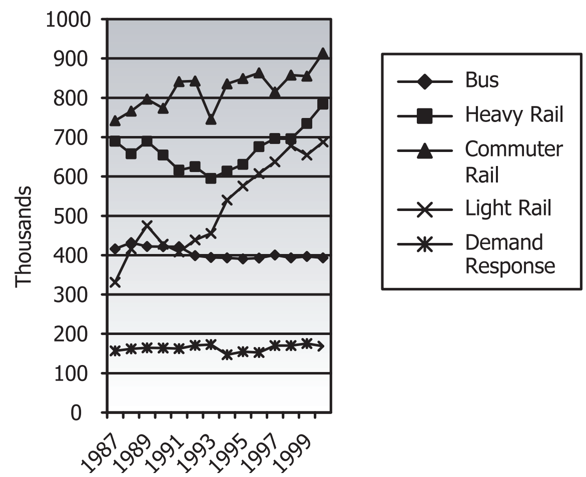



**Vehicle Utilization:** Vehicle utilization is measured as passenger miles per vehicle adjusted to reflect differences in the capacities of each type of vehicle. On average, rail vehicles operate at a higher utilization level than non-rail vehicles. Between 1997 and 2000 vehicle utilization for rail vehicles increased while decreasing for bus and demand response vehicles.

**Vehicle Utilization Passenger Miles per Capacity-Equivalent Vehicle**

| MODE | UTILIZATION | |
|---|---|---|
| | 1997 | 2000 |
| Heavy Rail | 697 | 784 |
| Commuter Rail | 815 | 914 |
| Light Rail | 638 | 688 |
| Bus | 401 | 393 |
| Demand Response | 170 | 169 |

**Vehicle Utilization Passenger Miles per Capacity-Equivalent Vehicle, 1987-2000**




**Frequency and Reliability of Service:** Waiting times vary according to the type of passenger making the trip. Passengers with limited incomes and without access to a private vehicle have the longest average waiting time (12.1 minutes); passengers with above-poverty incomes without access to a private vehicle have a slightly lower average waiting time (8.9 minutes); and those with access to a vehicle, but who choose to use transit (often to avoid road congestion), have the lowest average waiting time (7.3 minutes).

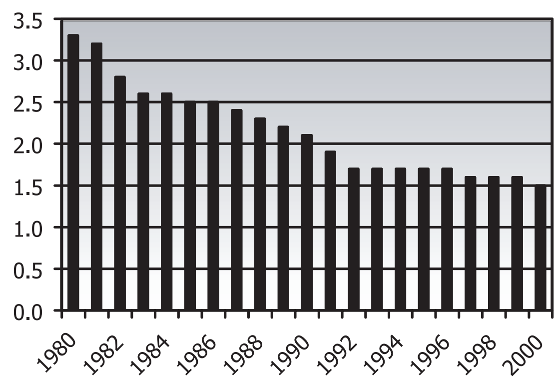
**Seating Conditions:** Seating conditions, measured by the percentage of passengers who find a seat unavailable upon boarding, are slightly worse for those with lower incomes and without access to a car.

## Safety Performance: Highway

Safety is the top priority for the U.S. Department of Transportation. The Safety Strategic Goal in the Department's 2003 Performance Plan aims to "promote the public health and safety by working toward the elimination of transportation-related deaths and injuries."

Over the past thirty years, remarkable progress has been made in making highways safer, with **highways becoming safer even as travel sharply increased.** The exhibit below, for example, describes the fatality rate per 100 million vehicle miles traveled from 1980 to 2000. **The fatality rate has decreased**, from 3.3 in 1980 to 1.5 in 2000, which met the Department's Performance Plan target.

**Fatality Rate, 1980-2000**




**The injury rate has also declined in recent years,** as detailed in the exhibit below. In 1988, the rate was 169 per 100 million vehicle miles traveled; by 2000, that rate had dropped to 116. While significant, the declining injury rate falls short of the Performance Plan goal of 113 per 100 million vehicle miles.

Alcohol impairment is a leading cause of crashes and a serious public safety problem in the United States. In 2000, alcohol was involved in 40 percent of fatal crashes and 8 percent of all crashes.

There are three main groups involved in alcohol-impaired driving:

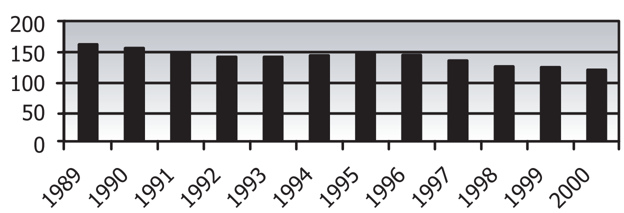
- The largest group, **21- to 34-year-old adults**, was responsible for 31 percent of all fatal crashes in 2000. Studies show that these drivers tend to have much higher levels of intoxication than other age groups.

- **Chronic drunk drivers** are another large group. Fatally injured drivers with a blood alcohol concentration greater than 0.10 grams per deciliter were six times as likely to have a prior conviction for driving while intoxicated than fatally injured sober drivers.

- Finally, **underage drinkers** are disproportionately over-represented in impaired driving statistics.

Speeding and alcohol impairment are closely linked in many crashes. In 2000, 23 percent of underage *speeding* drivers involved in fatal crashes were intoxicated. By contrast, 10 percent of underage *nonspeeding* drivers involved in fatal crashes were intoxicated.

**Injury Rate, 1989-2000**



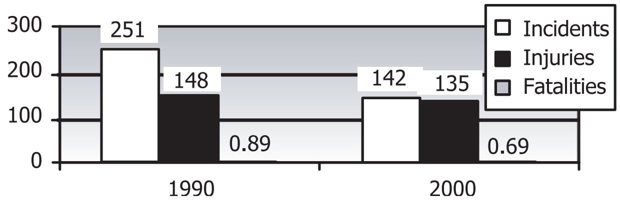

While the number of overall highway fatalities and injuries has decreased in recent years, this is not uniformly true for all vehicle groups. The number of occupants killed in passenger cars, for instance, decreased from 21,566 in 1993 to 20,492 in 2000. In contrast, the number of occupants killed in light and large trucks, motorcycles, and other vehicles all increased during this period.

## Safety Performance: Transit

**Public transit in the United States has been and continues to be a highly safe mode of transportation as evidenced by the decrease in incidents, injuries, and fatalities** reported by transit service providers for the vehicles they operate directly. (They exclude occurrences on contracted transportation).

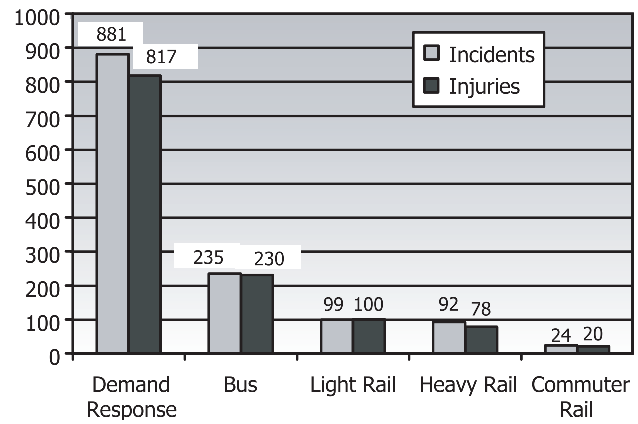
Reportable transit safety incidents include collisions and any other type of occurrence (e.g., derailment) that result in injury or death, or fire or property damage in excess of $1,000. Injuries and fatalities include those suffered by riders as well as by pedestrians, bicyclists, and people in other vehicles. Injuries and fatalities may occur either while traveling or while boarding, lighting, or waiting a for a transit vehicle.

**Incidents, Injuries and Fatalities per 100 Million PMT, 1990 and 2000**



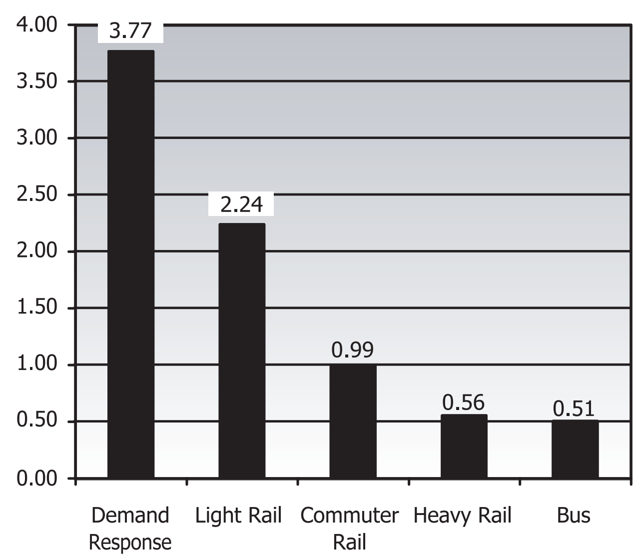

**In absolute terms, incidents were 36 percent lower in 2000 than in 1990, injuries 7 percent higher, and fatalities 11 percent lower.** When adjusted for changes in the level of transit usage, incidents per 100 million passenger miles traveled (PMT) fell from 251 in 1990 to 142 in 2000—a decrease of 45 percent. Injuries per 100 million PMT fell from 148 to 135, a decrease of 9 percent; and fatalities declined from .89 to .69, a decrease of 25 percent. Transit vehicles that travel by road have higher incident and injury rates than those that travel on fixed guideways. Incident and injury rates have consistently been the highest for demand response vehicles with widely fluctuating fatality rates often well above those for other types of transit services. Buses, likewise, have consistently had incident and injury rates above rail transit modes, but unlike demand response vehicles, buses rank among the lowest in fatality rates. Commuter rail, by contrast, has had the lowest incident and injury rates.

**Incidents and Injuries per 100 Million PMT, 2000**




Fatality rates for light rail have, on average, been higher and shown considerably more year-to-year variation over the past decade than commuter and heavy rail.

**Fatalities per 100 Million PMT, 2000**

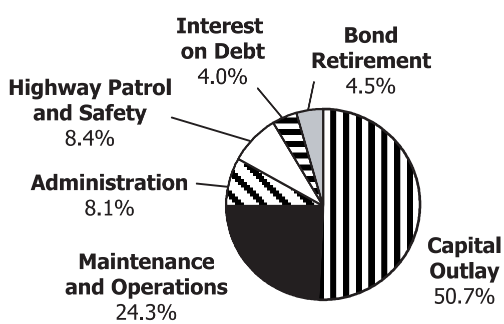


## Finance: Highway and Bridge

Taken together, all levels of government spent $127.5 billion for highways in 2000. The Federal government funded $27.7 billion (21.7 percent). States funded $67.0 billion (52.6 percent). Counties, cities, and other local government entities funded $32.7 billion (25.7 percent).

**Total highway expenditures by all levels of government increased 25.0 percent between 1997 and 2000.** Highway spending rose faster than inflation over this period, growing 14.4 percent in constant dollar terms.

**Highway Expenditures by Type, 2000**

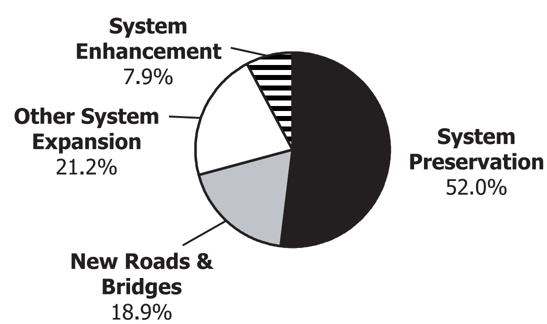



Of the total $127.5 billion spent for highways in 2000, $64.6 billion (50.7 percent) went for capital outlay. This was the first time this percentage exceeded 50 percent since 1975.

**Capital outlay grew by 33.7 percent between 1997 and 2000.** Federal funds accounted for $25.8 billion (39.9 percent) of total capital outlay. Large increases in Federal investment under the Transportation Equity Act for the 21st Century were outpaced by even larger increases in State and local investment, as the combined State and local share of funding for capital outlay rose from 58.4 percent in 1997 to 60.1 percent in 2000.

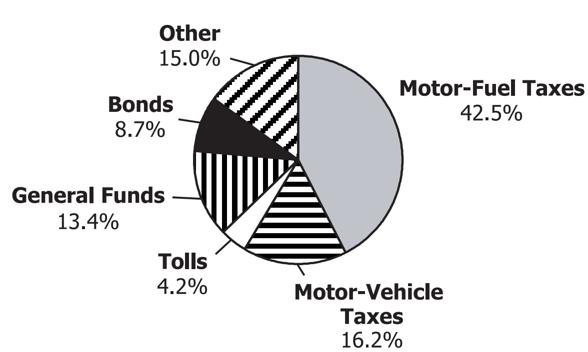
**State and local governments devoted a larger share of their capital spending to the preservation of their existing roads and bridges in 2000 than in 1997**. The share of capital funds used for system preservation rose from 47.6 percent to 52.0 percent. All levels of government spent a combined $33.6 billion of capital funds for system preservation in 2000; $12.2 billion went for new roads and bridges; $13.7 billion went for adding new lanes to existing roads; and $5.1 billion went for system enhancements, such as safety, operational or environmental enhancements.

**Distribution of Highway Capital Outlay By Improvement Type, 2000**




Highway-user revenues—the total amount generated from motor-fuel taxes, motor-vehicle fees, and tolls—were $100.6 billion in 2000. Of this, $81.0 billion (80.5 percent) was spent on highways. This represented 62.9 percent of the total revenues generated by all levels of government in 2000 for use on highways.

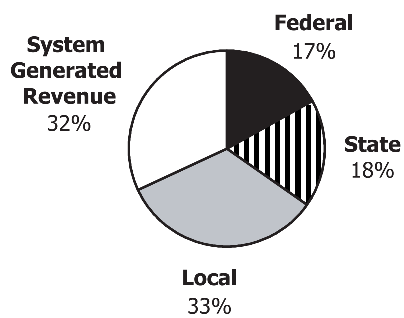
**Revenue Sources for Highways, 2000**



## Finance: Transit

In 2000, $30.8 billion was available from all sources to finance public transportation investment and operations. Public transportation 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 2000, Federal funds accounted for 17 percent of all public transportation revenue sources, State funds for 18 percent, local funds for 33 percent, and system generated funds for 32 percent.**

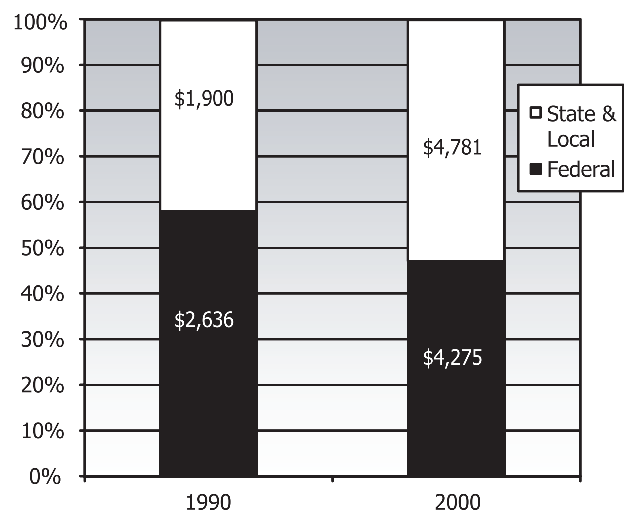
**Transit System Revenue Sources, 2000**




Eighty percent of Federal funds allocated to public transportation are from a dedicated portion of the Federal motor fuel tax and 20 percent are from general revenues. Federal funding for public transportation in constant 2000 dollars increased by 12.3 percent between 1999 and 2000, compared with a 2.4 percent increase between 1998 and 1999.

**In 2000, total capital expenditures on public transportation were $9.1 billion dollars. Federal capital assistance was $4.2 billion dollars, accounting for 47 percent of this amount. Between 1990 and 2000, Federal funding for capital investment grew at an average annual rate of 4 percent, while funding from State and local governments, grew at a 9 percent average annual rate.** State and local funding now accounts for a higher percentage of total capital investment expenditures.

**Composition of Transit Capital Investment Funding, 1990 and 2000**




In 2000, 58 percent of capital spending was for facilities, 31 percent for rolling stock, and 11 percent for other capital, an almost identical allocation as in 1997.

**Operating expenses for transit totaled $20.0 billion in 2000.** As in 1997, about 50 percent of operating expenses was for vehicle operations, 30 percent for vehicle and non-vehicle maintenance, and 20 percent for administrative expenses and purchased transportation. Bus operations accounted for 55 percent of operating expenditures in 2000 ($11.0 billion), heavy rail operations for 20 percent ($3.9 billion), and commuter rail for 13 percent ($2.7 billion). From 1997 to 2000, operating expenses for demand response vehicles increased by 21 percent, for light rail by 26 percent, for bus operations by 13 percent, for commuter rail by 18 percent and for heavy rail by 13 percent.

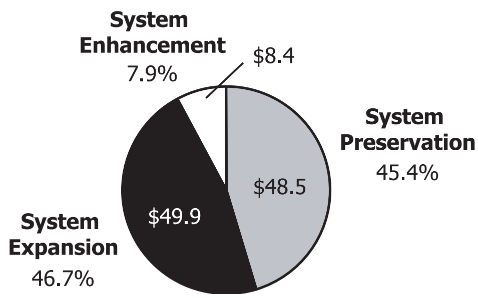
## Capital Investment Requirements: Highway and Bridge

The average annual **Cost to Improve Highways and Bridges for the 20-year period 2001–2020 is projected to be $106.9 billion. This represents the investment by all levels of government required to implement all cost-beneficial improvements on highways and bridges.** This level of investment would address the existing backlog of highway ($271.7 billion) and bridge ($54.7 billion) deficiencies, as well as new deficiencies as they arise during the 20-year period, when it is cost-beneficial to do so.

Investment requirements for system preservation make up 45.4 percent of the total Cost to Improve Highways and Bridges. This includes all *capital* investment required to preserve the condition of the pavement and bridge infrastructure, such as resurfacing, rehabilitation, and reconstruction. This does not include the costs of routine maintenance.

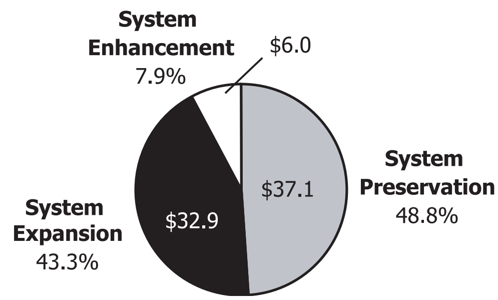
Investment requirements for system expansion make up 46.7 percent of the total Cost to Improve Highways and Bridges. The remaining 7.9 percent of the Cost to Improve is not directly modeled; this represents the current share of capital spending on system enhancements such as safety, operational, and environmental investments.

**Cost to Improve Highways and Bridges Distribution by Improvement Type**




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 2020 will match their year 2000 values.** For bridge preservation, it represents the level of investment required to maintain the existing backlog of bridge deficiencies at its current level. 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. Agency costs, such as maintenance, and societal costs, such as emissions, are also considered in the analysis, although they are not directly targeted. The average annual investment required for the **Cost to Maintain Highways and Bridges is projected to be $75.9 billion**.

**Cost to Maintain Highways and Bridges Distribution by Improvement Type**




The scope of user costs has been expanded from those considered in previous reports to include an estimate for delays resulting from incidents, as well as for recurring daily congestion. A reliability premium has also been added to reflect the additional costs that unpredictable delays impose beyond those of expected delays for which drivers can plan. Including these items in the analysis makes it considerably more expensive to maintain average user costs.

## Capital Investment Requirements: Transit

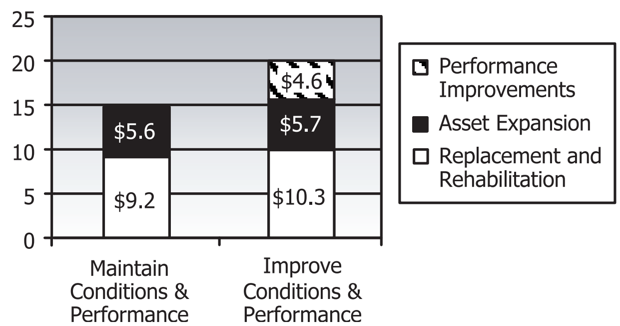
**Estimated transit capital investment requirements have increased substantially since the 1999 Report.** These requirements are estimated for the period 2001-2020 for four scenarios. The Maintain Conditions scenario projects the level of transit capital investment necessary to maintain average asset conditions over this 20-year period, and the Improve Conditions scenario projects the investment necessary to raise the average condition of each major 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 increase average vehicle speeds and reducing average vehicle occupancy rates.

**Summary of Transit Average Annual Investment Requirements, 2001-2020 (Billions of 2000 Dollars)**

| CONDITIONS | PERFORMANCE | AVERAGE ANNUAL COST | |
|---|---|---|---|
| | | 1997 | 2000 |
| Maintain | Maintain | $10.8 | $14.8 |
| Improve | Maintain | $14.4 | $16.0 |
| Maintain | Improve | $11.1 | $19.5 |
| Improve | Improve | $16.0 | $20.6 |

**Average annual investment requirements are estimated to be $14.8 billion to Maintain Conditions and Performance ($10.8 billion in 1997) and $20.6 billion to Improve Conditions and Performance ($16.0 billion in 1997).** Under the Maintain scenario, $9.2 billion annually would be needed for asset rehabilitation and replacement and $5.6 billion for asset expansion. Under the Improve scenario, $10.3 billion would be needed annually for replacement and rehabilitation, $5.7 billion for asset expansion, and $4.6 billion for performance improvements.

**Annual Cost to Maintain and Improve Conditions and Performance by Investment Type (Billions of 2000 Dollars)**

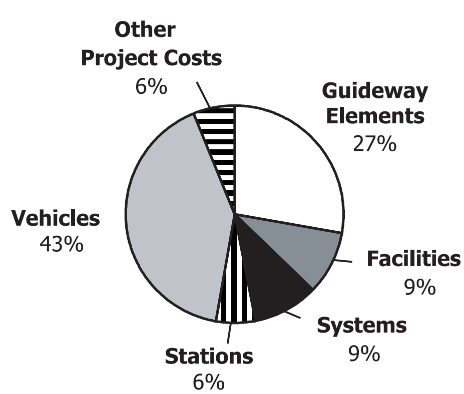



Vehicles, i.e., rolling stock, account for the largest percentage of investment requirements, followed by guideway elements—tracks, tunnels and bridges.

**Average Annual Transit Investment Requirements by Asset Type to Maintain Conditions and Performance, 2001-2020 (Billions of 2000 Dollars)**

| | |
|---|---|
| Guideway Elements | $4.1 |
| Facilities | $1.4 |
| Systems | $1.4 |
| Stations | $0.9 |
| Vehicles | $6.2 |
| Other Project Costs | $0.9 |

**Distribution of Costs by Asset Type to Maintain Conditions and Performance, 2001-2020**

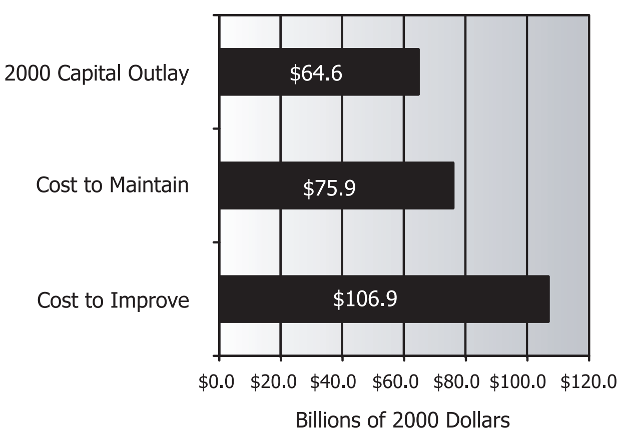


## Comparison of Spending and Investment Requirements: Highway and Bridge

**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 obtained.

Federal, State, and local capital expenditures for highways and bridges totaled $64.6 billion in 2000. **Capital outlay by all levels of government would have to increase by 17.5 percent above this level to reach the projected $75.9 billion Cost to Maintain Highways and Bridges level. An increase of 65.3 percent would be required to reach the projected $106.9 billion Cost to Improve Highways and Bridges level.**

**2000 Capital Outlay vs Highway and Bridge Investment Requirements**

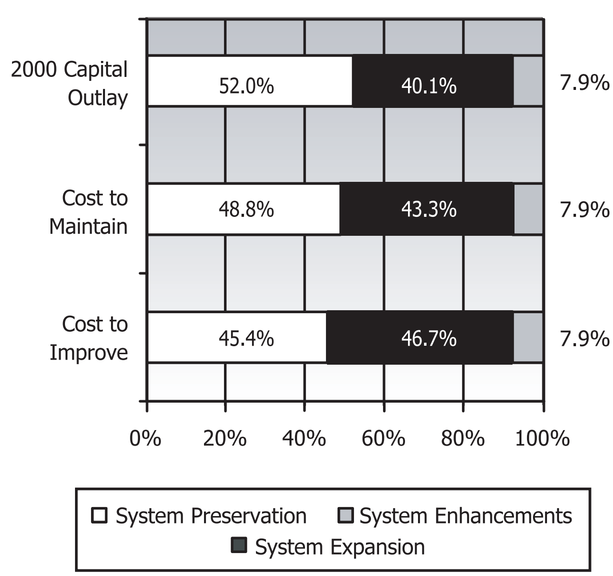



Capital spending by all levels of government grew sharply between 1997 and 2000 and is projected to continue to increase in constant dollar terms from 2000 to 2003, albeit at a slower rate. These projected increases in combined Federal, State and local capital spending would move the Nation closer to the level of the investment requirement scenarios. However, capital outlay would still have to increase 11.3 percent above projected annual spending over this period to reach the Cost to Maintain level, and would need to increase 56.6 percent to reach the Cost to Improve level.

In 2000, 40.1 percent of highway capital outlay went for system expansion, including the construction of new roads and bridges and the widening of existing facilities. **The analytical models used to develop the investment requirements in this report suggest that if capital investment increases, it would be cost beneficial to devote a larger share to system expansion** to alleviate the effects that future travel growth would have on recurring and non-recurring delay.

For the Cost to Maintain Highways and Bridges, 43.3 percent of the projected 20-year investment requirements are for system expansion. If funding increases above this level, the analysis suggests increasing investment in system expansion, so that for the Cost to Improve Highways and Bridges, 46.7 percent of the total investment requirements are for system expansion.

**Investment Requirements and 2000 Capital Outlay Distribution by Improvement Type**



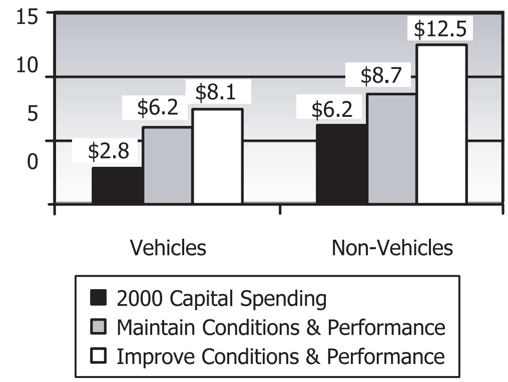
## Comparison of Spending and Investment Requirements: Transit

Transit capital expenditures from Federal, State, and local governments totaled $9.1 billion in 2000, below the estimated annual investment requirements for the 20-year period from 2001-2020. The annual capital investment necessary to Maintain Conditions and Performance is estimated to be $14.8 billion, 64 percent above actual spending in 2000. The investment required to Improve Conditions and Performance is estimated to be $20.6 billion, 128 percent above actual 2000 capital spending.

**These comparisons, however, overestimate the gap between capital investment requirements and future funding for transit capital investment.** This overestimation results from the lags that occur between the authorization of capital funds, their obligation and actual capital spending. Since TEA-21, annual obligations by FTA for capital investment have grown rapidly to $7.2 billion in FY 2000 from $4.1 billion in FY 1998, an increase of 76 percent. These higher levels have not yet worked their way through the process into capital spending. As these higher levels of authorized funds are obligated and spent, capital investment will rise and the gap between actual capital spending and estimated annual capital investment requirements will decrease.

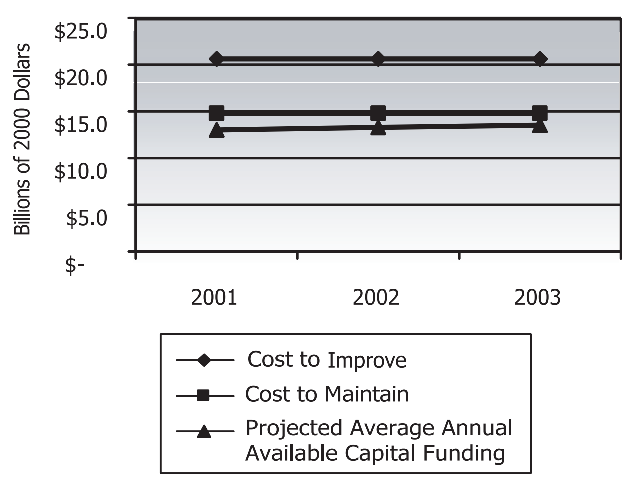
To Maintain Conditions and Performance investment in transit vehicles would need to be 117 percent above the $2.8 billion spent in 2000, and investment in non-vehicle assets 40 percent above the $6.2 billion spent in 2000. To Improve Conditions and Performance investment in vehicles would need to be 184 percent above the 2000 amount and investment in non-vehicle assets 101 percent above the 2000 amount.

**A Comparison 2000 Capital Spending with Average Annual Investment Requirements (Billions of Dollars)**




Projected funding levels, which are based on TEA-21 authorizations, flexible funding estimates and allocations from State and local governments are considerably closer to estimated investment requirements than current capital spending with the gap declining over the duration of the TEA-21 period. By 2003, investment requirements to Maintain Conditions and Performance are estimated to exceed estimated average annual available funding levels by 10 percent, and those to Improve Conditions and Performance by 52 percent.

**Available Capital Funding vs Investment Requirements**



## 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 45.7 percent from $23.0 to $33.6 billion between 1997 and 2000. 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.

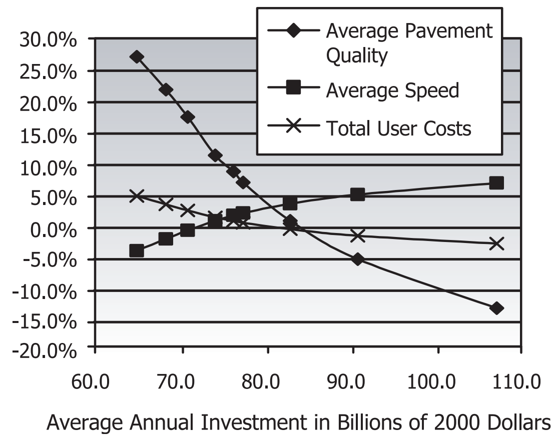
Investment in system expansion has also increased, but at a much lower rate relative to outlays for system preservation. While the rate of growth in average annual hours of traveler delay has decreased, the level of investment has not stopped the overall growth in congestion.

### *Impact of Future Investment on Highway Conditions and Performance*

If average annual highway capital investment from 2001 to 2020 reaches the projected $106.9 billion **Cost to Improve Highways and Bridges** level and is applied in the manner suggested by the analysis, the average pavement quality is projected to improve by 13.9 percent relative to year 2000 levels. Improvements in highway operational performance would cause average speeds to rise by 6.0 percent, while average highway user costs would decline by 3.6 percent.

If all levels of government combined invested at the **Cost To Maintain** projected level of $75.9 billion, and shifted more of their investment toward system expansion to address increasing congestion problems, average speeds would improve, while average pavement roughness would worsen. By definition, user costs would remain at year 2000 levels.

**Projected Changes in 2020 Highway Condition and Performance Measures Compared to 2000 Levels at Different Possible Funding Levels**




### *Impact of Investment on Travel Growth*

While future travel growth will be primarily driven by factors such as population growth and growth in economic activity, the amount of travel growth on a highway segment may also be affected by the level of investment on that segment. Investments that reduce the economic cost of using a facility may lead to increased use, while increasing congestion on an unimproved roadway may 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 1.96 percent. If highway-user costs declined, as they would under the Cost to Improve scenario, this rate would increase to 2.19 percent per year.

## Impacts of Investment: Transit

**The Transit Economic Requirements Model (TERM) does not estimate the impact of capital investment in transit infrastructure on the demand for transit services. Rather, assumed growth in passenger miles traveled (PMT) is the driving factor in estimating transit investment needs.** For this reason, it is impossible to determine how achieving the required investment levels would affect transit ridership, user costs, and the potential for additional capital investment. There is evidence, however, to suggest that investments in transit infrastructure in areas with latent transit demand will increase ridership.

Historically and since 1993, actual investment in transit capital infrastructure has been less than estimated investment requirements to Maintain Conditions and Performance.

### *Changes in Condition and Age*

As indicated in Chapter 3, **the average condition of bus vehicles has been relatively constant over the last 13 years, with a very slight improvement in 1993. The average condition of rail vehicles**, on the other hand**, appears to be gradually declining—from 3.91 in 1987 to 3.55 in 2000**. The average age of bus vehicles, including vans, gradually declined during the early nineties but has remained relatively constant (at about 7 years) since 1996. The average age of the rail fleet has increased from 15.6 years in 1987 to 20.4 years in 1997, and 21.8 years in 2000. As fleet size has increased since 1987, the absolute number of overage vehicles—both bus and rail—has also increased. In 2000, there were 16,000 overage buses, 44 percent more than in 1987, and 6,770 overage rail vehicles, 138 percent more than in 1987. Although the conditions of non-vehicle infrastructure appear to have improved since 1997, a significant percentage of these assets are in less than adequate condition.

### *Changes in Performance*

**In 2000, the average rail speed was 24.9 miles per hour, its lowest rate since 1990**, and rail vehicle utilization rates reached new highs in 2000, well above the utilization rates that existed in the early 1990s. This reflects increased usage in the larger, older systems, which tend to have slower speeds.

### *Historical Capital Investment and Conditions and Performance*

**Capital spending levels have been approximately equal to or slightly higher than the pure replacement and rehabilitation levels necessary to Maintain Conditions.** However, about half of current capital spending appears to have been allocated to rehabilitation and replacement, with the remainder going to asset expansion. Although past spending levels appear to have Maintained Conditions for buses and to have almost Maintained Conditions for rail vehicles, the absolute number of overage bus and rail vehicles has increased. During the past few years, funding levels have been sufficient to Maintain Performance for bus modes of public transport, but the performance of rail modes has declined slightly.

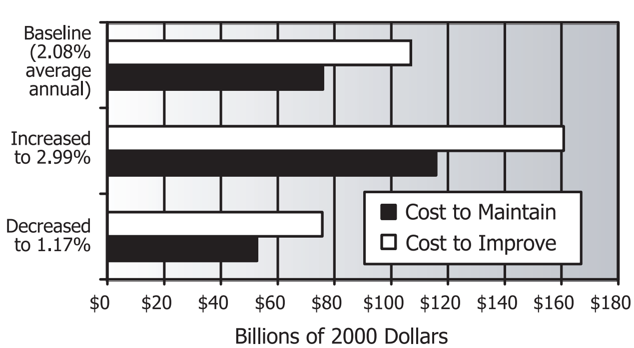
## Sensitivity Analysis: Highway and Bridge

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 Cost to Maintain Highways and Bridges and Cost to Improve Highways and Bridges to changes in these assumptions.

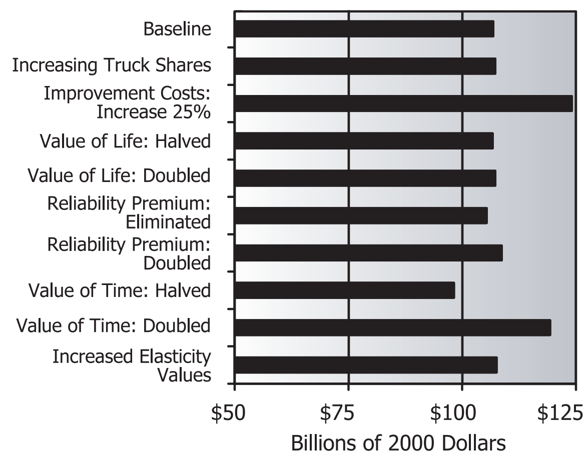
### *Travel Forecasts*

The Highway Economic Requirements System (HERS) assumes that the State-supplied baseline travel forecast for each highway section represents not what future travel *will* be, but what it *would* be if investment rose to the level required to keep highway user costs constant. The aggregate annual growth rate drawn from these section level forecasts is 2.08 percent. If instead, the 2.99 average annual VMT growth rate observed from 1980 to 2000 were a better predictor of future constant price VMT growth, then the estimated Cost to Maintain and Cost to Improve would each be over 50 percent higher. Conversely, if the "true" annual VMT growth that would occur at a constant level of service were only 1.17 percent, the Cost to Maintain and Cost to Improve would fall significantly.

**Impact of Alternate Baseline VMT Growth Assumptions on Average Annual Investment Requirements**




**Impact of Other Alternate Assumptions on the Average Annual Cost to Improve Highways and Bridges**




### *Value of Time*

The value of time in HERS was developed using a standard methodology adopted by the Department, but other values are used inside and outside the Federal government. Doubling the value of time would increase the Cost to Improve by 11.7 percent. Cutting it in half would reduce the Cost to Improve by 8.1 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 Cost to Improve by 16.1 percent. The increased cost of individual projects would be partially offset in this scenario by some projects that would no longer be cost-beneficial.

**Note:**
The impacts of alternative model parameters and procedures 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.

## Sensitivity Analysis: Transit

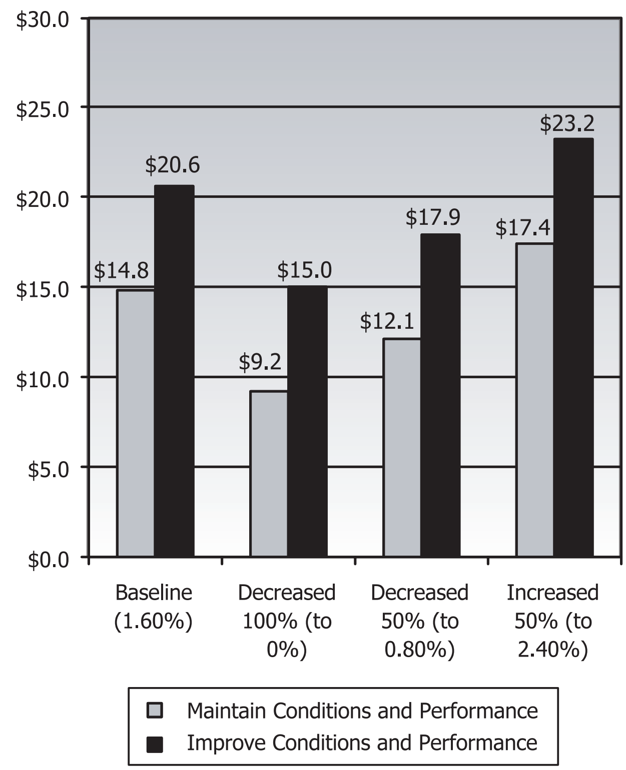
This chapter examines the sensitivity of projected transit investment requirements to variations in the values of the following exogenously determined model inputs: passenger miles traveled (PMT), capital costs, and the value of time. These alternative projections illustrate how transit requirements will vary according to different assumptions on these input values.

### *Sensitivity to Changes in PMT*

The Transit Economic Requirements Model (TERM) relies heavily on forecasts of PMT in large urbanized areas. These forecasts are primary factors behind TERM estimates of the investment necessary to expand the Nation's transit infrastructure to maintain and improve performance. Transit PMT forecasts are generally made by MPOs along with projections of vehicle miles traveled (VMT) for the regional transportation planning process and implicitly incorporate assumptions about the relative growth of transit and automobile travel. **The average annual growth rate in PMT of 1.6 percent used in this report is a weighted average of the most recent (primarily 2001) MPO forecasts available from 33 metropolitan areas.** (PMT increased at an average annual rate of 3.2 percent between 1993 and 2000.)

Varying the assumed rate of growth in PMT significantly affects estimated transit investment requirements. This effect is more pronounced under the Maintain Conditions and Performance scenario, as PMT growth rates influence asset expansion costs, which comprise a larger portion of total estimated Maintain Conditions and Performance needs. **A 50 percent increase/ decrease in growth will increase/decrease the cost to Maintain Conditions by 18 to 19 percent and the cost to Improve Conditions and Performance by 13 to 14 percent.** Needs decrease significantly if PMT remains constant.

**Growth on Transit Annual Investment Requirements (Billions of 2000 Dollars)**




### *Sensitivity to a 25 Percent Increase in Capital Costs*

A 25 percent increase in costs increases the amount necessary to Maintain Conditions and Performance and to Improve Conditions and Performance by close to the full 25 percent. Total benefits continue to exceed total costs for most investments even this 25 percent increase.

### *Sensitivity to a Change in the Value of Time*

The value of time is used to estimate the total benefits 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.

# Federal Bridge Program/Status of the Nation's Bridges

## *The Nation's Bridges*

States, local agencies, and the Federal Highway Administration conduct inspections of their bridges and culverts on public roads. The National Bridge Inventory (NBI) is the official repository for information collected through the inspection program, reflecting the condition of the Nations' bridges. The data is also used as the basis for the distribution of Highway Bridge Replacement and Rehabilitation Program (HBRRP) funding among the states as well as to establish eligibility for funding for individual bridges.

**Nation's Bridges**

| | FED | STATE | LOCAL | OTHER | TOTAL |
|---|---|---|---|---|---|
| **Rural Bridges** | | | | | |
| Interstate | 30 | 27,417 | 14 | 42 | 27,503 |
| Other Arterials | 565 | 71,301 | 2,501 | 156 | 74,523 |
| Collectors | 1,306 | 68,559 | 73,113 | 293 | 143,271 |
| Local | 6,856 | 27,534 | 174,973 | 761 | 210,124 |
| **Subtotal Rural** | **8,757** | **194,811** | **250,601** | **1,252** | **455,421** |
| **Urban Bridges** | | | | | |
| Interstate | 1 | 27,058 | 368 | 354 | 27,781 |
| Other Arterials | 50 | 44,435 | 17,539 | 575 | 62,599 |
| Collectors | 22 | 5,000 | 9,690 | 230 | 14,942 |
| Local | 110 | 4,675 | 20,440 | 434 | 25,659 |
| **Subtotal Urban** | **183** | **81,168** | **48,037** | **1,593** | **130,981** |
| **Rural & Urban** | | | | | |
| Interstate | 31 | 54,475 | 382 | 396 | 55,284 |
| Other Arterials | 615 | 115,736 | 20,040 | 731 | 137,122 |
| Collectors | 1,328 | 73,559 | 82,803 | 523 | 158,213 |
| Local | 6,966 | 32,209 | 195,413 | 1195 | 235,783 |
| **Total** | **8,940** | **275,979** | **298,638** | **2,845** | **586,402** |

## *Federal Bridge Program*

The National Bridge Program was established in 1971 to address safety concerns on the nation's bridges. A key element of the program is the National Bridge Inspection Program (NBIP). The inspection program is based on the National Bridge Inspection Standards (NBIS) adopted by the FHWA and the American Association of State Highway and Transportation Officials (AASHTO). Federal funding is provided through the HBRRP.

Inspection standards extend to procedures, frequency, personnel qualifications, reports, and inventories. The purpose of the inspection program is to locate and evaluate existing bridge deficiencies to assure their owners will act to keep them safe for the traveling public. Through the HBRRP, Congress has authorized more than $56 billion in federal funds for bridge replacement and rehabilitation projects.

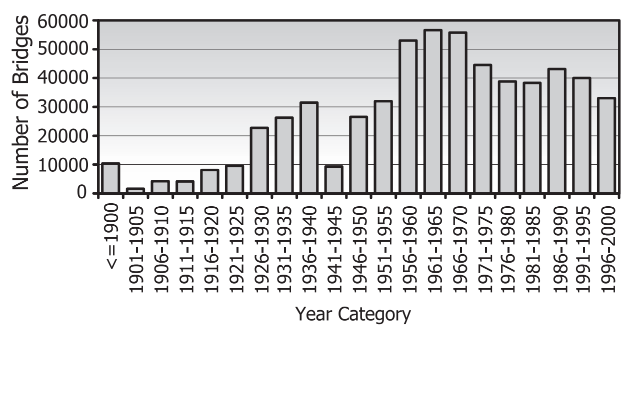
**Approximately 30 percent of the structures on the Nation's highway system are either structurally or functionally deficient. This total has been decreasing over the past few years.**

A structurally deficient bridge is not necessarily subject to immediate collapse, but has been identified as being restricted to lighter vehicles or is in immediate need of rehabilitation to remain open to 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.

## *Aging Bridges*

The Nation's bridges are deteriorating with age. At the same time, the amount of traffic on them is increasing putting a greater strain on the existing system. Older structures will require increasing future maintenance to remain functional or will need to be replaced on a systematic basis to maintain the integrity of the Nation's highway system.

**Year of Construction**



## National Security

The terrorist attacks on the United States on September 11, 2001, highlighted the need to better understand transportation security. The investment requirement projections described elsewhere in this report do not explicitly consider security-related benefits of investment in the highway and transit networks. Highways and transit, however, impact security in four important ways.

First, the Strategic Highway Network (STRAHNET) allows the Department of Defense to mobilize against global and domestic threats. STRAHNET is a 61,044-mile system of roads deemed necessary for emergency mobilization and peacetime movement. **This mileage includes the 45,376-mile Interstate Highway system and 15,668 miles of other important public highways**.

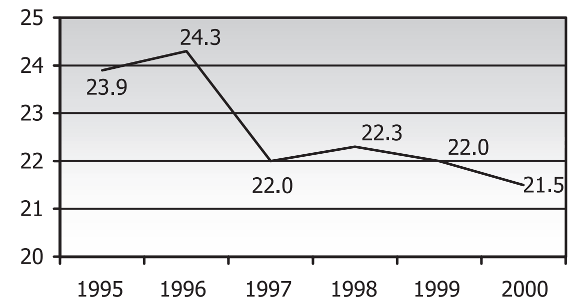
**Strategic Highway Corridor Network (STRAHNET) Mileage in 2000**

| | |
|---|---|
| Interstate | 45,376 |
| Non-Interstate | 15,668 |
| **Total** | **61,044** |

The percentage of STRAHNET pavement mileage with acceptable ride quality increased from 93.6 percent in 1995 to 96.3 percent in 2000.

Bridges are an important part of the STRAHNET. In 2000, there were 102,859 STRAHNET bridges. The percent of STRAHNET bridges rated deficient declined from 23.9 percent in 1995 to 21.5 percent in 2000.

**Percent of STRAHNET Bridges Rated Deficient**




Second, highways and transit systems also allow Federal, State, and local officials to respond to emergencies by evacuating populated areas. Highways need excess capacity to accommodate a sudden flow of vehicles in one direction, and to simultaneously allow the quick movement of emergency vehicles in the opposite direction. Transit systems need capacity to deal with the rapid evacuation of metropolitan areas.

Another element of transportation security is the need to improve the integrity of trucks and containers. The Department of Transportation is working with other agencies to create a system to track containers and identify the custodians of the cargo during transportation.

Finally, highways and transit systems are themselves strategic assets. Disruptions can paralyze regional or national economies, making it important to "harden" these structures against threats. The Department of Transportation is working with other agencies to better monitor the critical components of transit systems and better understand how to "harden" sensitive structures like bridges and tunnels.

Chapter 13 | **Executive Summary**

## Highway Transportation in Society

On average, each man, woman, and child in this country spends an hour a day traveling in cars and buses or walking. The 100 million U.S. households generate more than a billion person trips and over nine billion person-miles of travel in a typical day. Together, increasing demand for transportation, growing affluence of travelers, and rising values of goods being shipped have placed a premium on fast, reliable transportation. The highway transportation system serves households and businesses in a variety of ways.

### *Commuting*

Approximately 123 million people in the United States commuted to work outside the home in 2000.

### *Trucking*

The logistical needs of business establishments are met by about 21 million trucks traveling more than 412 billion miles.

### *Household Expenditures*

Highway transportation meets many household needs, and represents a major household expense. Households spent, on average, $7,000 per year on transportation, more than any other expenditure category except housing.

### *Travel Demand*

Since 1969, the population of the United States has increased by 32 percent while person-miles of travel increased by 143 percent. The number of U.S. households grew by 58 percent over the same period, while the rate of household vehicle travel grew nearly three times as fast—163 percent.

Chapter 14 | **Executive Summary**

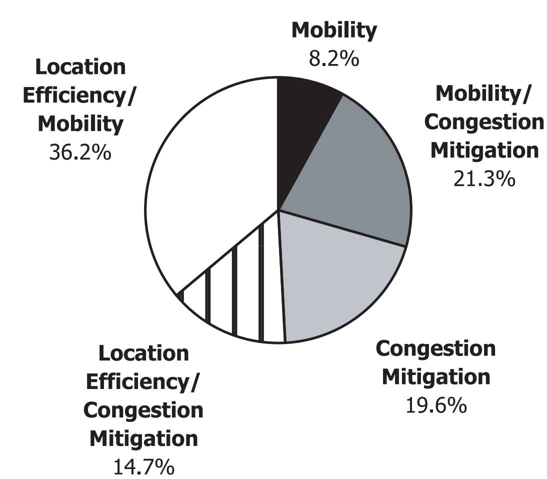
## The Importance of Public Transportation

Through the Transit Performance Monitoring System (TPMS), FTA collected data between 1996 and 1998 from onboard passenger surveys of auto ownership, frequency of transit use, and transit trip purpose to gain a better understanding of user characteristics and differences across geographic regions and cities of varying sizes.

Forty-nine percent of rail users and 68 percent of all users surveyed did not have access to a car at the time they made their trip. Slightly more than 70 percent of all the transit trips in the surveys were made by passengers using transit 5 days or more a week. Fifty percent of all passengers surveyed were on their way to or from work. The most frequently reported way of reaching transit was by walking, with about 70 percent of all those surveyed starting their transit trip in this way.

The following pie chart shows the composition of mobility, congestion mitigation, and location efficiency benefits provided by transit to transit riders. In many cases, trips provide more than one type of benefit. Transit also provides significant environmental and other benefits which onboard passenger surveys are unable to capture.

**Benefits of Transit to Riders**



## Macroeconomic Benefits of Highway Investment

The economic benefits of transportation infrastructure investment have traditionally been measured at the level of individual projects. In recent years, however, there has been growing interest in measuring the overall contribution to the economy made by many separate investments in highways and other transportation infrastructure.

Traditional microeconomic benefit-cost analysis tools such as HERS focus on reductions in costs of travel time, vehicle operations, maintenance, and crashes. Macroeconomic measures of highway investment benefits for the production sector capture the total savings in firms' production and distribution costs that result directly from an increased supply of highway capital. They may also capture indirect improvements in the productivity of labor and other capital.

These micro- and macroeconomic measures of transportation investment benefits may each include benefits not captured by the other approach, and thus have their own strengths and weaknesses. For example, macroeconomic measures reflect market outcomes at the regional or national level, while microeconomic approaches may include valuations of benefits that do not result from market activity. However, macroeconomic measures may also capture benefits such as logistic cost savings and increased competition through market area expansion that are not reflected in microeconomic models.

FHWA has been a major sponsor of recent research on macroeconomic approaches to measuring highway investment benefits. These studies have found that the economic returns on highway capital investment were very high in the 1960s, but had declined to the average rate of return on private capital by the 1980s.



## Pricing

Some of the congestion problems facing America's road network can be traced to imbalances between highway travel demand and supply, due to the "underpricing" of highway use. Road pricing can be a key long-term strategy for managing the Nation's transportation system more effectively and enhancing economic efficiency by improving the allocation of costs among users. FHWA's Value Pricing Pilot Program and its predecessor—the Congestion Pricing Pilot Program—have funded pilot projects to demonstrate the potential of this strategy.

Some types of road pricing projects that have been implemented in the U.S. over the past few years include variable tolls on existing toll facilities, variable tolls on added highway lanes, and the conversion of high-occupancy vehicle (HOV) lanes to high-occupancy/ toll (HOT) lanes. A key feature of such projects is that the prices charged to highway users vary by the time of day, reflecting the greater costs that motorists impose on the highway system during congested periods. These projects have been found to be effective in encouraging shifts in driver behavior (such as moving trips to off-peak hours) and making more efficient use of highway capacity. They also provide an option for premium service for users who may be particularly pressed for time due to business or personal commitments.

Other pricing concepts have been proposed and may be implemented in the future. These include fast and intertwined regular (FAIR) lanes, mileage-based pricing, and parking cash-out.

A recent study examining the effects of different value pricing policies on a hypothetical congested freeway found that the net benefits of such policies might greatly exceed their costs of implementation.

## Chapter 17 | Executive Summary

### Asset Management

A new initiative in the transportation community, Transportation Asset Management (TAM), provides a framework for the optimal allocation of resources by transportation agencies. TAM is a strategic approach to managing and investing in transportation infrastructure. When implemented, it will dramatically change the fundamentals of investment decisions.

The breakthrough of TAM arises from the fact that the expenditure of funds will (1) be based on trade-off analysis where alternatives are considered across functions, asset classes, and even modes; (2) be driven by customer requirements as reflected in performance goals; (3) include economic as well as engineering considerations; (4) incorporate an extended time horizon; and (5) be systematic and fact-based.

At its core, TAM will lead to the highest possible total return on investment, eventually reducing the gap between what the Nation needs to spend on its transportation assets and what it actually spends. When fully implemented, TAM has the potential to reduce the total life cycle costs of providing transportation services, and to improve safety, system reliability, pavement smoothness, and financial performance.

FHWA has identified four overarching themes: (1) ensuring the availability of necessary data and information; (2) developing innovative analytical tools and techniques, business processes and practices; (3) teaching, training, and bringing awareness to the people that will influence final investment decisions, and (4) providing assistance in deploying the tools, techniques, and processes.

## Chapter 18 | Executive Summary

### Travel Model Improvement Program

Among the most important inputs used by State and local governments in transportation planning are forecasts of future travel demand. To assist transportation planners with this important function, the Department of Transportation—in conjunction with the Environmental Protection Agency—has established the Travel Model Improvement Program (TMIP).

The TMIP consists of four primary components:

Outreach. This includes training, direct technical assistance, and building a community of practice among modelers to facilitate mutual support in the modeling process.

Near Term Improvements. This program aims to improve the capabilities of existing forecasting procedures, including models of trip generation and trip distribution, mode choice, and assignment procedures.

Long Term Improvements. The TMIP looks to redesign the travel forecasting process through development and deployment of the Transportation Analysis and Simulation System (TRANSIMS). This model uses state-of-the-art microsimulation technology to simulate both the movements of individuals and vehicles and the activities of households.

Freight Forecasting, Data Collection, and Land Use Modeling. The TMIP has special efforts devoted to improving the understanding of freight movement and freight forecasting procedures, the quality of travel data collection, and the impacts of transportation improvements on regional land use patterns.

## Air Quality

While the Clean Air Act has controlled pollutant emissions from all air pollution sources, the greatest success can be found in the control of on-road mobile sources. **Emissions reductions from motor vehicles have accounted for 84 percent of the total emissions reductions of the six criteria pollutants since 1970.**

Air pollutant levels nationally have improved considerably, and although some areas have shown increases, concentration levels in most urban areas, where problems have historically been the most severe, have shown marked improvement in response to stringent controls.

**Percent Decrease in Concentration of Criteria Pollutants [1]**

| POLLUTANT | 1980-1999 | 1990-1999 |
|---|---|---|
| Carbon Monoxide (CO) | 57 | 36 |
| Lead (Pb) | 94 | 60 |
| Nitrogen Dioxide ($NO_2$) | 25 | 10 |
| Ozone (O3)[2] | 20 | 4 |
| Particulate Matter ($PM_{10}$) | [3] | 18 |
| Sulfur Dioxide ($SO_2$) | 50 | 36 |

[1] National Air Quality and Emissions Trends Report, 1999, EPA OAQPS, Research Triangle Park, NC, March 2001. http://www.epa.gov/oar/aqtrnd99/.

[2] This ozone concentration is based on the 1-hour ozone NAAQS. In 1997, EPA promulgated a new 8-hour ozone National Ambient Air Quality Standard. However, due to legal challenges, this 8-hour standard has not yet been implemented.

[3] Concentration measurements of PM10 for 1980 are not available.

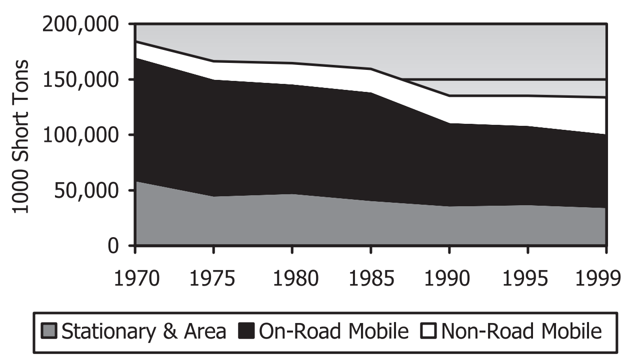
Since 1970, population has increased 38 percent; the number of people employed has increased 68 percent; the Gross Domestic Product has increased 147 percent; the number of drivers has increased 68 percent; and total vehicle miles traveled (VMT) per year have increased 142 percent. **Despite these challenges, national on-road motor vehicle emissions have declined 77 percent**.

Increasingly tight EPA engine and fuel standards for both cars and trucks have been instrumental in decreasing emissions, and will continue to do so. Emissions reductions have also been the focus of other programs, such as the Congestion Mitigation and Air Quality Improvement Program, which authorized over $8 billion in TEA-21 for transportation projects aimed at reducing emissions.

Transit vehicles account for a very small percentage of total vehicle emissions, less than one percent of the total. Transit operators, however, are still making strides in improving emissions from transit vehicles through the introduction of clean-burning, more fuel-efficient buses. **Since 1992, the share of alternative fuel buses in the transit fleet increased from 1.2 percent in 1992 to 7.5 percent in 2000. Alternative fuel transit buses currently operate in 39 States.**

Transit use also contributes to the reduction in air emissions from automobile and truck sources. **Public transportation produces about 90 percent less volatile organic compounds, more than 95 percent less carbon monoxide, and almost 50 percent less nitrogen oxides and carbon dioxide than private vehicles** that transport the same number of people.

**Total Emissions of Carbon Monoxide, NOx, VOCs, and $PM_{10}$**




Reducing pollutant emissions from motor vehicles has been the major factor to this trend in cleaner air, while enhancing the community and social benefits of transportation. Technological innovations, cleaner fuels, and targeted highway and transit programs have reduced emissions significantly over the past 30 years, and this trend is projected to continue well into the future.

## Federal Safety Initiatives

Over the past four decades, the U.S. Department of Transportation has used several tools to reduce highway fatalities and injuries. These include regulations, grants, public education campaigns, engineering and technological research. Rather than adopting a single policy to improve safety, the Department uses many initiatives and interacts with both the public and private sectors.

The public's acceptance of safety restraint systems, for example, represents one of the great public policy success stories of the past two decades. This resulted from a two-pronged effort involving education and enforcement. The exhibit below describes the estimated number of lives saved from seat belts, air bags, and child restraint systems in 1994 and 2000.

**Lives Saved by Restraint Systems**

| RESTRAINT TYPE | 1994 | 2000 |
|---|---|---|
| Seat Belts | 9,206 | 11,889 |
| Air Bags | 276 | 1,584 |
| Child Restraints | 308 | 316 |

The Department distributes grants to States to reduce crashes through better responsible driving. The Department also partners with industries and public interest groups; in the 1980s and 1990s, for example, a public-private partnership helped reduce the number of alcohol-related driving fatalities.

The Department also works to improve safety through engineering and technological research. Intelligent Transportation Systems, for example, have smoothed traffic flow by warning drivers of hazardous conditions and providing technology for better incident response and enforcement.

The Federal Transit Administration (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.

The Modal Safety program requires States with fixed guideway systems to designate an independent oversight agency to oversee the safety of rail systems not regulated by the Federal Railroad Administration (FRA). Currently, 22 States and 36 systems are included in the program. FTA audits the affected States for compliance with the rule and provides technical assistance. FTA participates with FRA in developing shared track and shared corridor safety standards and the granting of waivers for shared track operations.

The bus component of the modal safety program is a *Bus Testing Program* to ensure that deficiencies in new bus models are corrected before being put into revenue service. Since its implementation, this program has successfully identified more than 4,000 malfunctions ranging from minor problems to serious design deficiencies. A *Modal Transit Safety Bus Program*, initiated by FTA in 1998, provides guidance in driver selection and training, vehicle maintenance, drug and alcohol abuse programs, and safety data acquisition and analysis.

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## Operations Strategies

Historically, highway agencies have focused most of their attention on building and maintaining roads. Much less attention has been paid to operating the road system to provide the highest level of service possible. With increasing congestion, the expense and difficulty of building new facilities, and the need for safe and secure highways, this view has begun to change.

**Many highway officials now recognize that operations strategies can make a major difference in how the highway system performs.**

Operations strategies can influence the reliability, timeliness, security, and safety of highway use; this chapter primarily looks at the first two impacts.

Reliable, predictable travel times are especially important in a society where travelers put a high value on their own time and where many goods are relatively expensive and are needed in tightly scheduled manufacturing and distribution systems.

**A reliable transportation system, however, is inadequate if it does not get travelers to their destinations within a reasonable time.**

Traveler needs and economic efficiency are not served if highways slow consistently to a crawl. In addition to the temporary sources of capacity loss and delay, recurring congestion and poor traffic control increase travel time, adding significantly to the cost of travel and goods movement.

**With more attention to operations, lives will be saved and Americans will be less vulnerable to congestion, incidents, work zones, weather, and traffic control problems.**

Chapter 22 | **Executive Summary**

## Freight

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

Nearly seven million businesses rely on the U.S. transportation network to conduct local business, engage in interstate commerce, and carry out international trade. At the same time, more than 100 million households rely on freight transportation to provide access to goods and services produced by businesses both here and abroad.

Although commercial vehicles account for less than 10 percent of all vehicle-miles of travel, **truck traffic is growing faster than passenger vehicle traffic and 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 likely to grow substantially if the demand for freight transportation doubles over the next 20 years, as expected by many forecasters.

More than 25,000 miles of highway will carry more than 5,000 commodity-carrying trucks per day. **Approximately one-fifth of that mileage will be significantly congested.** Congestion is particularly onerous for freight companies and manufacturers who depend on the efficient shipment of materials and finished products. Congestion represents a hidden tax to these firms, which value speed and reliability. The U.S. Department of Transportation is working with its State and local partners to reduce congestion and eliminate bottlenecks in the surface transportation system.

## Chapter 23 | **Executive Summary**

### Interstate System

The Interstate System is the highest-order functional system. In 2000, it included 46,675 route miles. About 71 percent of these miles were in rural areas, and 29 percent were in urban communities. Between 1993 and 2000, rural Interstate route miles grew by about 0.2 percent annually, while urban Interstate route miles grew by about 0.6 percent annually. The Interstate System included 55,679 bridges in 2000.

Travel on rural and urban Interstates grew faster between 1993 and 2000 than on any other functional system. Congestion has also increased. The percent of congested daily travel grew from 26.7 percent in 1997 to 29.1 percent in 2000. Conditions, however, have mostly improved. The percent of Interstate miles with "Acceptable" ride quality, for example, increased between 1993 and 2000.

An average highway preservation investment of $2.95 billion on rural Interstates would be sufficient to maintain average pavement condition at its current level. For urban Interstates, this number is $5.24 billion.

For rural Interstates, average user costs would be maintained at an average annual investment level of $4.65 billion. For urban Interstates, this number is between $15.7 and $16.3 billion.

Current levels of highway preservation and system expansion investment on rural Interstates are close to the levels that would be necessary to maintain conditions and performance in the future. **On urban Interstates, however, substantial increases would be required to prevent both average physical conditions and operational performance from becoming severely degraded.**

## Chapter 24 | **Executive Summary**

### National Highway System

The National Highway System (NHS) comprises the most important routes for trade and commerce in the U.S. It includes all Interstates and over 84 percent of other principal arterials. The NHS comprises only 4.1 percent of total road mileage in the U.S. but accounts for 44.3 percent of total VMT.

**About 48.3 percent of NHS VMT is on pavement with "Good" ride quality, and 90.9 percent is on pavement with "Acceptable" ride quality versus 43.3 percent and 86.6 percent, respectively, for overall highway system**. The number of NHS bridges rated deficient has decreased from 25.8 percent in 1996 to 21.5 percent in 2000 and the percentage of deck area of NHS bridges rated deficient has declined from 35.9 percent in 1996 to 30.8 percent in 2000.

Between 1997 and 2000, total daily vehicle miles of travel (DVMT) per lane-mile on the NHS increased by 7.8 percent. The rate of growth was greater in rural areas (8.9 percent) than in urban areas (6.8 percent).

**An average annual investment of $47.4 billion would be sufficient to make all cost-beneficial highway improvements and eliminate the deficient bridge backlog on NHS roads. This amount is 55 percent above 2000 capital spending on the NHS.**

The NHS share of the Cost to Maintain Highways and Bridges is $37.0 billion (49 percent), which is 21 percent above current funding levels. In 2000, capital spending on the NHS was $30.6 billion, or 47.3 percent of total capital outlay. The suggested NHS share of investment at the Cost to Maintain level would be larger (48.7 percent) than the current share, and would be smaller (44.4 percent) at the Cost to Improve level of expenditure.

## Chapter 25 | **Executive Summary**

## NHS Freight Connectors

National Highway System (NHS) freight connectors serve as critical links between the mainline NHS and major intermodal terminals. A 2000 Federal Highway Administration report to Congress on the condition and performance of intermodal connectors identified 517 freight-only terminals composed of ocean and river ports, truck/rail, and pipeline/truck facilities. In addition to these freight-only terminals, 99 major freight airports (which handle both passenger and freight) were included in the list of freight intermodal terminals.

The report concluded **that connectors to ports have twice the percentage of mileage with pavement deficiencies when contrasted to non-Interstate NHS routes.** Connectors to rail terminals had 50 percent more mileage in the deficient category than non-Interstate NHS routes. Connectors to airport and pipeline terminals appeared to be in better condition than connectors to rail terminals; they showed about the same percentage of mileage with pavement deficiencies as non-Interstate NHS. The report also identified geometric and physical conditions of connectors. However, it did not include an assessment of needed improvements or investment requirements.

**Supplemental analysis conducted since the release of that report has indicated that approximately one-third of the connector system is in need of additional capacity based on current congestion levels.** Of the remaining connector mileage, 469 miles needed pavement or lane width improvements, while 243 miles (roughly 12 percent) have adequate pavement, lane, and shoulder width.

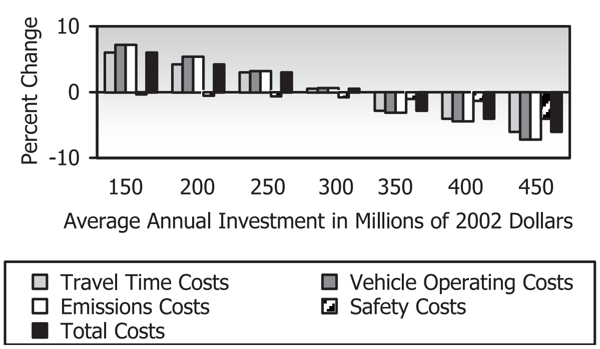
**Addressing this backlog of deficiencies would cost $2.597 billion.** Improving service to cope with expected increases in freight volumes would cost about $4.291 billion.

## Chapter 26 | **Executive Summary**

## 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 spend up to $7.8 billion in lost time at grade crossings over the next 20 years.** Auto users could spend 123 million more hours delayed at crossings and truckers could log an additional 6.6 million hours behind closed gates in 2022 compared to 2002.

**Projected Change In 2022 Highway User and Emissions Costs at Grade Crossings Compared To 2002 Levels For Different Possible Funding Levels**




**An estimated $300 million annual investment in grade separation over the next 20 years could maintain highway user costs <u>at grade crossings</u> at 2002 levels**. A projected annual investment of $450 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 are also reflected in the estimates of the Cost to Maintain and Cost to Improve Highways and Bridges presented in Chapter 7.

## Transit on Federal Lands

Federal lands account for approximately 29 percent of the land area of the United States, principally in the western part of the country. These lands include those owned by the National Park Service (NPS), the Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (USFWS) and the U.S. Forest Service (USFS).

Transit can serve as a cost-effective method of accommodating an increasing number of visitors to popular Federal lands while preserving the natural environment and providing visitors with a pleasant experience. Transit services have been put in place or are the process of being developed in the most heavily visited National Parks and in some smaller NPS sites without parking facilities. In Fiscal Year 2001, NPS and FHWA set aside approximately $8.4 million from the Federal Lands Highway Program (FLHP) for transit projects. USFWS offers transit services to the National Wildlife Refuge at Sanibel Island, Florida, and the Santa Anna National Wildlife Refuge, Texas. A transit system is being developed on both USFS and NPS lands to serve Grand Canyon National Park.

A 2001 study of transit needs on Federal Lands managed by the Interior Department identified significant transit needs at NPS, BLM, and USFWS sites. Total transit needs for the 20-year period (2001 to 2020) are estimated to be $1.71 billion in 1999 dollars ($17.45 billion in 2000 dollars). NPS will have the largest transit needs, estimated at just under $1,554 million, followed by USFWS with estimated needs of $126 million, and BLM with estimated needs of $30 million. (In 2000 dollars, $1,586 million, $129 million and $31 million, respectively.)



## Investment Requirements Methodology

Appendices A, B, and C describe the modeling techniques used to generate the estimates of future investment requirements highlighted in Chapters 7 through 10, focusing on changes in methodology since the previous C&P report. All three models incorporate benefit-cost analysis in their selection of transportation capital improvements.

**Appendix A** describes changes in the **Highway Economic Requirements System (HERS)**, which is used to generate estimates of investment requirements for highway preservation and highway and bridge capacity expansion. Significant changes to HERS include the addition of incident delay to the calculations of congestion levels; updating the routines for estimating vehicle emissions costs; and refinements to procedures incorporating travel demand elasticity in the model.

The **National Bridge Investment Analysis System (NBIAS)** is used for the first time in this report as the primary tool for estimating bridge preservation investment requirements. The model, which is described in **Appendix B**, includes routines for estimating investment for both bridge replacement and bridge repair and rehabilitation.

**Appendix C** presents the **Transit Economic Requirements Model (TERM)**, used to estimate transit investment requirements in urbanized areas. TERM estimates the funding that will be required to replace and rehabilitate transit vehicles and other assets; to invest in new assets to accommodate future transit ridership growth; and to improve operating performance to targeted levels. The results in this report reflect revisions in estimated depreciation schedules for rail vehicles, facilities and stations.