The Role of Highways and Transit

Highways and transit are crucial components of the U.S. public infrastructure and play vital roles in maintaining the vigor of the U.S. economy.

The use of private automobiles on our large highway network provides Americans with a high degree of personal mobility, continuing to allow people to travel where and with whom they want, but under conditions of increasing system unreliability and declining speeds. In 2001, 87 percent of daily trips involved the use of personal vehicles. Travel to and from work continues to decrease as a proportion of all travel, as trips rise for purposes including shopping, household errands, and recreational activities.

Highways are also a key conduit for freight movement in the United States. Trucks carried 60 percent of total freight shipments by weight and 70 percent by value (not including shipments moved by truck in combination with another mode). Trucks are playing an increasingly important role as businesses turn to just-in-time delivery systems to minimize logistics costs.

Transit plays a vital role in enhancing 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 and broader transportation choices to people with cars. Transit plays a key role in economic growth and development, connecting workers and employers.

Transit helps people without cars take advantage of a wider range of job and educational opportunities and access health care and other vital services. It also enables them to be more active members of their communities and to build and maintain social relationships. In 2001, 43 percent of nationwide transit riders lived in households with incomes of less than 20,000 and 44 percent came from households without cars.

The Complementary Roles of Highways and Transit

Highways and transit are complementary, serving distinct but overlapping markets in the Nation's transportation system. A high-quality transit system gives people who prefer living in a dense, urban environment the opportunity to do so without sacrificing their mobility. An adequate highway network does the same for people who prefer a suburban or rural lifestyle.

Highway investments can benefit those transit modes that share roadways with private autos (such as buses, vanpools, and demand response vehicles). Having good highway access to transit stations in outlying areas increases the accessibility of transit.

Transit improvements can improve the operational performance of highways by attracting private vehicle drivers off the road during peak periods of congestion. The availability of a transit alternative as a backup mode can increase the attractiveness of carpooling for commuters.

The Evolving Federal Role

The Federal-aid highway program is a Federally assisted, State-administered program. Federal, State, and local transportation partners work together to deliver the Nation's highway program. In recent years, Congress has increased statutory authority for States to assume certain Federal-aid highway project oversight responsibilities, where appropriate, while the Federal Highway Administration has maintained responsibilities for program-level oversight, research, and deployment of new technologies and methods.

The Federal transit program is a Federally assisted and administered program, operated through a program of formula and discretionary grants to urban areas and, through States, to rural communities. Over time, the focus of the Federal government has shifted from formula to discretionary programs, such as the New Starts Program, which provides funds for the construction of new fixed guideway systems or extensions to existing systems. The Federal Transit Administration works with grantees to ensure that projects meet a range of criteria for both project justification and local financial commitment.

System Characteristics: Highways and Bridges

The mobility needs of the American people were served by a network of 4.0 million miles of public roads in 2004. About 75.1 percent of this mileage was located in rural areas (those with populations less than 5,000). While urban mileage constitutes only 24.9 percent of total mileage, these roads carried 64.1 percent of the 3.0 trillion vehicle miles traveled (VMT) in the United States in 2004. In 2004 there were 594,101 bridges over 6.1 meters (20 feet) in length; approximately 76.8 percent of these were in rural areas.

Rural local roads made up 51.3 percent of total mileage, but carried only 4.4 percent of total VMT. In contrast, urban Interstate highways made up only 0.4 percent of total mileage but carried 15.5 percent of total VMT.

Percentage of Highway Miles, Lane Miles, and Vehicle Miles Traveled by Functional System, 2004

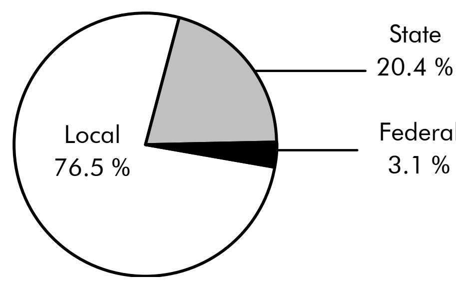
Functional System	Miles	Bridges	VMT
Rural Areas			
Interstate	0.8%	4.7%	9.0%
Other Principal Arterials	2.4%	6.1%	8.1%
Minor Arterial	3.4%	6.8%	5.7%
Major Collector	10.5%	15.8%	6.7%
Minor Collector	6.7%	8.3%	2.0%
Local	51.3%	35.1%	4.4%
Subtotal Rural	**75.1%**	**76.8%**	**35.9%**
Urban Areas			
Interstate	0.4%	4.7%	15.4%
Other Freeway & Expressway	0.3%	2.9%	7.0%
Other Principal Arterials	1.5%	4.1%	15.2%
Minor Arterial	2.5%	4.2%	12.3%
Collector	2.6%	2.6%	5.5%
Local	17.7%	4.7%	8.6%
Subtotal Urban	**24.9%**	**23.2%**	**64.1%**
Total	100.0%	100.0%	100.0%

Total highway mileage grew at an average annual rate of 0.2 percent between 1995 and 2004, while total VMT grew at an average annual rate of 2.5 percent. Rural road mileage has been declining since 1997, partly reflecting the reclassification of some Federal roads as nonpublic and the expansion of urban area boundaries as a result of the decennial Census.

Rural VMT grew at an average annual rate of 1.4 percent from 1995 to 2004, compared with an average annual increase of 1.8 percent in small urban areas (population 5,000 to 50,000) and 2.3 percent in urbanized areas. Rural VMT declined from 2002 to 2004 primarily as a result of boundary changes associated with the decennial Census; boundary changes also tend to inflate urban VMT growth.

In 2004, about 76.5 percent of highway miles were locally owned, States owned 20.4 percent, and 3.1 percent were owned by the Federal government.

Highway Mileage by Jurisdiction, 2004



In 2004, approximately 50.6 percent of bridges were locally owned, States owned 47.6 percent, 1.4 percent were owned by the Federal government, and 0.5 percent were either privately owned (including highway bridges owned by railroads) or had unknown or unclassified owners. Bridges are, on average, 40 years old with an average year of construction of 1964.

Based on surveys of 78 of the largest metropolitan areas, the deployment of intelligent transportation systems (ITS) has advanced steadily over time. Real-time data collection sensors have been deployed on more than one-third of the total freeway mileage in these areas, and on-call service patrols cover half of the freeway mileage.

Progress has also been made in the deployment of integrated ITS infrastructure. Among the 75 metropolitan areas tracked since 1997, the number with a “High” level of progress in the integrated deployment of ITS has risen from 11 to 30 in 2004, while the number of areas ranked “Low” has fallen from 39 to 12 (the remainder are ranked “Medium”).

System Characteristics: Transit

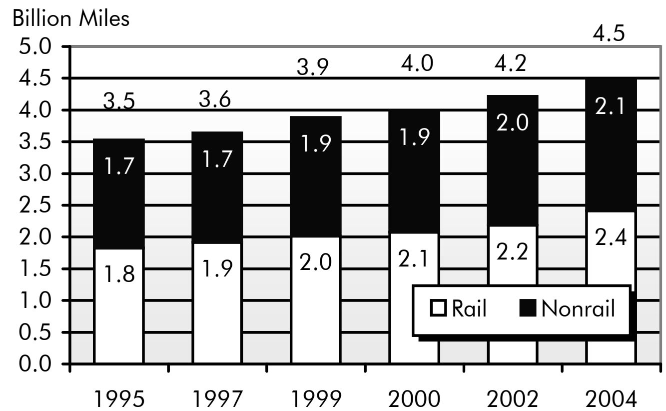
Transit system coverage, capacity, and use in the United States continued to increase between 2002 and 2004. In 2004, there were 640 transit operators serving urbanized areas, of which 600 were public agencies. A public transit provider may be a unit of a regional transportation agency, a State, a county, or a city government or it may be independent. In 2002, the most recent year for which information is available, there were 4,836 providers of special services to older adults and persons with disabilities receiving Federal Transit Administration (FTA) funds; and in 2000, the most recent year for which information is available, there were 1,215 transit operators serving rural areas.

In 2004, transit agencies in urban areas operated 120,659 vehicles (5 percent more than in 2002) of which 92,520 were in areas of more than 1 million people. Rail systems comprised 10,892 miles of track and 2,961 stations. There were 793 bus and rail maintenance facilities and 2,961 stations in urban areas, compared with 769 maintenance facilities and 2,862 stations in 2002. The most recent survey 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 2004, transit systems operated 226,402 directional route miles, of which 216,620 were nonrail and 9,782 were rail route miles. Total route miles decreased by 3.8 percent between 2002 and 2004. Nonrail route miles decreased by 4.1 percent and rail route miles increased by 3.1 percent during this period.

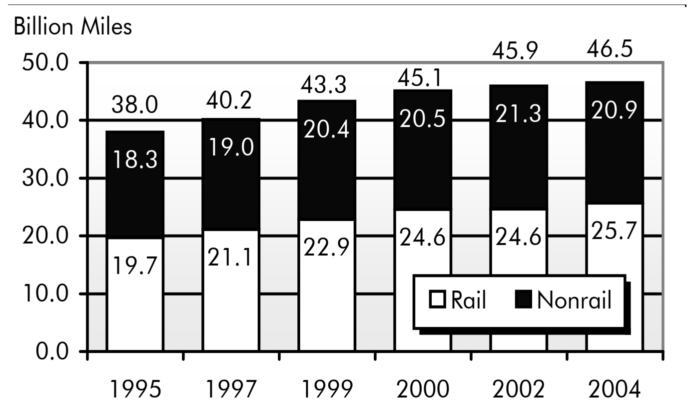
Transit revenue miles adjusted for capacity increased by 3.9 percent between 2002 and 2004. Rail capacity increased by 6.1 percent and nonrail capacity by 1.3 percent. Rail provided 2.4 billion capacity-equivalent miles in 2004, and nonrail provided 2.1 billion miles.

Urban Capacity-Equivalent Revenue Vehicle Miles (Billions)



Transit passenger miles traveled (PMT) increased by 1.3 percent between 2002 and 2004, from 45.9 billion to 46.5 billion. PMT traveled on nonrail modes decreased from 21.3 billion in 2002 to 20.9 billion in 2004, or by 2.1 percent. PMT on rail transit modes increased from 24.6 billion in 2002 to 25.7 billion in 2004, or by 4.3 percent.

Urban Passenger Transit Miles (Billions)



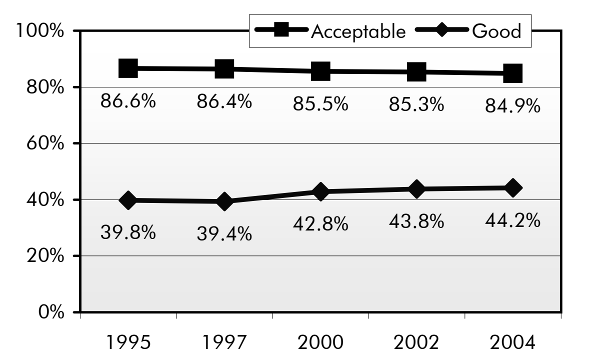
In 2004, 41 percent of PMT was on motorbus, 31 percent was on heavy rail, 21 percent was on commuter rail, and 3 percent was on light rail. The remaining modes accounted for 4 percent.

System Conditions: Highways and Bridges

Poor road surfaces impose costs on the traveling public in the form of increased wear and tear on vehicle suspensions and tires, delays associated with vehicles slowing to avoid potholes, and crashes resulting from unexpected changes in surface conditions. While highway agencies generally consider a variety of pavement distresses in assessing their overall condition, surface roughness most directly affects the ride quality experienced by drivers.

In 2004, 44.2 percent of travel on arterials and collectors for which data are available occurred on pavements with "good" ride quality, up from 39.8 percent in 1995. The percentage of VMT on roads with "acceptable" ride quality (a lower standard that includes roads classified as "good") fell from 86.6 percent to 84.9 percent over the same period of time.

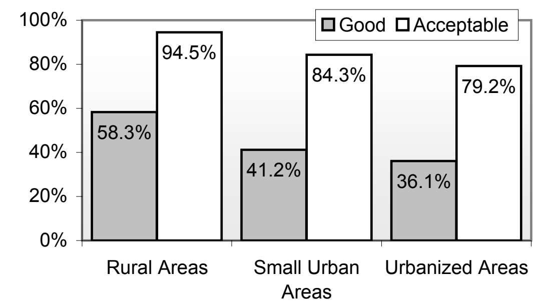
Percentage of VMT on Roads with Acceptable Ride Quality



Pavement ride quality is generally better on higher functional class roads and is better in rural areas than in urban areas. For example, approximately 97.8 percent of rural Interstate VMT in 2004 was on pavements with acceptable ride quality, compared with 72.4 percent for urbanized collectors.

In 2004, 58.3 percent of rural VMT occurred on roads with good ride quality, while 94.5 percent occurred on roads with acceptable ride quality. The comparable percentages for VMT in small urban areas were 41.2 percent good and 84.3 percent acceptable; for VMT in urbanized areas, 36.1 percent was on pavements with good ride quality, while 79.2 percent had acceptable ride quality.

Percentage of VMT on Roads with Acceptable Ride Quality, by Urban Area Size, 2004



Most bridges are inspected every 2 years and receive ratings based on the condition of various bridge components. Two terms used to summarize bridge deficiencies are "structurally deficient" and "functionally obsolete." Structural deficiencies are characterized by deteriorated conditions of significant bridge elements and reduced load-carrying capacity. Functional obsolescence is a function of the geometrics of the bridge not meeting current design standards. Neither type of deficiency indicates that a bridge is unsafe. Rural bridges tend to have a higher percentage of structural deficiencies, while urban bridges have a higher incidence of functional obsolescence due to rising traffic volumes. The percentage of bridges classified as deficient fell from 27.5 percent in 2002 to 26.7 percent in 2004. Most of this decline was the result of reductions in the percent of structurally deficient bridges.

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

Year		2002	2004
Rural Bridges	Structurally Deficient	15.1%	14.4%
	Functionally Obsolete	11.4%	11.0%
	Total Deficiencies	**26.5%**	**25.4%**
Urban Bridges	Structurally Deficient	9.2%	8.8%
	Functionally Obsolete	21.9%	21.6%
	Total Deficiencies	**31.2%**	**30.4%**
Total Bridges	Structurally Deficient	13.7%	13.1%
	Functionally Obsolete	13.8%	13.6%
	Total Deficiencies	**27.5%**	**26.7%**

System Conditions: Transit

The overall physical condition of the U.S. transit system can be evaluated by examining the age and condition of the various components of the Nation's 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.

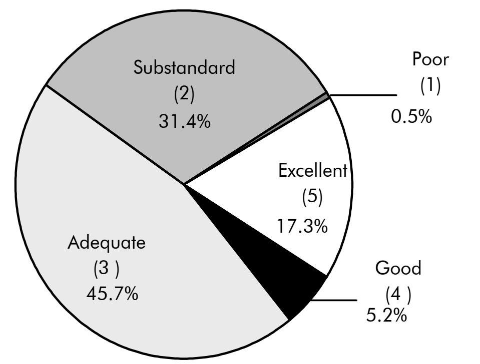
Definitions of Transit Asset Conditions

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.

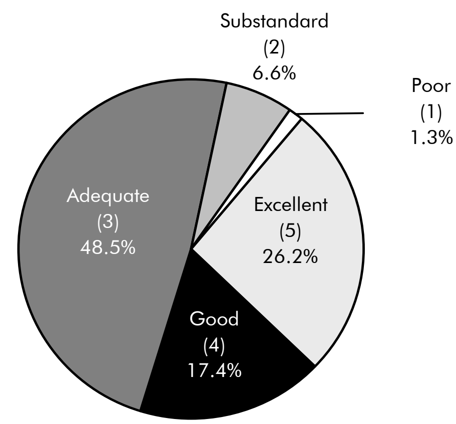
The average condition of urban bus vehicles has remained about the same, increasing from 3.07 in 2002 to 3.08 in 2004. The average age of urban bus vehicles decreased from 6.2 to 6.1 years. The average condition of bus maintenance facilities increased from 3.34 in 2002 to 3.41 in 2004. In 2004, 69 percent of bus maintenance facilities were in adequate or better condition, unchanged from 2002.

The average condition of rail vehicles increased from 3.47 in 2002 to 3.50 in 2004. The average age of rail vehicles declined from 20.4 years in 2002 to 19.7 in 2004. The condition of rail maintenance facilities increased from 3.56 in 2002 to 3.82 in 2004, primarily based on updated data collected directly from agencies. In 2004, 92 percent of rail maintenance facilities were estimated to be in adequate or better condition.

Conditions of Bus Maintenance Facilities 2004



Conditions of Rail Maintenance Facilities 2004



The condition of rail stations increased from 2.87 in 2002 to 3.37 in 2004, based on new deterioration curves estimated from on-site surveys in 2004 and on updated data collected directly from transit agencies. Condition estimates in this report also reflect updated deterioration curves for signaling, traction power, and communications systems for rail systems developed from on-site surveys in 2005. In 2004, 100 percent of communications systems, 74 percent of train control systems, and 99 percent of traction power systems were in adequate or better condition. The conditions of elevated structures, underground tunnels, track, and rail vehicle storage yards improved between 2002 and 2004.

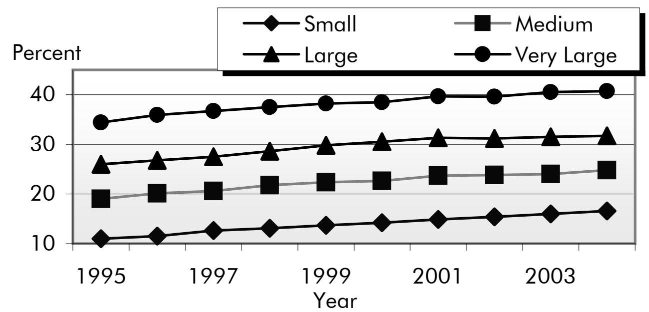
Operational Performance: Highways

Congestion on the Nation's highways imposes significant costs on drivers and society as a whole in the form of added travel time, vehicle operating costs, and emissions. Congestion results when traffic demand approaches or exceeds the available capacity of the highway system. It is clear that traffic demands vary significantly by time of day, day of the week, season of the year, and for special events. However, the available capacity at any given time is also variable, affected by weather, work zones, traffic incidents, and other nonrecurring events. Of the total congestion experienced by Americans, it is estimated that roughly half is "nonrecurring," associated with temporary disruptions in traffic demand and/or in available capacity.

There is no universally accepted definition or measurement of exactly what constitutes a congestion "problem," and this report uses a variety of different metrics to explore different aspects of congestion. The Texas Transportation Institute (TTI) has computed data for the FHWA for several measures, based on data for all 428 urbanized areas in 2004. (Note that the values shown for these same measures in TTI's 2005 *Urban Mobility Study* are different, since that study was based on a subset of 85 urbanized areas that is weighted more heavily to the most heavily populated areas.)

The Average Daily Percent of VMT under Congested Conditions is an indicator of the portion of daily traffic on freeways and other principal arterials in an urbanized area that moves at less than free-flow speeds. This percentage increased from 25.9 percent to 31.6 percent from 1995 to 2004 for the average urbanized area, and rose for each of four subsets based on population size reported by TTI; Small (population less than 500,000) rose from 15.4 percent to 16.6 percent, Medium (population 500,000 to 999,999) rose from 19.0 percent to 24.8 percent, Large (population 1 million to 3 million) rose from 26.0 percent to 31.7 percent, and Very Large (population greater than 3 million) rose from 34.4 percent to 40.7 percent. While the percent of VMT under congested conditions rose from 2002 to 2004, it rose at a lower rate than it had from 1995 to 2002.

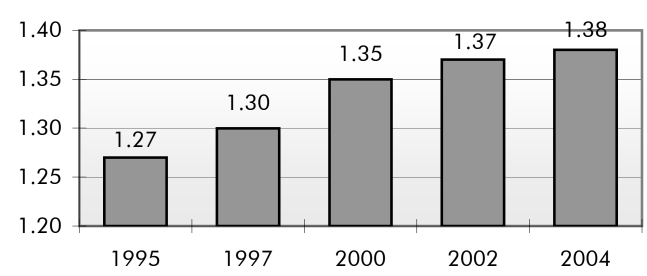
Percent of VMT Under Congested Conditions, by Urbanized Area Size, 1995–2004



The Average Length of Congested Conditions, a measure of the typical duration of congested travel conditions in urbanized areas, stabilized at approximately 6.6 hours per day in 2002 and 2004, after rising from 5.9 hours per day in 1995.

The Travel Time Index measures the amount of additional time required to make a trip during the congested peak travel period, rather than at other times of the day. The average travel time index for all urbanized areas for 2004 was 1.38, indicating that congestion caused travel times to be 38 percent longer. This is up slightly from the 1.37 value reported for 2002; the value for 1995 was 1.27.

Average Travel Time Index for All Urbanized Areas, 1995–2004



In 2004, the average delay experienced by the peak period travelers for all urbanized areas was 45.7 hours, up slightly from 45.4 hours in 2002. The average annual delay per capita (including all residents of a given area, not just peak travelers) rose from 23.8 hours in 2002 to 24.4 hours in 2004.

Operational Performance: Transit

Transit operational performance can be measured and evaluated on a number of different factors, including the speed of passenger travel, vehicle utilization, and service frequency.

Average operating speed in 2004 was higher than in 2002, and above its 10-year average. Average operating speed is an approximate measure of the speed experienced by transit riders and is affected by dwell times and the number of stops. In 2004, the average operating speed for all transit modes was 20.1 miles per hour, up from 19.9 in 2002, and above its 10-year average of 20.3. The average speed of nonrail modes was 14.0 miles per hour in 2004, up from 13.7 in miles per hour in 2002. The average speed for rail was 25.0 miles per hour in 2004, down from 25.3 in 2002.

Average vehicle utilization levels were lower in 2004 than in 2002 for all modes except demand response, ferryboat, and vanpool. Vehicle utilization is measured as passenger miles per vehicle operated in maximum service adjusted to reflect differences in the passenger-carrying capacities of transit vehicles. 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.

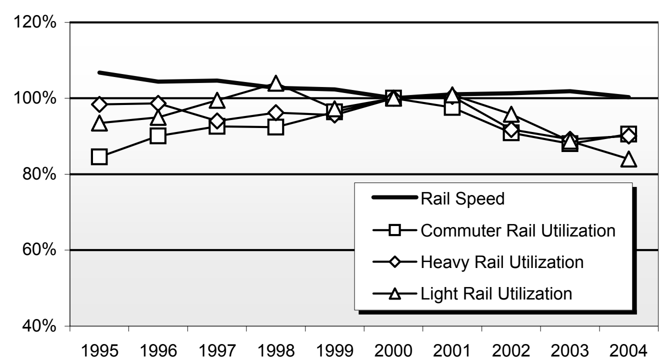
Vehicle Utilization Passenger Miles per Capacity-Equivalent Vehicle

(Thousands of Passenger Miles)

	Utilization	
Mode	**2002**	**2004**
Commuter Rail	769	755
Heavy Rail	655	652
Vanpool	498	502
Light Rail	533	468
Motorbus	389	373
Ferryboat	297	328
Trolleybus	246	237
Demand Response	168	181

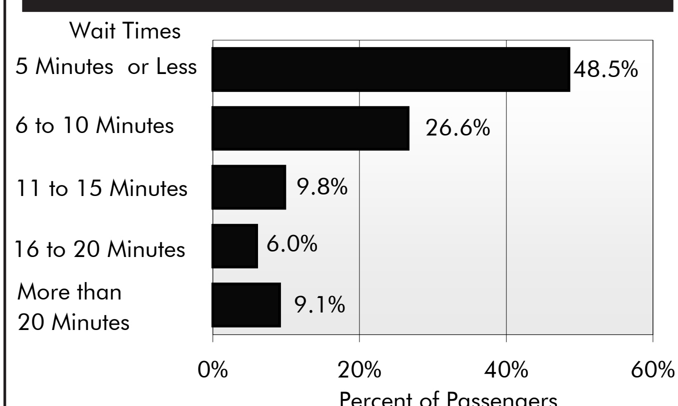
Changes in the capacity utilization of rail vehicles influence these vehicle operating speeds through changes in dwell times. As the capacity utilization of commuter rail, heavy rail, and light rail declined from 2001 to 2003, average rail speed increased; and as the capacity utilization of heavy and commuter rail increased from 2003 to 2004, average rail speed decreased.

Index of Rail Speed and Capacity Utilization of Rail Vehicles (2000=100%)



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.

Passengers by Waiting Times

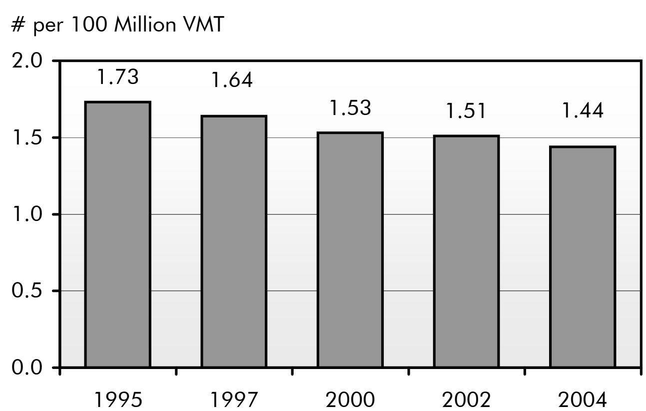


Safety Performance: Highways

Considerable progress has been made in reducing the number of highway fatalities since 1966, when Federal legislation first addressed highway safety. Since that time, the highest number of traffic deaths was 54,589 in 1972, while the lowest was 39,250 in 1992. Highway fatalities decreased from 43,005 in 2002 to 42,636 in 2004.

The fatality rate per 100 million VMT has declined over time, as the number of VMT has increased. In 1966, the fatality rate per 100 million VMT was 5.50; this figure had dropped to 1.73 in 1995, 1.51 in 2002, and 1.44 in 2004.

Fatality Rate, 1995–2004



Fatality rates are generally lower in urban areas than rural areas, and on higher-ordered functional systems than lower-ordered functional systems. For example, in 2004, the fatality rate per 100 million VMT on urban Interstate highways was 0.55, while the fatality rate on rural roads functionally classified as local was 3.08.

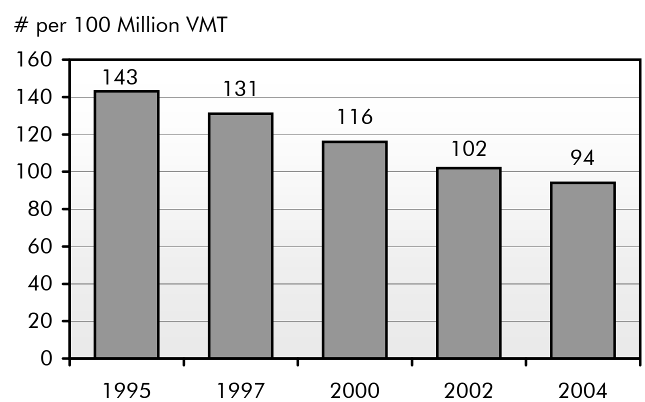
Of the 42,636 total fatalities in 2004, a reported 25,676 involved a roadway departure, in which a vehicle had left its lane. This includes 10,553 that involved a vehicle rollover, a 10.8 percent increase since 1997. The number of rollover fatalities among sport utility vehicles (SUVs) rose by 96.1 percent over that same time period.

About 9,117 highway fatalities occurred at intersections in 2004, down slightly from the 9,148 reported in 1995. Pedestrian fatalities have shown a steady decrease over time, dropping from 6,256 in 1995 to 5,494 in 2004.

Approximately 6.2 million crashes were reported in 2004. Only 0.6 percent of these crashes were severe enough to result in a fatality; 69.3 percent of these crashes resulted in property damage only, while 30.1 percent resulted in injuries.

The number of traffic-related injuries has declined over time, from 3.4 million in 1988, the first year for which statistics are available, down to 2.9 million in 2002 and 2.8 million in 2004. There were approximately 169 injuries per 100 million VMT in 1988; this figure declined to 143 in 1995, 102 in 2002, and 94 in 2004.

Injury Rate, 1995–2004



Alcohol-impaired driving is a serious public safety problem in the United States. Alcohol was a contributing factor in an estimated 16,694 fatalities in 2004 (39 percent of the total) and 7 percent of all crashes.

Speeding is one of the most prevalent factors contributing to traffic crashes. The estimated annual economic costs of speed-related crashes exceeded $40.4 billion in 2004. Speeding was a contributing factor in an estimated 13,192 fatalities in 2004 (31 percent of the total).

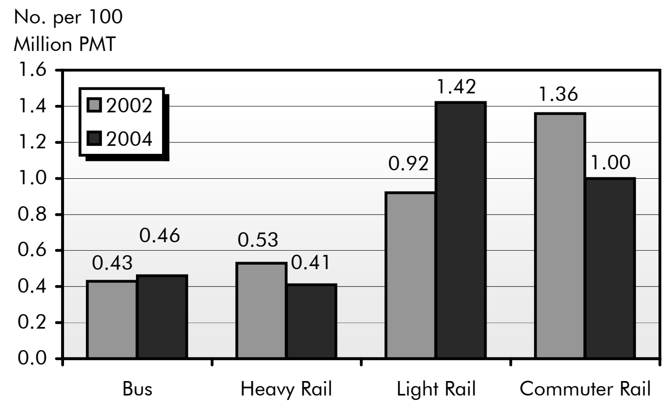
Safety Performance: Transit

Public transit in the United States has been and continues to be a highly safe mode of transportation, as evidenced by the statistics on incidents, injuries, and fatalities that have been reported by transit agencies for the vehicles they operate directly. Reportable safety incidents include collisions and any other type of occurrence that result in death, a reportable injury, 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. Reportable security incidents include a number of serious crimes (robberies, aggravated assaults, etc.), as well as arrests and citations for minor offenses (fare evasions, trepassings, other assaults, etc.). Injuries and fatalities may occur not just while traveling on a transit vehicle, but also while boarding, alighting, or waiting for a transit vehicle or as a result of a collision with a transit vehicle or on transit property.

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 incident and injury statistics with those for earlier years.

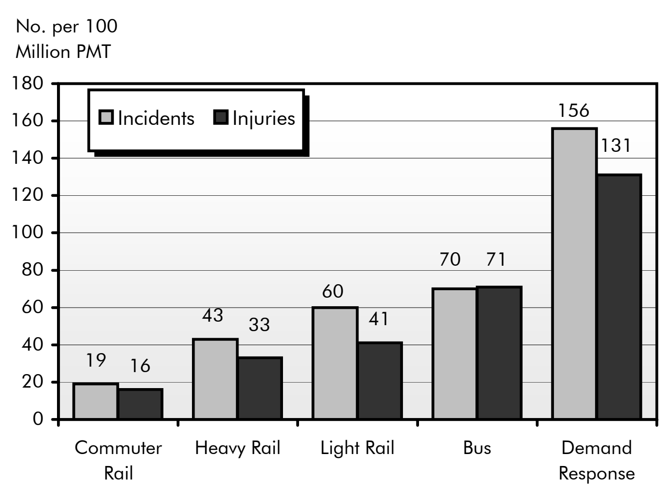
The definition of fatalities has remained the same. Fatalities decreased from 282 in 2002 to 248 in 2004, and fell from 0.66 per 100 million PMT in 2002 to 0.55 per 100 million PMT in 2004. Fatalities, adjusted for PMT, are lowest for motorbuses and heavy rail systems. Fatality rates for commuter and light rail have, on average, been higher than fatality rates for heavy rail. Commuter rail has frequent grade crossings with roads and shares track with freight rail vehicles; light rail is often at grade level and has minimal barriers between streets and sidewalks. There were no fatalities on demand response vehicles operated directly by public transit agencies in either 2002 or 2004.

Fatalities per 100 Million PMT, 2002 and 2004



Incidents (safety and security combined) and injuries per 100 million PMT declined for all modes combined from 2002 to 2004. Incidents and injuries, when adjusted for PMT, are consistently the lowest for commuter rail and highest for demand response systems.

Incidents and Injuries per 100 Million PMT, 2004

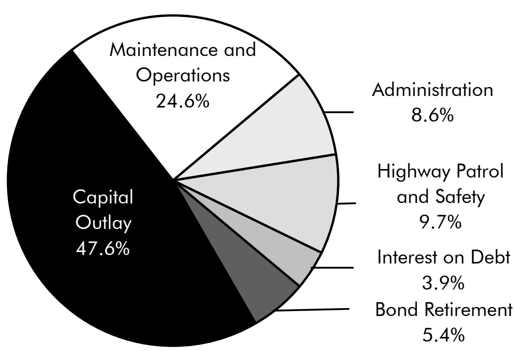


Finance: Highways

Taken together, all levels of government spent $147.5 billion for highways in 2004. Cash outlays by the Federal government for highway-related purposes were $33.1 billion (22.4 percent of the combined total for all levels), including both direct highway expenditures and amounts transferred to State and local governments for use on highways. States funded $72.9 billion (49.4 percent). Counties, cities, and other local government entities funded $41.5 billion (28.1 percent). **Private sector investment is playing an increasingly important role in highway finance**; this subject is discussed in Chapter 13.

Of the total $147.5 billion spent for highways in 2004, $70.3 billion (47.6 percent) was used for capital investments. Spending on maintenance and operations totaled $36.3 billion (24.6 percent); administrative costs (including planning and research) were $12.7 billion; $14.3 billion was spent on highway patrol functions and safety programs; $5.8 billion was used to pay interest; and $8.0 billion was used for bond retirement.

Highway Expenditures by Type, 2004

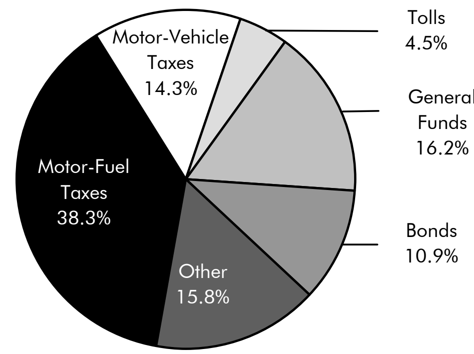


Total highway expenditures by all levels of government increased 44.7 percent between 1997 and 2004. Highway spending rose faster than inflation over this period, growing 22.7 percent in constant dollar terms. Capital spending grew by 45.2 percent between 1997 and 2002. Federal cash expenditures for capital purposes rose 52.9 percent, while State and local capital investment increased by 39.9 percent. As a result of Federal capital spending rising more quickly, the portion of total capital outlay funded by the Federal government rose from 41.6 percent in 1997 to 43.8 percent in 2004. The Federal percentage in 2002 was 46.1 percent, the highest level since 1986.

Of the $70.3 billion of capital spending by all levels of government in 2004, $36.4 billion (51.8 percent) was spent for system rehabilitation, the resurfacing, rehabilitation, and reconstruction of existing roadways and bridges. An estimated $14.7 billion (20.9 percent) was used to construct new roads and bridges; $12.8 billion (18.3 percent) went for adding new lanes to existing roads; and $6.4 billion (9.0 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 imposed by Federal, State, and local governments—were $105.8 billion in 2004. Of this, $83.0 billion (78.4 percent) was used for highways. This represented 57.1 percent of the total revenues generated by all levels of government in 2004 for use on highways. Other major sources of revenues for highways included bond proceeds of $15.8 billion (10.9 percent) and general fund appropriations of $23.6 billion (16.2 percent). Other sources such as property taxes, other taxes and fees, lottery proceeds, and interest income totaled $23.0 billion (15.8 percent).

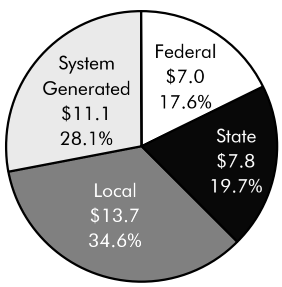
Revenue Sources for Highways, 2004



Finance: Transit

In 2004, $39.5 billion was available from all sources to finance transit capital investments and operations, compared with $36.5 billion in 2002. 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 2004, Federal funds accounted for 18 percent of all transit revenue sources, State funds for 20 percent, local funds for 35 percent, and system-generated funds for 28 percent.

2004 Transit Revenue Sources (Billions of Dollars)

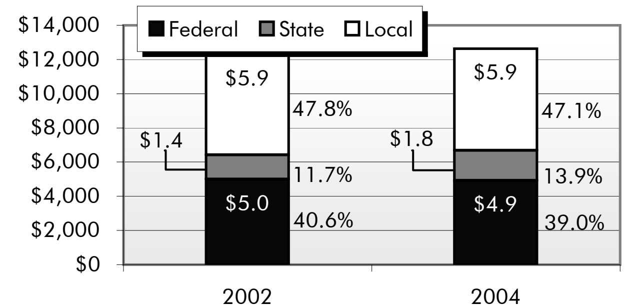


Eighty percent of the Federal funds allocated to transit are from a dedicated portion of the Federal motor-fuel tax receipts, and 20 percent are from general revenues. Federal funding for transit increased from $6.3 billion in 2002 to $7.0 billion in 2004, and State and local funding increased from $20.3 billion in 2002 to $21.5 billion in 2004.

In 2004, $12.6 billion, or 32 percent of total available transit funds, was spent on capital investment. Federal capital funding was $4.9 billion, or 39 percent of total capital expenditures; State capital funding was $1.8 billion, or 14 percent of total capital expenditures; and local capital funding was $5.9 billion, or 47 percent of total capital expenditures. Between 2002 and 2004, Federal capital funding decreased by 1.3 percent and State and local capital funding increased by 5.4 percent.

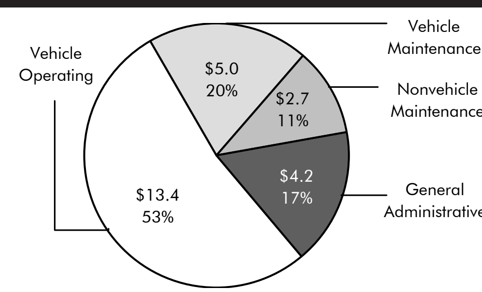
In 2004, $4.0 billion or 32 percent of total capital expenditures was for guideway; $3.4 billion or 27 percent of the total was for rolling stock, $2.1 billion or 16 percent of the total was for systems, and $1.1 billion or 9 percent of the total was for stations.

Sources of Transit Capital Investment Funding, 2002 and 2004 (Billions of Dollars)



In 2004, actual operating expenditures were $25.4 billion. Vehicle operating expenses were $13.4 billion, 53 percent of total operating expenses and 35 percent of total expenses; vehicle maintenance expenses were $5 billion, 20 percent of total operating expenses and 13 percent of total expenses; nonvehicle maintenance expenses were $2.7 billion, or 11 percent of total operating expenses and 7 percent of total expenses; and general administrative expenses were $4.2 billion, or 17 percent of total operating expenses and 11 percent of total expenses.

2004 Transit Operating Expenditures (Billions of Dollars)



In 2004, $26.9 billion was available for operating expenses, accounting for 68 percent of total available funds; the Federal government provided $2.0 billion or 8 percent of total operating expenses; State governments $6.0 billion or 22 percent of total operating expenses; local governments $7.9 billion or 29 percent of total operating expenses; and system-generated revenues $10.9 billion or 41 percent of total operating expenses.

Investment/Performance Analysis

Chapters 7 through 10 present and analyze estimates of 20-year capital investment scenarios for highways, bridges, and transit. The projections shown in this report reflect complex technical analyses that attempt to predict the impact that capital investment may have on the future conditions and performance of the transportation system. Separate estimates of investments for highways, bridges, and transit are generated independently by separate models and techniques. While the Highway Economic Requirements System (HERS), National Bridge Investment Analysis System (NBIAS), and Transit Economic Requirements Model (TERM) all utilize benefit-cost analysis, their methods for implementing this analysis are very different. Each model relies on separate databases, making use of the specific data available for only one part of the transportation system and addressing issues unique to each mode. **These three models have not yet evolved to the point where direct multimodal analysis would be possible**.

Chapter 7 presents estimates of future investment for specific scenarios, which are defined differently for each mode. These scenarios are intended to be illustrative only; **this report does not endorse any particular level of future highway, bridge, or transit investment.** While estimates are made of the cost to maintain future indicators of conditions and performance and current year levels, and the cost to improve performance based on standards unique to each model, these represent only two points on a continuum of alternative investment levels. Chapter 9 analyzes the impacts different levels of future investment might have on various measures of physical condition, operating performance, and system use.

Chapter 8 compares 2004 spending with the average annual investment scenario levels for the 2005–2024 period stated in constant 2004 dollars in Chapter 7 for the benchmark scenarios. The investment scenario estimates reflect the total capital investment required from **all sources**—Federal, State, local, and private—to achieve certain levels of performance. While the analyses in Chapter 8 identify the magnitude of the differences between current spending and the investment scenarios, they do not directly address which revenue sources might be used to finance additional investment, nor do they suggest how much might be contributed by each level of government. **This report makes no recommendations concerning future levels of Federal investment.**

As in any modeling process, simplifying assumptions have been made in HERS, NBIAS, and TERM to make analysis practical and to meet the limitations of available data. (See Appendices A, B, and C for more details on the individual models.) The accuracy of the projections of future investment scenarios depends in large part on the underlying assumptions used in the analysis. Chapter 10 explores the impact that varying some of these key assumptions would have on the overall results.

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 users of the system 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 capital 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 environmental or other societal costs).

Investment/Performance Analysis

While the economic-based approach would suggest that projects be implemented in order based on their benefit-cost ratios (BCRs) until the funding available under a given scenario is exhausted, **in reality other factors influence Federal, State, and local decisionmaking** that may result in a different outcome. If some projects with lower BCRs were carried out in favor of projects with higher BCRs, then the actual amount of investment required to achieve any given level of performance would be higher than the amount predicted in this report. Consequently**, increasing spending to the level identified as the 'Cost to Maintain" would not guarantee that conditions and performance would actually be maintained**. 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 in itself guarantee that these funds would be expended in a cost-beneficial manner. Further, there may also be some projects that, regardless of economic merits, may be infeasible as a practical matter due to factors beyond those considered in the models. As a result, the supply of feasible cost-beneficial projects could be exhausted at a lower level of investment than is indicated by this scenario, and the projected improvements to future conditions and performance under this scenario may not be fully obtainable in practice.

This report has traditionally identified the amount of additional spending above current levels that would be required to achieve certain performance benchmarks, without considering the types of revenues required to support this additional spending. The implicit assumption has been that the financing mechanisms would not have any impact on the investment scenario estimates. In reality, however, increased funding from general revenue sources (such as property taxes, sales taxes, income taxes, etc.) would have different implications than increased funding from user charges (such as fuel taxes, tolls, and fares). For this report, the highway investment modeling procedures have been modified to assume that any increase in highway and bridge investment above 2004 levels would be funded entirely by increases in user charges, and a feedback loop has been added to account for the impact that this increase in the "price" of travel would have on deterring future travel and, by extension, reducing future investment scenario estimates.

While the assumption of increased levies on users via the current tax structure draws revenues, investment, and travel demand together, the inherent economic inefficiencies of the current structure would remain, whereby travel on uncongested facilities is charged at the same rate as those with significant congestion issues. In an ideal (from an economic point of view) world, users of congested facilities would be levied charges precisely corresponding to the economic cost of the delay they impose on one another, thereby reducing peak traffic volumes and increasing net benefits to all users combined.

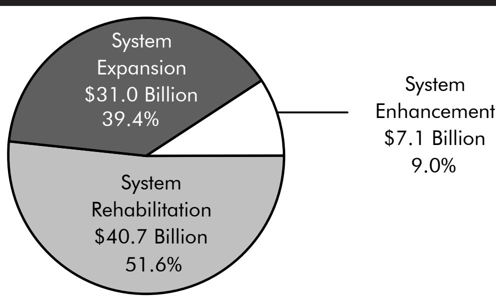
For this report, the HERS model has been adapted to illustrate the maximum, theoretical impact that efficient pricing could have on the estimates of future highway investment scenarios. This highly stylized analysis, presented in Chapter 10, assumes that congestion pricing would be implemented universally on all congested roads. **This analysis demonstrates that congestion pricing has considerable potential for reducing peak period congestion and future investment scenario estimates**. However, this analysis should be viewed as an interim product that will be refined in future editions of the C&P report. Importantly, it does not account for the considerable costs that could be associated with implementing and administering such a comprehensive pricing system. The methodology used for this analysis is presented in Appendix A. The "Pricing Effects" section in Part IV provides a further discussion of ongoing research in this area.

Capital Investment Scenarios: Highways and Bridges

Chapter 7 presents two illustrative future investment scenarios for highways and bridges. The Introduction to Part II (summarized on pages ES-12 and ES-13) includes critical background material required to properly interpret these scenarios. These scenarios assume the continuation of current highway financing mechanisms and current trends in the deployment of certain operations strategies and deployments; Chapter 10 explores the impacts of changing these and other key scenario assumptions.

The average annual **Cost to Maintain Highways and Bridges for the 20-year period 2005–2024 is estimated to be $78.8 billion**, stated in constant 2004 dollars. This scenario represents the level of investment **by all levels of government** required to (1) maintain the existing level of bridge deficiencies in constant dollar terms, and (2) keep the physical condition and operational performance of the highway system at a level sufficient to prevent average highway user costs (including travel time costs, vehicle operating costs, and crash costs) from rising above the existing level in constant dollar terms.

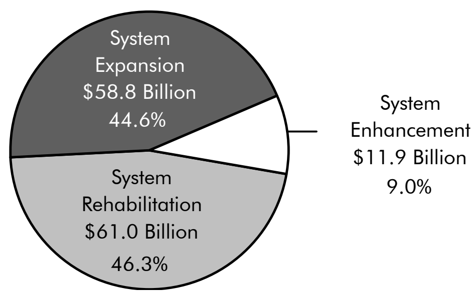
Cost to Maintain Highways and Bridges Distribution by Improvement Type



Agency costs, such as maintenance, and societal costs, such as emissions, are considered in the benefit-cost analysis for future highway investments, but are not included in the calculation of the maintain user cost performance goal. Taxes are also excluded from the user cost target, since they are not a reflection of system conditions or performance. User taxes would rise under this scenario to cover the additional investment required above 2004 spending levels, so the total costs including taxes experienced by individuals under this scenario would increase.

The average annual **Maximum Economic Investment Level for Highways and Bridges for the 20-year period 2005–2024 is estimated to be $131.7 billion,** stated in constant 2004 dollars. This scenario represents the level of investment **by all levels of government** required to implement all cost-beneficial improvements on highways and bridges. This scenario can be viewed as an "investment ceiling" above which it would not be cost-beneficial to invest, even if unlimited funding were available.

Maximum Economic Investment for Highways and Bridges Distribution by Improvement Type



System rehabilitation improvements make up 51.6 percent of the Cost to Maintain and 46.3 percent of the Maximum Economic Investment level. This includes all capital investment aimed at preserving the existing highway and bridge infrastructure. System expansion improvements (adding capacity to the system through widening or other means) make up 39.4 percent of the Cost to Maintain and 44.6 percent of the Maximum Economic Investment level. The remaining 9.0 percent of each scenario is not directly modeled; this represents the current share of capital spending on system enhancements such as safety, traffic control facilities, and environmental enhancements.

Capital Investment Scenarios: Transit

Transit capital investment estimated under the "Maintain Conditions and Performance" scenario and estimated under the "Improve Conditions and Performance" scenario are 1.3 percent higher and 9 percent lower than in the 2004 report; the amount to improve performance has declined due to revisions in the benefit-cost analysis. Current investment estimates are for the period 2005–2024. The Maintain Conditions and Performance scenario projects the level of investment to maintain current average asset conditions over the 20-year period and to maintain current vehicle occupancy levels as transit passenger travel increases. The Improve Conditions and Performance scenario projects the level of invesment to raise the average condition of each major transit asset type to at least a level of "good," reduce average vehicle occupancy rates, and increase average vehicle speeds. The Improve Conditions and Performance scenario defines an upper limit above which additional investment in transit is unlikely to be economically justifiable.

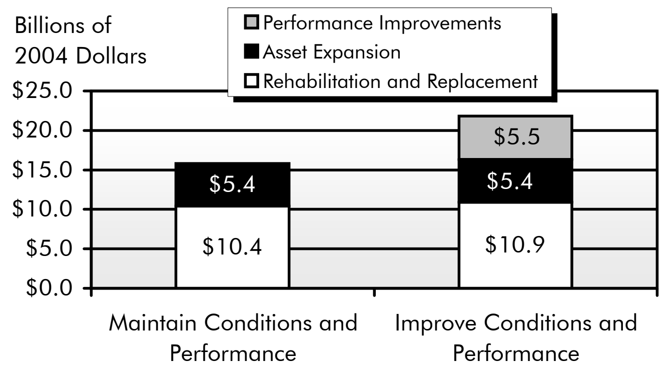
Transit Average Annual Investment Scenario Estimatess, 2003–2022 and 2005–2024

(Billions of Dollars)

Conditions & Performance	Average Annual Cost 2003–2022 2002 Dollars	2005–2024 2004 Dollars
Maintain	$15.6	$15.8
Improve	$24.0	$21.8

Average annual investment is estimated to be $15.8 billion to maintain conditions and performance ($15.6 billion in 2002) and $21.8 billion to improve conditions and performance ($24.0 billion in 2002). Under the "Maintain" scenario, $10.4 billion annually would be needed for asset rehabilitation and replacement and $5.4 billion for asset expansion. Under the "Improve" scenario, $10.9 billion would be needed annually for replacement and rehabilitation, $5.4 billion for asset expansion, and $5.5 billion for performance improvements. Eighty-seven percent

Annual Cost to Maintain and Improve Conditions and Performance by Investment Type, 2005–2024



of the investment under the "Maintain" scenario, or $13.8 billion, would be required in urban areas with populations of over 1 million, reflecting the fact that in 2004, 92 percent of the Nation's passenger miles were in these areas.

Of the investment required to maintain conditions and performance, vehicles account for 45 percent ($7.1 billion annually), guideway elements for 18 percent ($2.9 billion), facilities for 12 percent ($1.9 billion), stations for 9 percent ($1.4 billion), systems for 9 percent ($1.4 billion) and other project costs for 6 percent ($1.0 billion). Of the investment under the Improve Conditions and Performance scenario, vehicles account for 42 percent ($9.2 billion annually), guideway elements for 19 percent ($4.2 billion), facilities for 11 percent ($2.4 billion), stations for 10 percent ($2.1 billion), systems for 7 percent ($1.6 billion) and other project costs for 11 percent ($2.3 billion).

Average Annual Transit Investment Scenario Estimates by Asset Type, 2005–2024

(Billions of 2004 Dollars)

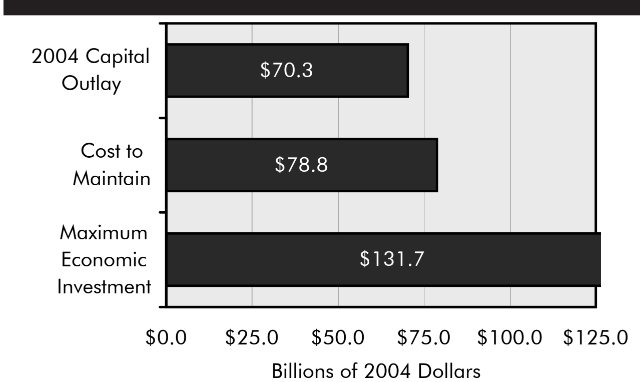
	Maintain	Improve
Vehicles	$7.1	$9.2
Guideway Elements	$2.9	$4.2
Facilities	$1.9	$2.4
Stations	$1.4	$2.1
Systems	$1.4	$1.6
Other Project Costs	$1.0	$2.3

Comparison of Spending and Investment Scenario Estimates: Highway and Bridge

Chapter 8 compares the investment estimates for the two illustrative scenarios introduced in Chapter 7 with current and projected spending levels. **This report does not endorse either of these two scenarios as a target level of funding**, nor does it make any recommendations concerning future levels of Federal funding.

Federal, State, and local capital expenditures for highways and bridges totaled $70.3 billion in 2004. **Capital outlay by all levels of government would have to increase by 12.2 percent above this level to reach the $78.8 billion Cost to Maintain Highways and Bridges level.** The percentage gap for highway resurfacing and reconstruction (part of the system rehabilitation component of the Cost to Maintain) is larger, at approximately 23.0 percent. In contrast, capital expenditures for bridge rehabilitation and replacement (also part of system rehabilitation) were 16.6 percent higher than the estimated annual cost to maintain the current economic backlog of bridge improvements in constant dollar terms. This is consistent with the reduction in the number of deficient bridges observed in recent years.

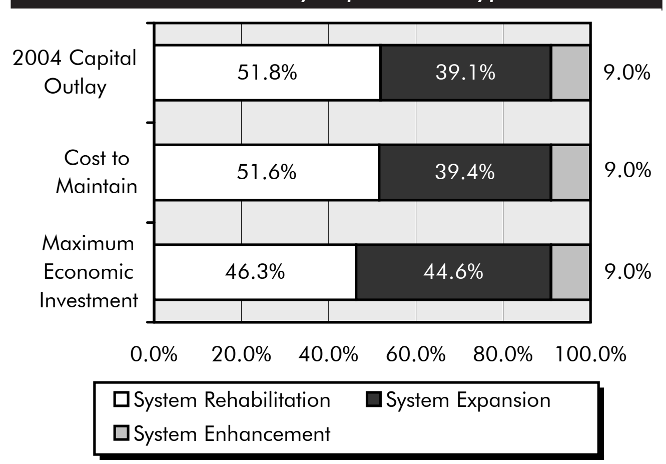
2004 Capital Outlay by All Levels of Government vs. Highway and Bridge Investment Scenario Estimates



An increase in capital outlay of 87.4 percent above current levels would be required to reach the projected $131.7 billion Maximum Economic Investment level for highways and bridges.

The distribution of funding by investment type suggested by the investment scenarios developed using the HERS and NBIAS models depends on the level of funding. In 2004, 39.1 percent of highway capital outlay went for system expansion, including the construction of new roads and bridges and the widening of existing facilities. This is very close to the percentage suggested by the "Cost to Maintain" scenario to be used for capacity expansion investments (39.4 percent). However, if funding levels were to rise significantly above this level, the analysis identifies a number of cost-beneficial potential investments to combat highway congestion, so that at the Maximum Economic Investment level, 44.6 percent of total investments are for capacity expansion.

Investment Scenarios and 2004 Capital Outlay Distribution by Improvement Type



The estimated gaps between current spending and the two investment scenarios are higher than the estimates shown in the 2004 edition of this report, which compared 2002 highway capital outlay with investment scenarios for 2003 to 2022. The estimated Cost to Maintain in that report was 8.3 percent higher than 2002 spending, and the gap between 2002 spending and the Maximum Economic Investment level was 74.3 percent.

Comparison of Spending and Investment Scenario Estimates: Transit

Transit capital expenditures from Federal, State, and local governments totaled $12.6 billion in 2004, below the annual investment amounts estimated by the TERM scenarios for the 20-year period from 2005–2024. **The annual capital investment estimated by the Maintain Conditions and Performance scenario is $15.8 billion, 25 percent above actual spending in 2004.** The investment estimated by the Improve Conditions and Performance scenario is $21.8 billion, 73 percent above actual 2004 capital spending.

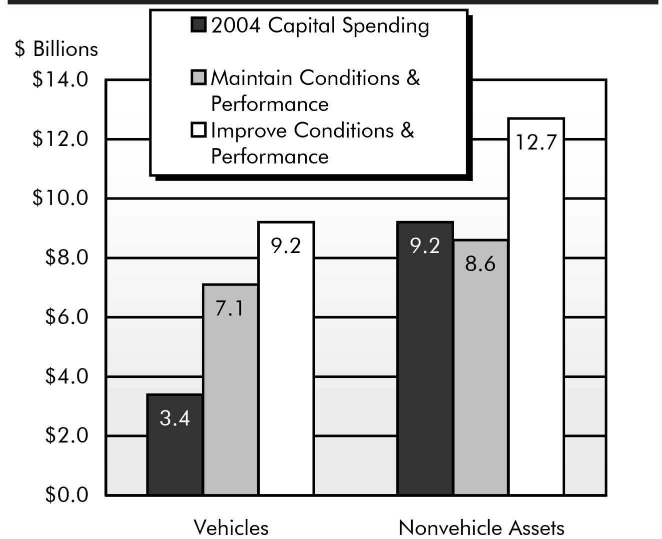
The gap between actual vehicle capital investment and the amount to maintain and improve the conditions of vehicle assets has widened since the last report and the gap between actual nonvehicle asset investment and the amount to maintain and improve the conditions of nonvehicle assets has declined, in part, due to a decrease in the share of capital spending on vehicles from 31 percent in 2002 to 27 percent in 2004, and an increase in the share of capital spending on nonvehicles from 69 to 73 percent.

The estimated average annual amount to maintain the conditions and performance of the Nation's transit vehicle assets of $7.1 billion is 109 percent above actual spending of $3.4 billion in 2002. The estimated average annual amount to improve conditions and performance of transit vehicles is $9.2 billion, 171 percent above the 2004 investment.

The average annual amount to maintain the conditions and performance of the Nation's nonvehicle transit infrastructure of $8.6 billion is 7 percent below the $9.2 billion spent in 2004. The average annual amount to improve the conditions and performance of the nonvehicle infrastructure is $12.7 billion, 38 percent above actual spending in 2004.

In addition to continually replacing existing transit assets, the annual investment scenarios estimates include the expansion of existing assets to meet

A Comparison of 2004 Capital Spending with Average Annual Investment Scenario Estimates (Billions of Dollars)



projected demand and improve operational performance. To maintain performance, TERM estimates that an additional 26,000 buses and 5,500 rail vehicles would need to be purchased between 2005 and 2024 to meet a projected ridership growth of 1.57 percent. This would be roughly a 24 percent increase in the 2004 bus fleet size, and a 21 percent increase in the 2004 rail fleet size. To improve performance, TERM estimates that an additional 3,000 rail vehicles would be needed, or about a 12 percent increase in the 2004 rail fleet size.

The gap between the annual investment estimated by the Maintain Conditions and Performance scenario and actual investment is similar to what was reported in the 2004 edition. The gap between the annual investment estimated by the Improve Conditions and Performance scenario and actual investment is about 20 percent lower than reported in the 2004 report due to a decrease in the estimate required to improve conditions and performance. This decline was primarily due to a decrease in investment needed to improve performance resulting from a reduction in the assumed hourly cost of congestion delay.

Impacts of Investment: Highways and Bridges

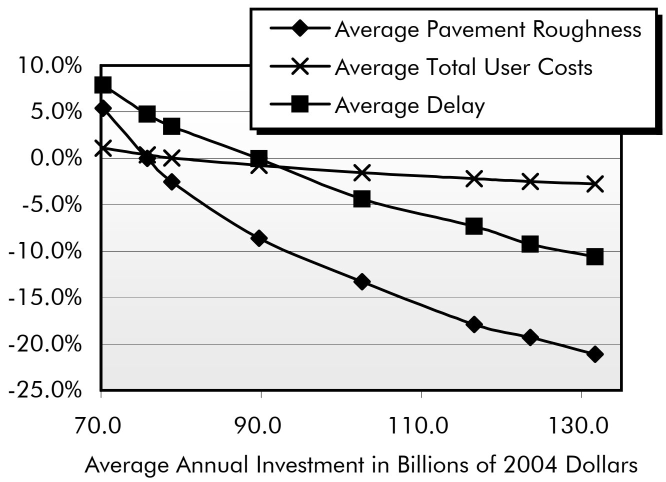
Spending by all levels of government on system rehabilitation rose by 58.0 percent between 1997 and 2004, from $23.0 billion to $36.4 billion. This increased investment in roadway resurfacing and reconstruction and bridge rehabilitation and replacement is reflected in the increases in the percent of VMT occurring on pavements with good ride quality and the decreases in bridge deficiencies that are described in Chapter 3.

Investment in system expansion has also increased from 1997 to 2004, 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 that is described in Chapter 4.

If annual highway capital investment from 2005 to 2024 averages the $131.7 billion (in constant 2004 dollars) level specified by the "Maximum Economic Investment" scenario, and is applied in the manner suggested (devoting a larger share of investment toward capacity expansion to address congestion problems), then average highway user costs would be expected to decline by 2.8 percent per VMT in constant dollar terms. While this percentage appears relatively low, by the year 2024 it would translate into approximately $116 billion in annual user cost savings. (There is a practical limit on the ability of highway investments to cause dramatic reductions in total user costs, since they include the time costs associated with getting from point A to point B in uncongested conditions). Average delay per VMT would decline by 10.6 percent under the "Maximum Economic Investment" scenario. (Delay due to incidents would decline much more sharply, as the level of future investments in operations and intelligent transportation systems assumed in these scenarios would have a greater effect on nonrecurring delay.) Average pavement ride quality would be expected to improve by 21.1 percent relative to 2004 levels.

If all levels of government combined invested at the projected Cost to Maintain level of $78.8 billion, average highway user costs in 2024 would by definition match those in 2004. Average pavement ride quality would improve by 2.5 percent, while delay per VMT would worsen by 3.4 percent.

Projected Changes in 2024 Highway Condition and Performance Measures Compared with 2004 Levels, at Different Possible Funding Levels



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 in this report are dynamic, in the sense that they allow feedback between the level of future investment and future VMT growth.

Relative to previous editions, the difference between the projected average annual VMT growth rate in the two scenarios is narrower (1.94 percent versus 1.88 percent), due to the imposition of user charges to cover the increased spending associated with each scenario.

Impacts of Investment: Transit

Funding levels between 2002 and 2004 have been sufficient to maintain conditions. The investment estimated by the "Maintain Conditions" scenario assumes that an average condition of 3.6 will be reached in 2024, compared with an average condition of 3.9 in 2004. To reach an average condition of 3.9 in 2024 would require the maintain conditions investment estimate to include replacement expenditures for some assets not needing replacement over the 2003 to 2024 period.

If the amount spent on capital investment is 10 percent lower than the amount estimated to be needed to maintain conditions in urban areas ($8.89 billion annually instead of $9.88 billion annually), the average condition of transit assets is estimated to fall from 3.6 in 2004 to 3.5 in 2024. If this amount is lowered by 30 percent to $6.92 billion annually, average asset conditions are estimated to fall to 3.4 in 2024.

Effect of Capital Spending Constraints on Transit Conditions

	2004 Condition	Percent of Recommended Rehabilitation and Replacement Expenditures to Maintain Conditions			
Asset Type		**100%**	**90%**	**80%**	**70%**
Guideway Elements	4.4	4.1	4.0	4.0	3.9
Facilities	3.6	3.2	2.9	2.9	2.9
Systems	3.9	3.7	3.7	3.5	3.4
Stations	3.4	3.1	3.1	3.1	3.1
Vehicles	3.4	3.4	3.3	3.3	3.1
All Assets	**3.9**	**3.6**	**3.5**	**3.5**	**3.4**
Replacement Expenditure Scenarios [1]		$9.88	$8.89	$7.91	$6.92

[1] Excludes rural vehicles and facilities.

Funding levels between 2002 and 2004 have also been sufficient to maintain performance as measured by passenger travel time and vehicle occupancy. TERM estimates that for urban areas $5.2 billion annually will be needed to maintain current performance if PMT increases annually at the projected rate of 1.57 percent, or about 850 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 composed 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. Out-of-pocket savings occur when passengers switch from automobiles to transit.

TERM estimates that $5.2 billion annually is required to improve transit performance in urban areas, $2.01 billion annually for asset expansion in new rail or BRT service to increase speed, and $3.16 billion annually for asset expansion in new vehicles to reduce occupancy levels. The average ridership estimated to result from increasing speed is 22.9 million passengers annually; the average annual ridership estimated to result from decreasing occupancy levels is 51.6 million passengers annually.

Sensitivity Analysis: Highways and Bridges

The usefulness of any investment scenario 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 baseline analyses presented in Chapter 7 to changes in these assumptions.

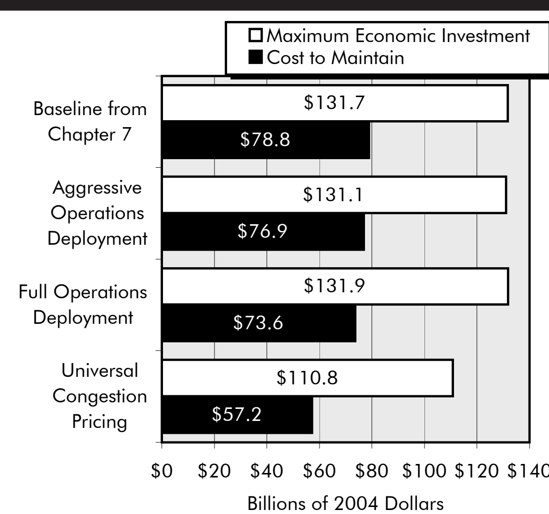
While previous editions of the C&P report have examined the effects of a 25 percent constant dollar increase in highway construction costs, this alternative analysis has taken on additional significance due to recent spikes in the costs of various construction materials and petroleum products. Such an increase would lead to a comparable increase in the average annual Cost to Maintain highways and bridges; the Maximum Economic Investment level would rise by only 11.2 percent, as some potential improvements would no longer be cost-beneficial.

This edition of the report also includes theoretical scenarios involving alternative congestion reduction strategies. The baseline scenarios in Chapter 7 reflect the effects of selected operations strategies and intelligent transportation systems (ITS), assuming existing deployment trends continue. However, if the deployment rates were to accelerate significantly, the Cost to Maintain could decline by 2.4 percent. Assuming full immediate deployment in all applicable locations would bring down the Cost to Maintain by 6.6 percent. The Maximum Economic Investment level would not change significantly, as many of these operations deployments would complement, rather than substitute for, other cost-beneficial highway investments. However, under these alternative assumptions, projected future operational performance would be significantly improved; highway users would save an extra $10 billion annually by 2024 in terms of reduced delay and other costs assuming aggressive deployment rates; assuming full immediate deployment, these savings would rise to $27 billion per year by 2024.

The baseline scenarios in Chapter 7 also assume the continuation of existing financing structures, with their inherent economic inefficiencies. In an ideal (from an economic point of view) world, users of congested facilities would be levied charges precisely corresponding to the economic cost of the delay they impose on one another, thereby reducing peak traffic volumes and increasing net benefits to all users combined. **A preliminary analysis of universal congestion pricing using the HERS model suggests that such a strategy could significantly reduce the level of future highway investment that would be required to maintain or improve highway operational performance.**

Applying congestion tolls along the principles outlined above to all congested roads could reduce the Cost to Maintain by $21.6 billion per year (27.5 percent), leaving it well below the $70.3 billion level of capital spending in 2004. The Maximum Economic Investment level would be reduced by $20.9 billion (15.9 percent) even while generating a better level of system performance than the baseline scenario. Note that this analysis does not reflect the startup or administrative costs that would be associated with implementing a pricing strategy of this nature. This analysis will be refined in future editions of the C&P report, which might increase or decrease these estimated impacts.

Impact of Congestion Reduction Strategies on Average Annual Investment Scenario Estimates



Sensitivity Analysis: Transit

Chapter 10 examines the sensitivity of projected transit investment to variations in the values of exogenously determined model inputs including 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 estimates of projected investment in the Nation's transit systems for the "Maintain Performance" scenario (i.e., current levels of passenger travel speeds and vehicle utilization rates) as ridership increases and the "Improve Performance" scenario (i.e., increase passenger travel speeds and reduce crowding).

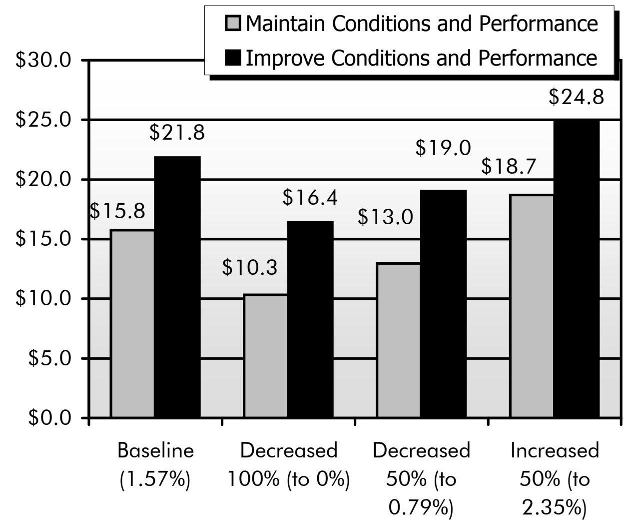
PMT forecasts are generally made by metropolitan planning organizations (MPOs) in conjunction with projections of vehicle miles traveled (VMT). The average annual growth rate in PMT of 1.57 percent used in this report is a weighted average of the most recent MPO forecasts available from 92 of the Nation's largest metropolitan areas. Transit investment estimates in the 2004 report were based on a projected PMT growth rate of 1.5 percent, based on projections from 76 MPOs. (PMT increased at an average annual rate of 2.29 percent between 1995 and 2004 and by 0.65 percent between 2002 and 2004.)

Varying the assumed rate of growth in PMT affects estimated transit investment both for the "Maintain" and "Improve" scenarios. 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 13 to 14 percent. Investment estimated by both the "Maintain" and "Improve" scenarios would decrease significantly if PMT was assumed to remain 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

The Effect of Variations in PMT Growth on Transit Annual Investment Scenario Estimates (Billions of 2004 Dollars)



higher capital costs on the projected transit investment. A 25 percent increase in capital costs increases the investment estimated by the Maintain Conditions and Performance scenario by 18 percent and increases the investment estimated by the Improve Conditions and Performance scenario by 15 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 the investment estimates, 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 was found to have almost no effect on projected investment.

CHAPTER 11: *Executive Summary*

Interstate System

In 2006, the Dwight D. Eisenhower National System of Interstate and Defense Highways, commonly known as the Interstate System, turned 50 years old. The 46,747 miles of Interstate highways serve as the backbone of transportation and commerce in the United States. About 67.1 percent of this 2004 mileage was in rural areas, 4.5 percent was in small urban areas, and 28.3 percent was in urbanized areas. In 2004, Americans traveled approximately 267 billion vehicle miles on rural Interstates, 26 billion on small urban Interstates, and 434 billion on urbanized Interstates. Taken together, this represents approximately 24.5 percent of all U.S. travel in 2004.

The Interstate System is growing more crowded; Interstate VMT grew at an average annual rate of 2.8 percent from 1995 to 2004, outpacing the 0.5 percent average annual growth in lane miles over that period. On rural Interstates, 73.7 percent of VMT in 2004 was on pavements with good ride quality; comparable figures for small urban and urbanized Interstates were 65.6 percent and 48.5 percent, respectively. Current spending on rural Interstate highways appears adequate to further improve pavement ride quality and reduce overall highway user costs, if sustained in constant dollar terms. On urban Interstates, significant increases in funding for rehabilitation and expansion would be required to prevent both average physical conditions and operational performance from becoming degraded.

The Interstate System included 55,315 bridges in 2004, 27,648 in rural areas and 27,667 in urban areas. In 2004, about 15.9 percent of rural Interstate bridges were considered to be deficient, including 4.2 percent classified as structurally deficient and 11.7 percent classified as functionally obsolete. Among urban Interstate bridges, about 26.5 percent were considered to be deficient in 2004, including 5.1 percent classified as structurally deficient and 20.5 percent classified as functionally obsolete.

CHAPTER 12: *Executive Summary*

National Highway System

The National Highway System (NHS) has five components, including (1) the Interstate System, (2) selected other principal arterials deemed most important for commerce and trade, (3) the Strategic Highway Network (STRAHNET), (4) STRAHNET connectors, and (5) intermodal connectors that provide access between major intermodal passenger and freight facilities and other NHS components. The NHS includes 87.5 percent of urban other freeways and expressways, 35.9 percent of urban other principal arterials, and 83.8 percent of rural other principal arterials. While the NHS makes up only 4.1 percent of total U.S. mileage, it carries 44.8 percent of total travel.

In 2004, 68.0 percent of rural NHS travel was on pavements with good ride quality, compared with 42.5 percent of urban NHS travel. Approximately 97 percent of rural NHS travel was on pavements with acceptable ride quality, compared with 86.9 percent of urban NHS travel.

In 2004, 19.4 percent of all U.S. bridges were located on the NHS, but these bridges had 49.5 percent of the total deck area on all bridges and carried 71.1 percent of the traffic on all bridges. Approximately 20.5 percent of NHS bridges were considered deficient in 2004, including 5.6 percent classified as structurally deficient and 14.9 percent classified as functionally obsolete.

In 2004, all levels of government spent a combined $34.6 billion for capital improvements to the NHS, which was 49.2 percent of total capital expenditures on all roads. If current spending for NHS bridge rehabilitation and replacement were sustained in constant dollar terms over 20 years, the current backlog of deficient bridges could be reduced, but not eliminated. If current spending levels on the urban NHS for system expansion plus pavement resurfacing and reconstruction were sustained, urban pavement condition and operational performance would be expected to decline. Current spending on the rural NHS is adequate to improve rural conditions and performance.

Innovative Finance

While the traditional financing mechanisms discussed in Chapter 6 provide most of the funding that supports surface transportation, innovative financing mechanisms are playing an increasingly important role. This report defines "Innovative Finance" broadly, reflecting a wide array of techniques designed to supplement traditional financing mechanisms, including credit assistance, innovative debt financing and public-private partnerships.

The **Transportation Infrastructure and Finance Innovation Act** (TIFIA) program is administered by the DOT and offers eligible applicants the opportunity to compete for secured (direct) loans, loan guarantees, and standby lines of credit for up to one-third of the cost of construction for nationally and regionally significant projects, provided that the borrower has an associated revenue stream, such as tolls or local sales taxes, that can be used to repay the debt issued for the project. Since the program's inception in 1999 through July of 2006, TIFIA has provided almost $3.2 billion in credit assistance to projects representing more than $13.2 billion in infrastructure investment.

The **State Infrastructure Bank (SIB) Pilot Program** provides increased financial flexibility for infrastructure projects by offering direct loans and loan guarantees. SIBs are capitalized with Federal and State funds. Each SIB operates as a revolving fund and can finance a wide variety of surface transportation projects. As loans are repaid, additional funds become available to new loan applicants. As of June 2005, $5.1 billion in loan agreements had been made by 33 States, of which $3.7 billion had been disbursed for 457 loan agreements. SIB loans are being used to fund both highway and transit projects; 21 States have signed SIB cooperative agreements with the FTA and eight have executed at least one public transit loan. SIB transit loans of $94.5 million are assisting $318.7 million in transit projects.

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. The private sector often has expertise that may not be readily available in the public sector that can bring innovation and efficiency to many projects.

A variety of institutional models are being used including (1) concessions for the long-term operation and maintenance of individual facilities or entire highway systems; (2) purely private sector highway design, construction, financing, and operation; and (3) **Public-Private Partnerships (PPPs)** in designing, constructing, and operating major new highway systems.

Options for PPPs stretch across a spectrum of increased private responsibilities and range from transferring tasks normally done in-house to the private sector, to combining typically separate services into a single procurement or having private sector partners assume owner-like roles.

SAFETEA-LU amended the Internal Revenue Code to include highway facilities and surface freight transfer facilities among the types of privately developed and operated projects that can utilize tax-exempt **private activity bond** financing.

The FHWA has a number of initiatives underway to help remove barriers to greater private sector involvement in highway construction, operation, and maintenance. These include workshops to provide States with resources to overcome barriers to PPP implementation; development of model legislation for States to use in drafting new or more flexible State laws and regulations; the development and launch of the PPP Web site, **http://www.fhwa.dot.gov/ppp**, which contains links to many PPP resources, both domestic and international; and case studies of how States and local governments have overcome institutional barriers to PPP implementation.

CHAPTER 14: *Executive Summary*

Freight Transportation

Freight transportation enables economic activity, and trucking is a key element of freight transportation. Trucks carried 70 percent of the value and 60 percent of the tons of commodities shipped in 2002, not including shipments moved by truck in combination with another mode.

Trucking is both a critical component of the Nation's economy and a concern to the traveling public, who share increasingly crowded highways with freight-hauling vehicles. Commercial truck travel doubled over the past two decades. On one-fifth of the mileage of the Interstate Highway System, trucks account for more than 30 percent of all vehicles. Truck travel has been exceeding the growth in passenger travel over time, suggesting that the percentage of trucks in the traffic stream is likely to grow substantially if current trends continue. Freight tonnage is forecast to increase by 70 percent between 1998 and 2020, and trucking is expected to account for the majority of the projected increase.

Highway congestion affects motorists, freight carriers, and freight shippers. Shippers are affected through an increase in logistics costs made up of transportation costs, inventory costs, and order costs (involving the size and frequency of an order of goods). Slower and more unreliable transportation increases transportation costs directly, but also increases order costs and inventory costs.

A recent study for FHWA has identified over 2,000 truck bottlenecks throughout the United States, which cause more than 243 million hours of delay to truckers annually, translating into direct user costs of $7.8 billion per year. Of the four major types of bottlenecks analyzed, 227 urban freeway interchange bottlenecks accounted for an estimated 124 million truck hours of delay. Other types of bottlenecks include 859 steep grades (66 million hours of delay), 517 signalized intersections (43 million hours of delay), and 507 lane drops (11 million hours of delay).

CHAPTER 15: *Executive Summary*

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; providing traveler information through variable message signs, 511 telephone service, and other means; 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. States and local governments are making progress in the adoption of these strategies, but much work in this area remains to be done.

Without greater attention to operations, travelers and goods moving on the 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.