STATE AND NATIONAL PUBLIC TRANSPORTATION NEEDS ANALYSIS

Requested by:

American Public Transportation Association

and

American Association of State Highway and Transportation Officials (AASHTO)

Prepared by:

Cambridge Systematics, Inc.
4800 Hampden Lane, Suite 800
Bethesda, MD 20814
September 9, 2008

The information contained in this report was prepared as part of TCRP Project H-33(B), Transit Cooperative Research Program, Transportation Research Board.

Acknowledgements

This study was conducted for the American Public Transportation Association and the American Association of State Highway and Transportation Officials (AASHTO), with funding provided through the Transit Cooperative Research Program (TCRP) Project H-33(B), *State and National Public Transportation Needs Analysis.* The TCRP is sponsored by the Federal Transit Administration; directed by the Transit Development Corporation, the education and research arm of the American Public Transportation Association; and administered by the National Academies, through the Transportation Board. The report was prepared by Cambridge Systematics, Inc. The work was guided by a technical working group. The project was managed by Dianne S. Schwager, TCRP Senior Program Officer.

Table of Contents

List of Tables

Public Transportation – The Bottom Line

Executive Summary

An efficient, safe, and environmentally sound public transportation system is essential to moving people in both rural and urban areas, and is a critical part of the nation's multimodal transportation infrastructure and services. The nation's extensive public transportation network is essential to the economy of the United States. It connects workers to jobs and employers to labor markets. Public transportation also provides basic mobility options for the economically challenged, the young, the elderly, and the physically challenged individuals with disabilities in residents of urban areas, small towns, villages, and rural areas. Public transportation also plays a significant role in state and national efforts to mitigate traffic congestion, to conserve fuel, to enhance the efficiency of highway transportation, to address air quality issues, and to support security and emergency preparedness activities.

Four alternative investment scenarios were identified by applying combinations of physical conditions and service performance. For each of these scenarios, investment needs were calculated for a 2.4 percent annual ridership growth in urbanized areas, a 3.52 percent annual ridership growth in urbanized areas, and a 4.63 percent annual ridership growth in urbanized areas. Public transportation capital investment needs have been estimated for several different investment scenarios. The public transportation investment scenarios are based on combinations of the following:

- **Maintain Physical Conditions –** This scenario assumes that the public transportation fleet and other assets will continue to be replaced following replacement cycles reflected by the current average age of assets, which often falls behind the assumptions of the expected age for FTA recommended replacement cycles;

- **Improve Physical Conditions –** This scenario assumes that the public transportation fleet and other assets will be replaced according to the assumptions for the expected recommended FTA replacement cycle service life, resulting in an overall improvement in asset conditions;

- **Maintain Service Performance –** This scenario assumes that service will be provided at existing levels with increases in service only to accommodate new riders. Under the Maintain Service Performance scenario, systems operating with excessive crowding will continue to do so and transit operating speeds will continue to be unchanged even if they are unreasonable. Transit densities in terms of passengers per vehicle have increased substantially in recent years, commensurate with increases in ridership. As a result, the Maintain Service Performance scenario assumes a continuation into the future of this more crowded condition; and

- **Improve Service Performance –** This scenario assumes that improvements are made to both reduce passenger densities on the most crowded systems and to improve the

speed of service for systems where the average speed falls well below the national average. Under this scenario, investments are made to improve both of these measures so that they come closer to the national average.

Table 1 shows the estimated annual capital investment needs for each of four scenarios and for the three alternative levels of ridership growth.

Table 1. Summary of Average Annual Public Transportation Capital Requirements

Alternative Capital Investment Scenario	Range of Average Annual Cost at 2.4 Percent, 3.52 Percent, and 4.63 Percent Annual Ridership Growth (in Billions of 2006 Dollars)
Maintain Physical Conditions, Maintain Service Performance	$35.1 to $48.2 to $64.2
Improve Physical Conditions, Maintain Service Performance	$38.8 to $52.0 to $68.0
Maintain Physical Conditions, Improve Service Performance	$42.4 to $55.4 to $71.4
Improve Physical Conditions, Improve Service Performance	$46.1 to $59.2 to $75.2

The Value of Public Transportation

An efficient, safe, and environmentally sound public transportation system is essential to moving people in both rural and urban areas, and is an essential critical part of the nation's multimodal transportation infrastructure and services. The nation's extensive public transportation network is essential to the economy of the United States. It connects workers to jobs and employers to labor markets. Public transportation also provides basic mobility options for the economically challenged, the young, the elderly, and the physically challenged individuals with disabilities in residents of urban areas, small towns, villages, and rural areas. Public transportation also plays a significant role in state and national efforts to mitigate traffic congestion, to conserve fuel, to enhance the efficiency of highway transportation, to address air quality issues, and to support security and emergency preparedness activities.

In 2007Annually, 10.3 billion passenger trips were provided by the Nation's public transportation systems in 2007. In some of the nation's largest cities, public transportation carries one-third to more than one-half of all work trips destined for central business districts (CBD), and is an essential link between these CBDs and the rest of the region. Table 2 identifies the 15 cities in the United States with the highest levels of workers using public transportation.

Without effective public transportation service, many dynamic economic centers would be unable to function effectively. Throughout the United States, public transportation is

viewed as critical to reducing traffic congestion, improving air quality, and increasing the functionality of economic centers. In growing midsized cities across the country, public transportation is often seen as a potential solution to congestion. In rural and small urban areas, as well as in larger urban regions, public transportation provides crucial mobility options for economically disadvantaged persons, elderly individuals and, physically challenged individuals with disabilities, and economically disadvantaged persons.

With the United States projected to continue to experience significant population and employment growth in coming decades, and with the continued aging of the population, and with continued issues of greenhouse gases and energy supplies and prices, the demand for public transportation services is projected to continue to increase.

Table 2. Percentage of Workers 16 Years and Over Traveling to Work by Public Transportation

2004

City[a]	Percent Using Public Transportation
New York, New York	53.2%
Washington, D.C.	33.6%
Boston, Massachusetts	31.8%
San Francisco, California	29.6%
Philadelphia, Pennsylvania	27.0%
Newark, New Jersey	25.5%
Chicago, Illinois	23.6%
Oakland, California	22.3%
Baltimore, Maryland	20.5%
Pittsburgh, Pennsylvania	19.4%
Seattle, Washington	15.2%
St. Louis, Missouri	13.8%
Portland, Oregon	13.3%
Atlanta, Georgia	12.3%
Minneapolis, Minnesota	12.2%

Source: 2004 American Community Survey, United States Bureau of the Census.

[a] All data is for the city proper only and does not include the entire metropolitan area.

Public Transportation Services and Ridership

Public transportation services are available in 451 urbanized areas. In every state, some level of public transportation is available to support provided to rural residents, elderly individuals, and/or physically challenged individuals with disabilities citizens. There are:

- 729 public transportation service providers in urbanized areas;
- 1,217 public transportation service providers in rural areas; and
- 4,836 public transportation service providers to the elderly and persons with physical challenges, across both urban and rural areas.

The return on federal, state and local investment is clear. The American Public Transportation Association (APTA) reports that since the mid-1990s, public transportation ridership in the nation has grown 32% (from 7.8 billion trips annually in 1995 to 10.3 billion trips in 2007). The ridership information is shown in terms of unlinked trips. As shown in Table 3, 59 percent of all public transportation trips in the nation are work related – significantly supporting the country's economic growth and vitality.

Table 3. Public Transportation Trips by Trip Type

Type of Trip	Percent of Total
Employment/Work	59%
School	11%
Shopping	9%
Recreation/Social	7%
Medical	3%
Other	12%

Source: American Public Transportation Association, Public Transportation Fact Book, June 2008.

Although public transportation is commonly associated with the nation's major urban-area subway (heavy-rail) or commuter-rail systems, approximately 59 percent of all public transportation trips in the United States are carried on buses. About 29 percent of public transportation trips are provided by heavy-rail systems. The remaining trips are made on other types of public transportation, including commuter rail (four percent), light rail (four percent), demand responsive services (one percent), and others, including automated guideways and ferries. A breakdown of public transportation usage by mode is shown in Table 4. In terms of passenger miles of travel, commuter rail's share increases substantially, to 20 percent, due to the long average trip lengths on that mode.

Table 4. Public Transportation Ridership by Mode
2006

Mode	Annual Unlinked Trips (in Millions)	Percentage of All Public transportation Trips	Annual Passenger Miles Traveled (Millions)	Percentage of All Transit Passenger Miles Traveled
Bus	5,894	58.8%	22,821	43.8%
Heavy Rail	2,927	29.2%	14,721	28.2%
Commuter Rail	441	4.4%	10,361	19.9%
Light Rail	407	4.1%	1,866	3.6%
Demand Responsive	126	1.3%	1,078	2.1%
Trolleybus	100	1.0%	164	0.3%
Other	121	1.2%	1,143	2.2%
Total	**10,017**	**100.0%**	**52,154**	**100.0%**

Source: American Public Transportation Association, Public Transportation Fact Book, June 2008.

■ Public Transportation Capital Assets

The nation's public transportation services are provided through a broad range of services, delivered by public or private operators. Types of public transportation services include traditional fixed-route/fixed-schedule bus routes, urban heavy rail, light rail, and commuter rail in urbanized areas; rural and small urban services; and specialized transportation services that serve our nation's elderly individuals and physically challenged individuals with disabilities citizens. Rural areas are primarily served by smaller buses, vans, or taxis. Intercity rail and intercity bus services are the subject of a separate research report. Public transportation services and infrastructure needs are funded through a combination of system-generated revenues, primarily fares, and Federal, state, and local government assistance.

Urban Bus Systems

According to the FTA National Transit Database (NTD), the nation's public transportation bus fleet is approximately 70,000 vehicles. As shown in Table 5, there are currently over 400 providers of traditional bus services and over 400 providers of paratransit service in urbanized areas which report data to the FTA National Transit Database (NTD). According to the NTD, the nation's public transportation bus fleet is now about 70,000 vehicles.

Table 5. Existing Public Transportation Bus Providers by Mode in Urbanized Areas in National Transit Database
2005

	Number of Providers[a]
Bus	468
Paratransit	438
Trolleybus	4
Vanpool	43

Source: Federal Transit Administration.

[a] Note that many bus providers operate more than one mode of these modes.

The average age of the bus fleet and the percentage of overage vehicles that are older than the years assumed as the replacement age for such vehicles are an indicator that public transportation systems nationwide have not been able to keep pace with investment needs for vehicle replacement guidelines established by FTA. As shown in Table 6, 18 percent of forty foot or greater transit buses, the most prevalent vehicle type, have exceeded the assumptions utilized for expected service life and are, thus, recommended for replacement. Other categories show similar percentages. Table 6 illustrates that almost all bus categories have an average age that exceeds the mid-point of their FTA rated service life. In addition, one-in-x transit buses currently in revenue service have exceeded their FTA rated service life and are recommended for replacement.

The continued use of overage vehicles that have exceeded their recommended service life may provide less comfortable and less reliable service for customers, and may cost the operating agencies more to maintain. In addition to the existing backlog of buses that are already eligible for replacement, 41 percent of the nation's over forty foot urban bus fleet will reach the end of their expected FTA recommended service life and will need to be replaced during the next 6 years. Thus, in total, 59 percent of the nation's 40-foot urban bus fleet are overage, or will reach the end of their expected service life during FTA recommended service life during the next 6 years. Figures are comparable for other types of buses. For those vehicle types with seven year cycles, the proportion of needed replacements within six years are of course a given.

Most, if not all, of the fleet will also require a midlife rehabilitation to maintain a proper and safe condition. Of course, the useful service life of vehicles can vary based upon operating conditions, weather, pavement quality, vehicle technology, and other factors.

Table 6. Characteristics of the Existing Public Transportation Bus Fleet in Urbanized Areas

Vehicle Type	Total Fleet	Assumption of Expected Life FTA Recommended Replacement Age (Years)	Percentage Currently Overage	Percentage that Will Reach Replacement Age within Next 6 Years	Total Percentage That Will Need Replacement In Six Years
Articulated	2,294	12	2%	58%	60%
Transit buses, Class A (> 40 feet)	44,607	12	18%	41%	59%
Transit buses, Class B (35 to 40 feet)	6,730	12	21%	40%	61%
Transit buses, Class C (30 to 35 feet)	5,332	10	17%	58%	75%
Transit buses, Class D (< 30 feet)	11,083	7	21%	72%	93%
Trolley buses	615	7	35%	65%	100%
Vans	25,954	7	10%	71%	81%

Source: FTA and Cambridge Systematics Estimates.

Urban Rail Systems

In many large and midsized cities across the country, fixed-guideway rail operations play a significant role in providing public transportation service. Today, services are provided by 72 urban public rail systems, with nearly 11,000 track miles and almost 3,000 stations in revenue service. The number of rail systems, track miles, and stations are shown in Table 7 by type of system (heavy rail, light rail, commuter rail, and other rail). As reported to the NTD, there are now more than 19,000 vehicles in the existing rail transit fleet, as shown in Table 8.

Parallel to the issues associated with the nation's bus fleet, the average age and percentage of overage rail rolling stock are indicators that public transportation systems have not been able to keep pace with their expected replacement cycle as estimated for this analysis with the recommended replacement cycles established by FTA. More than thirty percent of the heavy rail and commuter rail passenger vehicles currently being operated in revenue service have exceeded their expected service life as estimated for this analysis. FTA recommended service life. As with the public transportation bus fleet, the continued use of vehicles that have exceeded their recommended service life overage vehicles can be associated with passenger discomfort, less reliability, and higher operating and maintenance costs for agencies.

In addition to the existing backlog of rail vehicles eligible for replacement, an additional 18 percent of the nation's rail fleet will exceed their FTA recommended service life expected service life and will need to be replaced and will reach the age of their expected life during the next 6 years. In total, about 50 percent of the nation's rail fleet are overage

or will reach the age of their expected life exceed FTA's recommended replacement age during the next 6 years. In addition, a significant portion of the remaining rail fleet will require a midlife rehabilitation to maintain a proper and safe condition.

Table 7. Existing Public Transportation Rail Systems, Track Miles, and Stations by Mode

	Number of Systems	One-Way Track Miles	Number of Stations
Heavy rail	15	2,277	1,042
Light rail	29	1,211	764
Commuter rail	22	7,406	1,169
Other rail	6	39	68
Total	**72**	**10,933**	**3,043**

Source: FTA National Transit Database.

Table 8. Characteristics of Urban Public Transportation Rail Fleets

Vehicle Type	Total Fleet	FTA Recommended Replacement Age Assumption of Expected Life (Years)	Percentage Currently Overage	Percentage that Will Reach Replacement Age within Next 6 Years
Heavy Rail	11,083	25	36%	28%
Commuter Rail Passenger Coaches	3,426	25	31%	14%
Commuter Rail Self-Propelled Coaches	2,571	25	36%	16%
Commuter Rail Locomotives	779	25	27%	8%
Light Rail	1,838	25	18%	12%
Cable Car	40	25	90%	0%
Automated Guideway	87	25	0%	26%
Inclined Plane	8	50	0%	50%

Source: FTA and Cambridge Systematics Estimates.

Other Urban Public Transportation Assets

In addition to the bus and rail vehicles discussed in the previous two sections, the nation's urban public transportation systems consist of a wide variety of nonrevenue vehicle assets. Unlike vehicles, the expected life cycles for these assets are generally quite long. Table 9 shows that the service life for other assets ranges from 25 years for ferries to 96 years for guideway elements. Ten percent of nonrevenue vehicle assets are estimated to have exceeded their expected service life as defined for this analysis. In addition to the existing backlog of assets eligible for replacement, another 6 percent of nonrevenue vehicle assets will reach the age of their expected life. In total, 16 percent of nonrevenue vehicle assets are overage or reach the age of their expected life during the next 6 years.

Table 9. Characteristics of Existing Other Public Transportation Assets in Urbanized Areas

Asset Category	Assumption of Expected Life (Years)*	Average Age*	Percentage Currently Exceeding Expected Life[a]	Percentage that Will Reach Replacement Age within Next 6 Years *
Guideway Elements	95.8	28.4	6%	5%
Stations	91.7	46.6	4%	2%
Facilities	44.1	22.6	12%	6%
Systems	36.8	23.8	20%	8%
Vehicles (not including revenue vehicles)	12.0	16.6	54%	27%
Ferries	25.0	17.9	30%	13%
Averages	**73.7**	**29.5**	**10%**	**6%**

Source: FTA and Cambridge Systematics Estimates. Expected life based on useful estimates provided by FTA as guidance in estimating New Starts costs. Average age based on National Transit Database.

[a] Dollar-weighted.

Rural Public Transportation Systems

Typically, rural public transportation systems are quite small with only a handful of employees and operate a limited number of vehicles. Rural public transportation data is now being collected by FTA but is not yet available. These additional sources of data will eventually provide a mechanism to improve the overall analysis of rural public transportation system assets and needs. The primary source of data used on the number of existing rural public transportation systems funded under Section 5311 is the Status of

Rural Public Transportation 2000.[1] That study identified approximately 22,000 vehicles engaged in the provision of rural general public transportation service through the Section 5311 program (see Table 10).

Table 10. Estimated Rural Public Transportation Fleet

Fleet Segment	Estimated Fleet
Rural General Public (S. 5311 recipients)	22,000
Rural Specialized Operators (S. 5310 recipients)	33,000
Rural Intercity (S. 5311f eligible)	1,700
Total Fleet	**53,700**

The most recent inventory of Section 5310 providers and vehicles was conducted in 1994 by the Community Transportation Association of America (CTAA) under the Rural Transportation Assistance Program (RTAP). Based on this study, about 19,200 vehicles were estimated to serve nonurbanized areas in 1994. Based on the observed increase in rural public transportation service provided between 1989 and 1994 (an increase in fleet size of 37 percent), an increase in the total fleet size from 1994 to 2004 of more than 70 percent was assumed. This resulted in a total year 2004 estimated fleet size of approximately 33,000 vehicles. Based on information obtained from private intercity bus operators, it is also estimated that there are approximately 1,700 vehicles eligible to receive Section 5311(f) funding. The total current rural public transportation fleet is, thus, estimated to be approximately 53,700 vehicles. It is limited by limited funding.

Assuming a service life of 5 years for vans, 7 years for small buses, and 10 years for medium buses, an estimated 55 percent of the existing fleet has already exceeded their expected FTA recommended service life; and within the next 6 years, almost all of the nation's rural public transportation vehicles will need to be replaced.

Types of Public Transportation System Expansion Needs

It is recognized that addressing the public transportation needs associated with the projected growth in ridership over the next 20 years will require significant capital investment in system expansion, in addition to the investments needed just to replace existing assets. This section provides a summary of the major components of the public transportation system expansion needs that would be necessary to accommodate continuing ridership growth.

[1] CTAA and Institution for Economic and Social Measurement, *Status of Rural Public Transportation – 2000*, April 2001.

Capacity and Core Capacity Improvements

In many of the nation's largest cities, public transportation ridership has significantly increased over the last several years. As a result, some existing rail systems are operating near to or in excess of their physical capacity, and above a level that provides acceptable passenger comfort and safety. Without significant capital investment to expand the core capacity of these systems, it is likely that some public transportation systems will be unable to address growing demands – potentially resulting in shifts of people from overburdened public transportation systems to the use of the urban areas' already congested highway networks. "Core capacity" is defined here as those improvements that are required to provide sufficient capacity at the major points of constraint on public transportation system capacity. Core capacity constraints are equivalent to bottlenecks on major highway corridors or on rail freight systems.

This issue is emerging primarily in some of the largest urban rail systems in the country that have benefited from faced significant ridership growth in recent years, such as Washington, D.C. and New York, New York. This is an emerging issue for public transportation systems and, as a result, systems are exploring ways to address these specific capacity constraints. Although public transportation systems are just beginning to develop detailed cost estimates of needed capital infrastructure investment to address the topic of core capacity, this will become an increasingly significant issue if ridership growth continues in some of the systems facing these capacity constraints. Capital investments to meet needs for most types of capacity are included already. However, the largest public transportation systems do not yet have publicly available estimates of the cost of these core capacity improvements.

New Starts Program Improvements

In addition to the expansion of existing systems, ridership growth will also be accommodated through the introduction of new systems or new public transportation modes within existing systems. Many metropolitan areas across the country have recently completed or are pursuing major fixed-guideway public transportation capital improvements. Fixed-guideway public transportation often provides one of the few options to increase transportation system capacity into growing CBDs.

"New Starts," a Federal-aid category under the FTA Section 5309 Capital Investment Program (49 USC 5309), is a term used for these types of fixed-guideway public transportation capital improvements. New Starts projects involve the construction of new public transportation systems, or the expansion of existing fixed-guideway public transportation systems, related vehicles, stations, and other infrastructure associated with fixed-guideway services and busways and bus rapid-transit systems. Between 1996 and 2006, more than 460 miles of fixed-guideway public transportation service were added in 26 cities.

Rural Public Transportation

Rural public transportation needs are much more difficult to define on a national basis than urban public transportation needs. Many rural areas do not currently have any public transportation service; and in those areas with service, the quality and coverage of service are not consistent. Service may be limited to only a few days a week, to only a few hours in the day, or to only very limited service areas. In contrast to urban public transportation systems, very limited data are available on public transportation ridership, trends in service provision, or growth in ridership. New data collection efforts by the FTA will provide better background information on existing service and use over the long term.

Alternative Fuels and Technology Enhancements

There is increasing attention on issues of technology and alternative fuels that are likely to affect capital and operating costs. Similarly, a number of public transportation systems are exploring approaches to improve the quality of traveler information, system management, and fare collection. Enhancements are often designed to improve the quality and reliability of service. Alternative fuel vehicles are also increasing rapidly in response to environmental concerns, with consumption in 2006 already over 25 percent as high as the diesel consumption, or about twenty percent of the total fossil fuels.

Security Enhancements

Public transportation systems across the country are also facing increasing needs associated with improving the security of systems. Although system-by-system estimates are not available, a recent study conducted by APTA, *Survey of United States Transit System Security Needs and Funding Priorities* (2004), estimates that total capital needs for security enhancements are in the range of $5.2 billion. These needs should be included in a comprehensive summary of all needs, in addition to the traditional capital needs that are estimated here.

Public Transportation Needs

Ridership Forecasts and Assumptions

The estimate for projected public transportation investment needs is highly dependent on changes in ridership, and ridership forecasts are critical in determining national transit needs. Several points of comparison frame the assumptions used for ridership growth for the purposes of this analysis:

- The nation's population has increased 1.0 percent annually between 2000 and 2005; the U.S. Census projects a similar level of just below 1 percent per year annual population growth through 2030;

- Public transportation ridership has increased at an average of 2.4 percent annually between 1995 and 2007, according to APTA;; and

- Annual highway vehicle miles traveled (VMT) have increased by an average of 1.6 percent annually over the 10 years through 2007 and is declining as of 2008 – the increase in public transportation ridership in excess of this average highway VMT growth has increased public transportation's share of the total travel market.

The actual pace of future public transportation ridership growth will depend on a number of factors that are difficult to predict, including, but not limited to, changes in fuel prices, the health of urban CBDs, the dispersion of housing and employment growth, the relative health of metropolitan areas where public transportation plays a large role in the transportation system, and overall economic growth. National policy decisions to encourage public transportation use and make heavy investments to encourage a shift in travel modes might also contribute to higher ridership growth. In addition, ridership growth is also heavily influenced by the pace of investment in the existing system. Gaps in funding levels that result in a deterioration in service or the quality of the system will likely contribute to a reduction in use.

Given the uncertainty in public transportation ridership growth, projected investment needs were calculated assuming a range of ridership growth assumptions for urbanized areas. These include assumptions of:

- A continued 2.4 percent increase, the average annual growth between 1995 and 2007;

- A 3.52 percent annual growth, which is a rate that would result in a needed to double ridership in 20 years; and

- Another higher growth rate of 4.63 percent, a rate based on a variety of potential factors could cause public transportation ridership to grow more rapidly, including the potential for continued high energy prices, the potential for continued implementation of policies to promote development around public transportation services, the potential

for increased concern for the impacts of global warming, and the potential for a stronger emphasis on the relationships between land use and transportation.

Types of Public Transportation Capital Needs

Urban public transportation capital needs are defined both by the requirements of updating or replacing the physical assets associated with the existing systems and with the physical assets associated with system expansion that are needed to serve an increase in riders. Public transportation needs estimates presented in this section are based on the following major components:

- Replacement of bus and rail vehicles as they reach the end of their expected FTA recommended service life;
- Major rehabilitation of bus and rail vehicles (midlife rebuilds) to maintain vehicles in proper and safe condition and to allow the fleet to remain fully usable until the end of its FTA recommended expected service life;
- Elimination of the backlog of vehicle needs to bring the nation's fleet into a state-of-good-repair;
- Replacement and rehabilitation of other existing public transportation assets, including, but not limited to, bus and rail maintenance and yard facilities, stations, track, signals, switching systems, power generation, and distribution facilities, structures, and fare collection and communication systems and other associated capital equipment;
- Expansion of the bus and rail vehicle fleet to accommodate increased ridership demands, provide new services, and reduce crowding on some existing systems; and
- Expansion of other public transportation assets to accommodate increased ridership demands, including the construction of new fixed-guideway public transportation systems to serve high demand corridors.

Rural public transportation needs have been estimated in a separate analysis from the urban analysis, and consist of two major components – the maintenance of the existing system and the expansion of the system to address unmet needs. Given the limited availability of data on existing rural systems, a single estimate of rural needs was developed for both the maintain and improve physical condition scenarios, based on an estimated doubling of needs, which is consistent with a scenario of ridership doubling in twenty years.

Public Transportation Investment Scenarios

Four alternative investment scenarios were identified by applying combinations of physical conditions and service performance. For each of these scenarios, investment

needs were calculated for a 2.4 percent annual ridership growth in urbanized areas, a 3.52 percent annual ridership growth in urbanized areas, and a 4.63 percent annual ridership growth in urbanized areas. Public transportation capital investment needs have been estimated based on combinations of these condition and performance levels:

- **Maintain Physical Conditions –** This scenario assumes that the public transportation fleet and other assets will continue to be replaced following replacement cycles reflected by the current average age of assets, which often falls behind the assumptions of the expected age for FTA recommended replacement cycles;

- **Improve Physical Conditions –** This scenario assumes that the public transportation fleet and other assets will be replaced according to the assumptions for the expected recommended FTA replacement cycle service life, resulting in an overall improvement in asset conditions;

- **Maintain Service Performance –** This scenario assumes that service will be provided at existing levels with increases in service only to accommodate new riders. Under the Maintain Service Performance scenario, systems operating with excessive crowding will continue to do so and transit operating speeds will continue to be unchanged even if they are unreasonable. Transit densities in terms of passengers per vehicle have increased substantially in recent years, commensurate with increases in ridership. The Maintain Service Performance scenario assumes a continuation into the future of this more crowded condition; and

- **Improve Service Performance –** This scenario assumes that improvements are made to both reduce passenger densities on the most crowded systems and to improve the speed of service for systems where the average speed falls well below the national average. Under this scenario, investments are made to improve both of these measures so that they come closer to the national average.

Results of the investment analysis for each scenario are shown in Tables 11 through 15.

Table 11. Average Annual Capital Requirement (2006 $ in Billions)

Maintain Physical Conditions, Maintain Service Performance

	Maintain Physical Conditions, Maintain Service Performance			
		Total Including Expansion and Modernization of Assets to Accommodate Ridership Growth At:		
Needs Component	**Replacement/ Rehabilitation of Existing Assets**	**2.4% Annual Growth**	**3.53% Annual Growth**	**4.63% Annual Growth**
Urban Total	$13.9	$34.3	$47.4	$63.3
Rural/Small Urban[a]	$0.8	$0.8	$0.8	$0.8
Total needs	**$14.7**	**$35.1**	**$48.2**	**$64.2**

[a] Public transportation ridership growth assumptions are not explicitly a part of the rural public transportation needs estimates. Figures sometimes may not add due to rounding.

Table 12. Average Annual Capital Requirement (2006 $ in Billions)
Improve Physical Conditions, Maintain Service Performance

	Improve Physical Conditions, Maintain Service Performance			
		Total Including Expansion and Modernization of Assets to Accommodate Ridership Growth At:		
Needs Component	**Replacement/ Rehabilitation of Existing Assets**	**2.4% Annual Growth**	**3.53% Annual Growth**	**4.63% Annual Growth**
Urban Total	$17.5	$38.0	$51.2	$67.2
Rural/Small Urban[a]	$0.8	$0.8	$0.8	$0.8
Total Needs	**$18.3**	**$38.8**	**$52.0**	**$68.0**

Note: Figures may not add due to rounding.

Table 13. Average Annual Capital Requirement (2006 $ in Billions)
Maintain Physical Conditions, Improve Service Performance

	Maintain Physical Conditions, Improve Service Performance			
		Total Including Expansion and Modernization of Assets to Accommodate Ridership Growth At:		
Needs Component	**Replacement/ Rehabilitation of Existing Assets**	**2.4% Annual Growth**	**3.53% Annual Growth**	**4.63% Annual Growth**
Urban Total	$13.9	$40.8	$53.9	$69.9
Rural/Small Urban[a]	$0.8	$1.5	$1.5	$1.5
Total Needs	**$14.7**	**$42.4**	**$55.4**	**$71.4**

Note: Figures may not add due to rounding.

Table 14. Average Annual Capital Requirement (2006 $ in Billions)
Improve Physical Conditions, Improve Service Performance

	Improve Physical Conditions, Improve Service Performance			
		Total Including Expansion and Modernization of Assets to Accommodate Ridership Growth At:		
Needs Component	**Replacement/ Rehabilitation of Existing Assets**	**2.4% Annual Growth**	**3.53% Annual Growth**	**4.63% Annual Growth**
Urban Total	$17.5	$44.5	$57.7	$73.7
Rural/Small Urban[a]	$0.8	$1.5	$1.5	$1.5
Total Needs	**$18.3**	**$46.1**	**$59.2**	**$75.2**

Note: Figures may not add due to rounding.

Table 15 provides a summary of the cost estimates generated under the four alternative policy scenarios.

Table 15. Summary of Average Annual Public Transportation Capital Requirements (2006 $ in Billions)

Alternative Capital Investment Scenario	Range of Average Annual Cost at 2.4 Percent, 3.52 Percent, and 4.63 Percent Annual Ridership Growth (in Billions of 2006 Dollars)
Maintain Physical Conditions, Maintain Service Performance	$35.1 to $48.2 to $64.2
Improve Physical Conditions, Maintain Service Performance	$38.8 to $52.0 to $68.0
Maintain Physical Conditions, Improve Service Performance	$42.4 to $55.4 to $71.4
Improve Physical Conditions, Improve Service Performance	$46.1 to $59.2 to $75.2

■ Potential Operating Costs

An average growth rate per year based on ridership growth for each year would result in annual growth in operating costs in real terms at the same rate as the respective growth in ridership for each scenario. With a total operating cost of $33.7 Billion in 2006, the operating cost would grow gradually over twenty years to $54.2 billion per year at the 2.4 percent growth rate, to $67.4 billion per year at the 3.52 percent growth rate, and to $83.3 billion per year at the 4.63 percent growth rate. Of course, the operating cost per passenger would remain constant, which is the most important measure.

■ Historical Funding for Public Transportation

According to APTA, operating and capital expenditures from all sources for public transportation in 2006 totaled approximately $47.1 billion, representing an increase of 28 percent since 2001. Capital funding, totaled about $13.3 billion in 2006. This represents about one-third to one- fifth of the projected annual investment required to maintain public transportation system physical conditions and service performance at current levels, or about one fourth to one sixth of the projected investment required to improve physical conditions and service performance.

Table 16. Public Transportation Funding by Year in Millions of Current Year Dollars

	2001	2002	2003	2004	2005	2006
Total Funding (all sources)	$36,707	$39,480	$41,262	$42,964	$44,091	$47,053
Operating Funding (all sources)[a]	$25,288	$26,632	$28,021	$29,718	$31,708	$33,713
Capital Funding (all sources)	$11,419	$12,848	$13,241	$13,246	$12,383	$13,340
Percent Capital	31%	33%	32%	31%	28%	28%
Federal Share of Total Funding	19%	17%	17%	17%	16%	18%
Federal Share of Capital Funding	51%	41%	40%	39%	39%	44%

Source: APTA Fact Book.

[a] Operating funding includes funds received from passenger fares that cover approximately 33 percent of total operating expenditures nationally.

During this same period, from 2001 to 2006, the Federal share of total capital funding declined ranged from 51 percent in 2001 to 44 percent in 2006. During those same years, the Federal share of total funding was consistently in the range of 16 to 19 percent. Other sources of funding included passenger fares, and local and state funding.