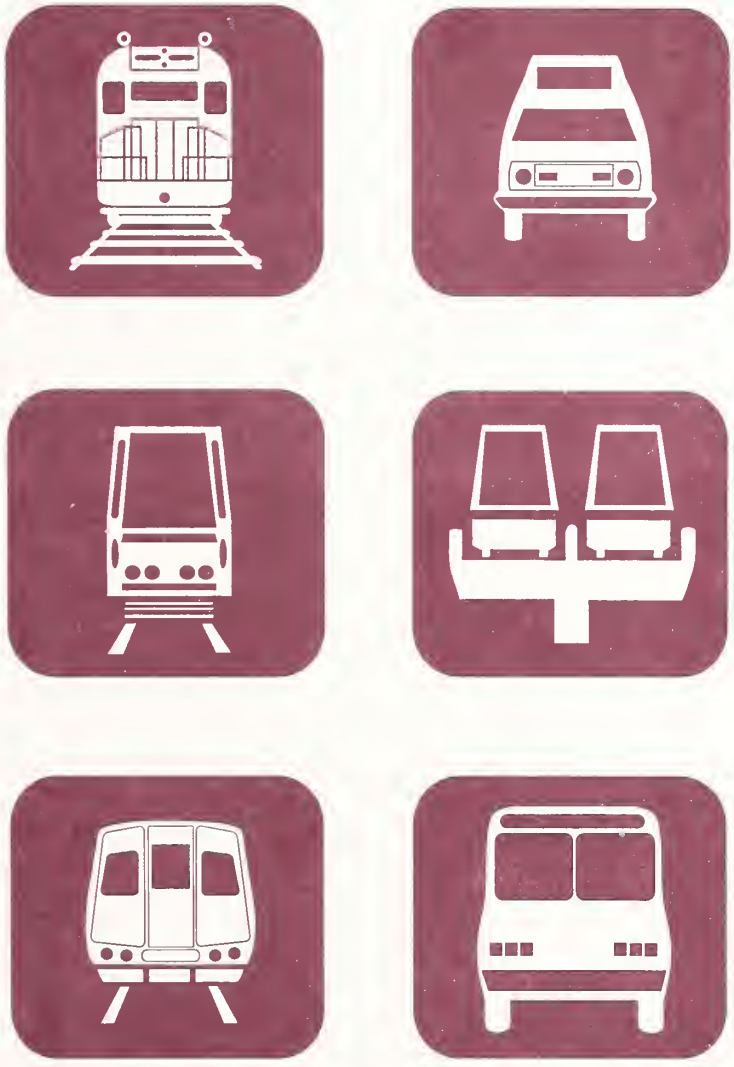
U.S. Department
of Transportation

Federal Transit
Administration

National Transit Summaries and Trends

From the 1992 National Transit Database



Audit Review and Analysis Division
Office of Capital and Formula Assistance

CAUTION: Extensive efforts have been made to assure the quality of information contained in this report. It is impossible, however, to achieve complete accuracy and consistency of the reported data. In addition, the reported data do not include all relevant information generally necessary to explain apparent differences in performance (e.g., information related to work rules, topography, climate, and unusual events such as strikes and service start-ups). Users of this report, therefore, should be careful not to draw unwarranted conclusions based solely on the data contained herein.

National Transit Summaries and Trends

from the 1992 National Transit Database

May 1994

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List of Exhibits

Executive Summary

Overview

The *National Transit Summaries and Trends (NTST)* provides a national overview of the mass transit industry. The *NTST* highlights the aggregate financial and operational characteristics and trends of mass transit for the five-year period 1988-1992 and the ten-year period 1983-1992. Key statistics and performance indicators are presented.

This report presents a National Transit Profile, as well as profiles for urbanized areas of under 200,000; 200,000 to one million; and, over one million residents. The National Transit Profile is contained within this Executive Summary. Exhibits presented later in the *NTST* reflect National Transit Profile information by size of urbanized area. These profiles provide aggregate transit service performance and financial information for 1992. Performance indicators are used to measure the effectiveness and efficiency of transit service supplied, and the cost effectiveness of that service. These performance indicators are presented by mode of service and by type of service (directly operated versus purchased transportation services). Performance indicators by size of urbanized area are presented in selected instances.

A new chapter has been created for 1992, Key Characteristics for Individual Systems by Mode. Chapters are also included for capital funding; operating funding and expenses; as well as service supplied and consumed. A chapter concerning safety, reliability and maintenance is also included.

Based on data received in the 1992 report year, the following observations have been made:

Capital Funding

- Capital funding of the nation's public transit systems increased by approximately four percent from 1991 to 1992. Capital investment has increased 48 percent since 1988. Fixed guideway systems investments account for 70 percent of capital expenditures.

Operating Funding and Expenses

- Passenger fares accounted for 36 percent of the 15.9 billion required to operate transit services in 1992, while local assistance accounted for 30 percent. State assistance provided another 23 percent, while Federal assistance represented slightly more than five percent. Other sources of funding account for the remainder.

Service Supplied and Consumed

- Nearly 7.7 billion riders used some mode of transit service in 1992, amassing 37.2 billion passenger miles. Two and one half billion miles of vehicle revenue service were provided with nearly 68,000 transit vehicles operating daily in maximum service.

Safety, Reliability, and Maintenance Effectiveness

- The 1992 Section 15 data reflect an excellent safety record for transit. The national rate of transit patron injuries is 11.6 per ten million passenger miles, all modes combined. Transit service is also highly reliable. For example, bus service had only one maintenance roadcall per 4,487 miles of operation, a 33 percent improvement since 1988.

National Transit Profile
1992

General Information (System Wide)

Service Consumption*

Annual Passenger Miles	37,154.0
Annual Unlinked Trips	7,695.7
Average Weekday Unlinked Trips	25.5
Average Saturday Unlinked Trips	12.5
Average Sunday Unlinked Trips	7.9

Service Supplied

Annual Vehicle Revenue Miles*	2,533.9
Annual Vehicle Revenue Hours*	170.7
Total Fleet	86,294
Vehicles Operated in Maximum Service	67,676
Base Period Requirement	30,704

Vehicles Operated in Maximum Service

Directly Operated

	Vehicles	Systems **
Bus	40,822	339
Heavy Rail	8,180	13
Commuter Rail	3,598	9
Light Rail	796	15
Demand Response	2,383	173
Other	1,428	41

Purchased Transportation

	Vehicles	Systems **
Bus	3,025	107
Heavy Rail	0	0
Commuter Rail	351	9
Light Rail	2	1
Demand Response	6,884	226
Other	207	18

Financial Information (System Wide)

Sources of Operating Funds*

Passenger Fares	$5,697.3
Local Funds	4,832.6
State Funds	3,680.6
Federal Funds	849.1
Other Funds	848.2
Total Operating Funds	**$15,907.8**

Summary of Operating Expenses*

Salaries/Wages/Benefits	$11,285.5
Materials & Supplies	1,405.3
Purchased Transportation	1,269.2
Other Expenses	1,538.5
Total Operating Expenses	**$15,498.5**

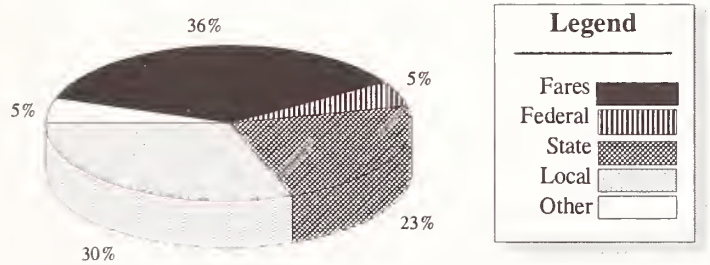
Sources of Capital Funds*

Local Funds	$1,906.2
State Funds	777.7
Federal Assistance	2,598.7
Total Capital Funds	**$5,282.6**

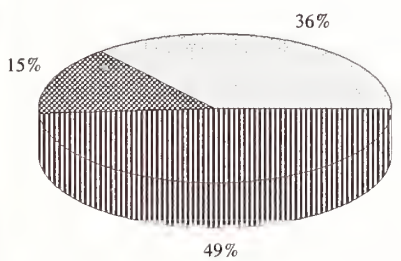
Uses of Capital Funds*

Rolling Stock	
Bus	$543.6
Other Modes	677.5
Facilities	
Bus	480.3
Other Modes	2,485.8
Other Capital	1,075.2
Total Uses of Capital Funds	**$5,262.4**

Sources of Operating Funds



Sources of Capital Funds



* Millions

** Number of reporters by mode

Introduction

Purpose of this Publication

The *1992 National Transit Summaries and Trends (NTST)* highlights aggregated financial and operational characteristics and trends for key statistics and performance indicators for the nation's mass transit industry. The *NTST* is developed from the Section 15 database and thus represents a portion of the 1992 Section 15 Annual Report. This is the third annual edition of the *NTST* and is designed to provide a picture of the mass transit industry in 1992, as well as five-year and ten-year overviews of selected transit industry statistics. The *NTST* is intended to serve as a reference for transit professionals, researchers and policy makers, describing the condition of urban mass transportation in the United States.

Comments Welcomed

Several organizational changes, as well as modification to the data presented, have been made from the prototype *1990 NTST* and the *1991 NTST* editions based on comments received. Suggestions and comments regarding this document are encouraged and welcomed.

Report Organization and Overview

The *NTST* is organized to first offer a National Transit Profile followed by chapters on Key Characteristics of Individual Systems; Capital Funding; Operating Funding and Expenses; Service Supplied and Consumed; and, Safety, Reliability and Maintenance Effectiveness.

Chapter 1: National Transit Profile

The National Transit Profile provides aggregate operating statistics and financial data for the transit industry. Profiles are also presented by size of urbanized area. Key financial and operating data, along with related performance indicators, are provided for the ten-year period 1983-1992.

Chapter 2: Key Characteristics of Individual Systems

Data regarding operations and performance indicators for major individual systems for seven different modes is offered in this chapter.

Chapter 3: Capital Funding

This chapter discusses sources of capital funding and its uses (for rolling stock, facilities or other uses) by mode and size of urbanized area.

Chapter 4: Operating Funding and Expenses

Sources of operating funding, as well as the cost of operating service are discussed in this chapter. Cost effectiveness and efficiency of service are evaluated through analysis of performance measures relating to operating expense and service supplied. The various components of cost (functions and object classes) are discussed.

Chapter 5: Service Supplied and Consumed

This chapter provides the analysis of service effectiveness, discussing amounts and kinds of transit services provided and utilized. Performance measures are used to evaluate the effectiveness of transit service by reflecting ridership and operating costs by various measures of service supplied. These measures are presented by mode and by type of service (directly operated or purchased transportation).

Chapter 6: Safety, Reliability, and Maintenance Effectiveness

The document is concluded with a discussion of various measures of accident data and maintenance expense and service interruptions designed to offer data on safety, reliability of service and effectiveness of vehicle maintenance.

Inflation

All revenue and cost information is represented in dollars as actually reported. For historical comparisons, changes in the Cost Price Index (CPI) are noted.

Rounding

It should be noted that rounding may lead to minor variations in total values from one table to another for similar data, or may lead to instances where percentages may not add to 100.

Number of Reporters

Section 15 records reporters by several different measures. One measure is to record the actual number of individual reporters in each report year. For the 1992 Report Year, the number of individual reporters included in the database is 503. However, Section 15 is also measured by the number of modes and types of service by mode because most Secton 15 data is reported both by mode and by type of service. This measure provides a better representation of Section 15 reporting as most transit systems operate more than one mode and have more than one type of service.

As shown in **Exhibit 1**, the number of Section 15 reporters has grown by eight percent since 1988. Subsequently, some of the increases in data are attributable to this increased number of reporters as well as the growth in the size and number of individual transit systems.

As is also reflected in **Exhibit 1**, the number of reporters for bus has actually decreased slightly while the number of demand response reporters has increased by 17 percent since 1988.

Number of Reporters by Mode and Type of Service
1988-1992

Exhibit 1

Type of Service	1988	1989	1990	1991	1992
Bus					
Directly Operated	377	367	374	356	339
Purchased Transportation	80	93	103	102	107
Total	457	460	477	458	446
Heavy Rail					
Directly Operated	12	12	12	12	13
Purchased Transportation	-	-	-	-	-
Total	12	12	12	12	13
Commuter Rail					
Directly Operated	10	10	12	10	9
Purchased Transportation	9	8	7	8	9
Total	19	18	19	18	18
Light Rail					
Directly Operated	13	13	13	14	15
Purchased Transportation	1	1	1	1	1
Total	14	14	14	15	16
Demand Response					
Directly Operated	152	164	173	170	173
Purchased Transportation	189	202	212	219	226
Total	341	366	385	389	399
Other					
Directly Operated	30	32	36	40	41
Purchased Transportation	8	10	11	13	18
Total	38	42	47	53	59
Total Directly Operated	594	598	620	602	590
Total Purchased Transportation	287	314	334	343	361
Total	881	912	954	945	951

The number of reports indicating purchased transportation of transit service has also increased. As shown in **Exhibit 1**, this is most noticeable in the number of demand response reporters. The number of reporters indicating purchased demand response service has increased by 20 percent since 1988.

Purchased Transportation

If a transit system has multiple providers of purchased transportation services, the data for all the providers is aggregated for the subject mode, regardless of the number of contracts. An exception involves those purchased transportation providers operating 100 vehicles in annual maximum service. Such providers submit a separate Section 15 report from the perspective of directly operated service. There are 20 Purchased Transportation reporters who reported as Directly Operated rather than Purchased Transportation in 1992, as reflected in **Exhibit 2**.

Exhibit 2

Key Statistical Indicators for Purchased Transportation Reporters Who Report as Directly Operated 1992

Mode	Number of Reporters	Operating Expense (000s)	Unlinked Passenger Trips (000s)	Passenger Miles (000s)	Vehicle Revenue Hours (000s)	Vehicle Revenue Miles (000s)	Vehicles Operated in Maximum Service
Bus	15	$432,765.8	$216,537.5	143,602.3	6,268.2	90,001.3	2,622
Commuter Rail	2	129,799.1	34,758.3	734,088.8	486.7	16,217.8	416
Demand Response	4	38,320.4	553.3	8,003.4	220.1	3,008.8	93
Total	21*	$600,885.3	$251,849.1	885,694.5	6,975.0	109,227.9	3,131
% Directly Operated	3.6%	3.9%	3.3%	6.1%	4.5%	4.8%	5.5%

* One reporter provides multi-mode service (Bus and Demand Response).

Exemption for Five or Fewer Vehicles

Beginning with the 1991 report year, FTA granted reporting exemptions to agencies with three or fewer non-fixed guideway vehicles operated in maximum service. This threshold was increased to five vehicles for the 1992 report year. Twenty-two (22) agencies requested and were granted the waiver for 1992 as compared to 16 for the 1991 report year.

Calculation and Treatment of Joint Modal Expenses

Prior to 1992, joint modal expenses were allocated by function only and were included as part of the Other object class. In 1992, reporters fully allocated joint expenses for each mode by function and object class.

Performance Indicators

The *NTST* presents several performance measures as indicators of efficiency and effectiveness. These indicators include operating expense per vehicle revenue hour, operating expense per vehicle revenue mile, unlinked passenger trips per vehicle revenue hour, unlinked passenger trips per vehicle revenue mile, operating expense per unlinked passenger trip, and operating expense per passenger mile. Most of these measures are presented by mode and type of service.

Chapter 1
National Transit Profile

Introduction

This chapter commences with **Exhibit 3**, the National Transit Profile, which provides an overview of the mass transit industry by displaying aggregated reported data for the U.S. mass transit systems in 1992. Included among these data are indications of the service supplied and consumed, the uses of capital funding, a summary of operating expenses, and the sources of operating and capital funding. This information is also depicted for each of five major modes of service: bus, heavy rail, commuter rail, light rail, and demand response. Additionally, performance indicators for each mode are graphically depicted, providing measures of service and cost effectiveness and efficiency.

The chapter continues with a depiction of the same information categories as found in **Exhibit 3**, subdivided by size of urbanized area (UZA size), and related discussion. The chapter concludes with exhibits reflecting ten years of national transit data, including vehicle revenue miles, unlinked passenger trips, operating expense and passenger fare revenue, along with associated performance measures.

Service Supplied and Service Consumed

In 1992, the nation's transit industry provided over 2.5 billion miles of revenue service to its customers. During the ten-year period from 1983 to 1992, there has been a slight but steady increase in vehicle revenue miles each year for all modes. Vehicle revenue miles operated have increased 20 percent since 1983.

In the aggregate, transit service consumed, as measured by unlinked passenger trips, decreased during the 1983-1992 timeframe by nearly six percent. However, upon examination of each mode, only bus service shows a substantive decline in ridership during this period. All other modes of service show increases in ridership, or remain relatively stable. Annual bus ridership declined by approximately one billion riders when comparing ridership in 1984 to that of 1992. Bus service in 1992 accounted for 12 percent fewer riders than in 1983, yet it accounted for 62 percent of the unlinked passenger trips made via transit in 1992. Heavy rail, while carrying two percent greater ridership in 1992 than in 1983, has also displayed declining ridership in recent years, carrying 13 percent fewer riders in 1992 than 1989. In contrast, such modes as light rail, commuter rail, and demand response carried substantially greater numbers of riders in 1992 than in 1983. These modes show ridership increases of 37 percent, 20 percent, and 114 percent, respectively, in 1992 when compared with 1983.

Exhibit 3
National Transit Profile
1992

General Information (System Wide)

Service Consumption*	
Annual Passenger Miles	37,154.0
Annual Unlinked Trips	7,695.7
Average Weekday Unlinked Trips	25.5
Average Saturday Unlinked Trips	12.5
Average Sunday Unlinked Trips	7.9
Service Supplied	
Annual Vehicle Revenue Miles*	2,533.9
Annual Vehicle Revenue Hours*	170.7
Total Fleet	86,294
Vehicles Operated in Maximum Service	67,676
Base Period Requirement	30,704

Vehicles Operated in Maximum Service

Directly Operated

	Vehicles	Systems **
Bus	40,822	339
Heavy Rail	8,180	13
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Financial Information (System Wide)

Sources of Operating Funds*	
Passenger Fares	$5,697.3
Local Funds	4,832.6
State Funds	3,680.6
Federal Funds	849.1
Other Funds	848.2
Total Operating Funds	**$15,907.8**
Summary of Operating Expenses*	
Salaries/Wages/Benefits	$11,285.5
Materials & Supplies	1,405.3
Purchased Transportation	1,269.2
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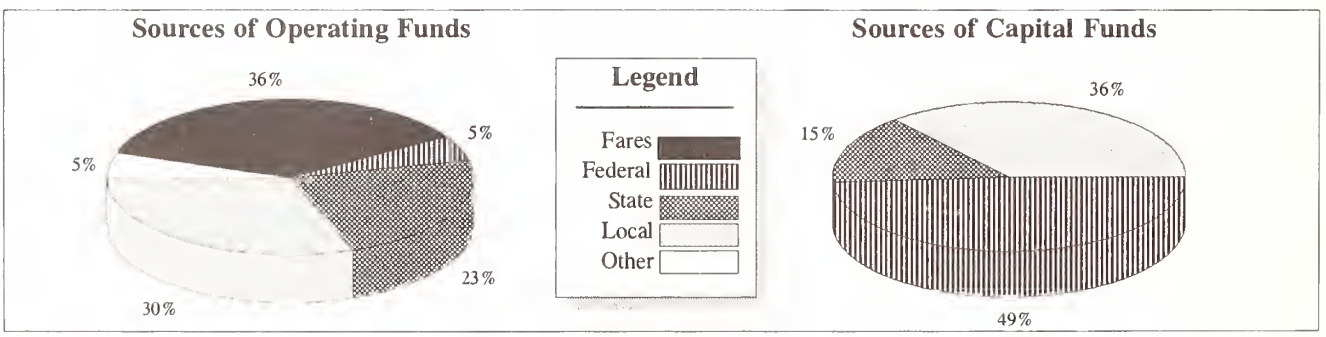
Total Operating Expenses	**$15,498.5**
Sources of Capital Funds*	
Local Funds	$1,906.2
State Funds	777.7
Federal Assistance	2,598.7
Total Capital Funds	**$5,282.6**
Uses of Capital Funds*	
Rolling Stock	
Bus	$543.6
Other Modes	677.5
Facilities	
Bus	480.3
Other Modes	2,485.8
Other Capital	1,075.2
Total Uses of Capital Funds	**$5,262.4**



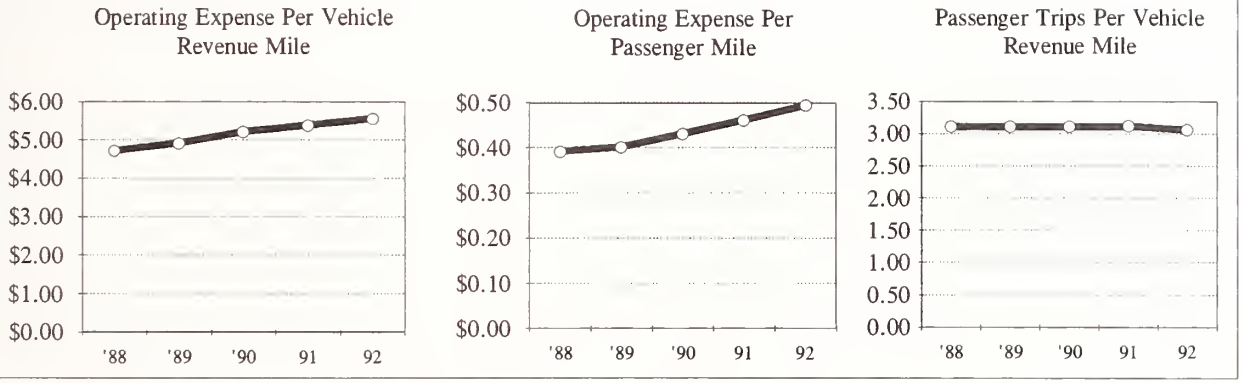
* Millions

** Number of reporters by mode

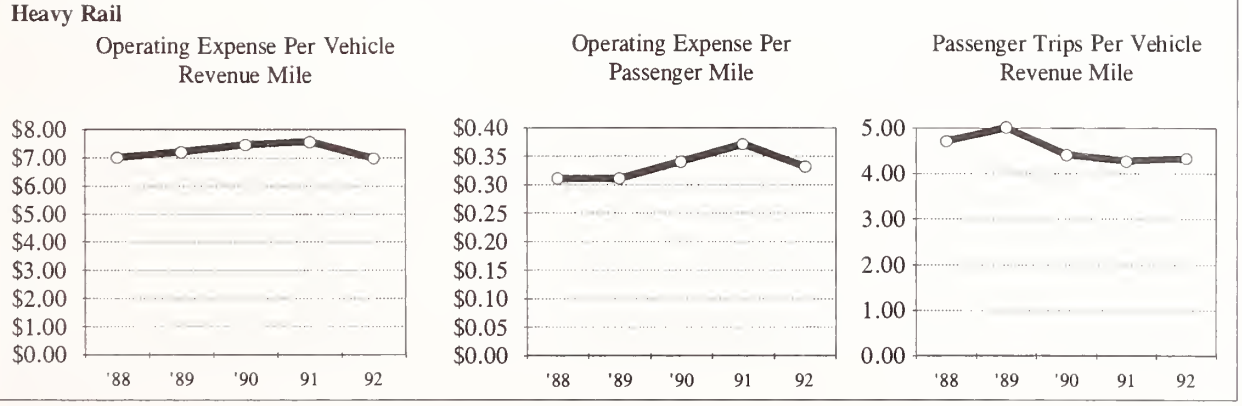
Exhibit 3 (continued) National Transit Profile by Mode

Characteristics	Motorbus	Heavy Rail
Operating Expense*	$8,625.1	$3,555.1
Capital Funding*	$1,296.1	$2,055.1
Annual Passenger Miles*	17,494	10,737
Annual Vehicle Revenue Miles*	1,556	510
Annual Unlinked Trips*	4,748	2,207
Average Weekday Unlinked Trips*	16	7
Annual Vehicle Revenue Hours*	122	23
Fixed Guideway Directional Route Miles	998.3	1,403.2
Total Fleet	53,685	10,236
Average Fleet Age in Years	8.3	17.8
Vehicles Operated in Maximum Service	43,847	8,180
Peak to Base Ratio	1.95	1.93
Percent Spare	22%	25%
Performance Measures		
Service Efficiency		
Operating Expense/Vehicle Revenue Mile	$5.54	$6.97
Operating Expense/Vehicle Revenue Hour	$70.70	$154.57
Cost Effectiveness		
Operating Expense/Passenger Mile	$0.49	$0.33
Operating Expense/Unlinked Passenger Trip	$1.82	$1.61
Service Effectiveness		
Unlinked Passenger Trips/Vehicle Revenue Mile	3.05	4.33
Unlinked Passenger Trips/Vehicle Revenue Hour	38.92	95.96

Motorbus



Heavy Rail



Source: 1992 Section 15 Annual Report

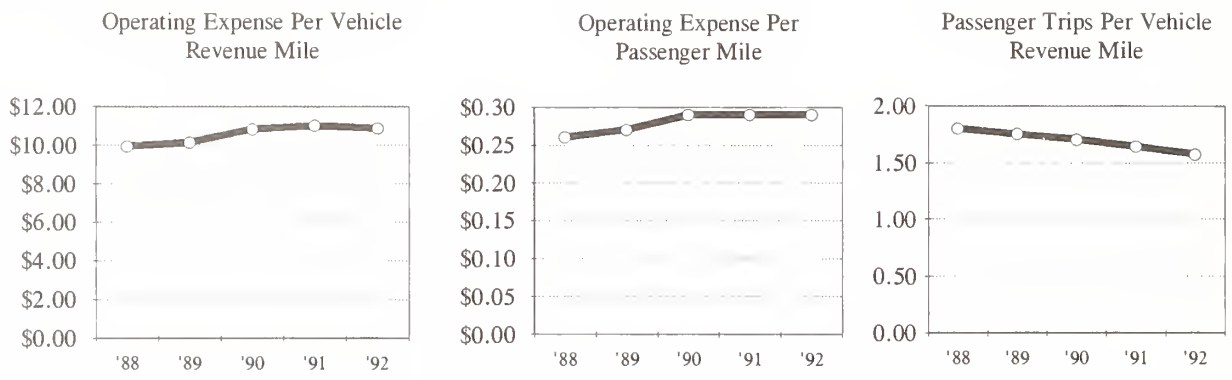
Exhibit 3 (continued) National Transit Profile by Mode

Characteristics	Commuter Rail	Light Rail
Operating Expense*	$2,169.7	$307.2
Capital Funding*	$1,159.1	$467.1
Annual Passenger Miles*	7,320.4	700.4
Annual Vehicle Revenue Miles*	199.9	27.8
Annual Unlinked Trips*	313.6	187.4
Average Weekday Unlinked Trips*	1.0	0.6
Annual Vehicle Revenue Hours*	6	2
Fixed Guideway Directional Route Miles	5036.7	562.9
Total Fleet	4,882	1,063
Average Fleet Age in Years	18.5	17.1
Vehicles Operated in Maximum Service	3,949	798
Peak to Base Ratio	2.23	1.95
Percent Spare	17.6%	32.4%
Performance Measures		
Service Efficiency		
Operating Expense/Vehicle Revenue Mile	$10.85	$11.05
Operating Expense/Vehicle Revenue Hour	$372.73	$153.60
Cost Effectiveness		
Operating Expense/Passenger Mile	$0.29	$0.44
Operating Expense/Unlinked Passenger Trip	$6.92	$1.64
Service Effectiveness		
Unlinked Passenger Trips/Vehicle Revenue Mile	1.57	6.74
Unlinked Passenger Trips/Vehicle Revenue Hour	53.10	93.70

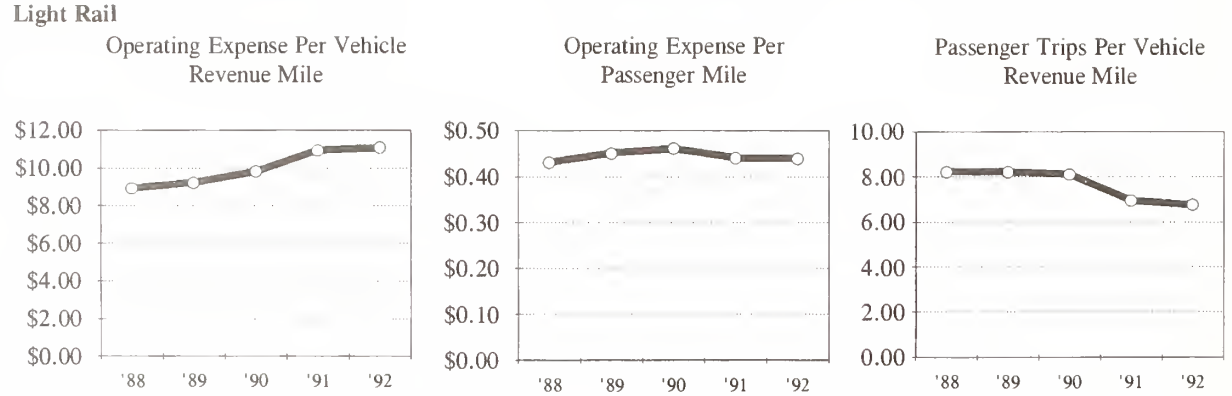
1,543 33% ACC

557 ACC 45%

Commuter Rail



Light Rail



Source: 1992 Section 15 Annual Report

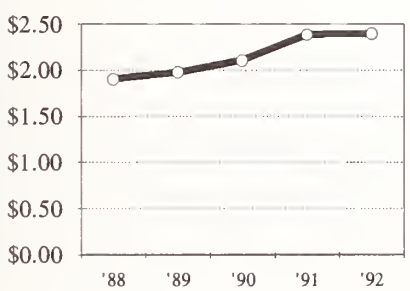
Exhibit 3 (continued)

National Transit Profile by Mode

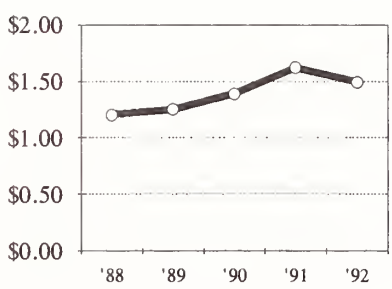
Characteristics	Demand Response
Operating Expense*	$499.8
Capital Funding*	$53.4
Annual Passenger Miles*	317
Annual Vehicle Revenue Miles*	209
Annual Unlinked Trips*	45
Average Weekday Unlinked Trips*	0.1
Annual Vehicle Revenue Hours*	15
Fixed Guideway Directional Route Miles	N/A
Total Fleet	14,164
Average Fleet Age in Years	3.4
Vehicles Operated in Maximum Service	9,267
Peak to Base Ratio	N/A
Percent Spare	25.5%
Performance Measures	
Service Efficiency	
Operating Expense/Vehicle Revenue Mile	$2.40
Operating Expense/Vehicle Revenue Hour	$31.56
Cost Effectiveness	
Operating Expense/Passenger Mile	$1.49
Operating Expense/Unlinked Passenger Trip	$11.03
Service Effectiveness	
Unlinked Passenger Trips/Vehicle Revenue Mile	0.22
Unlinked Passenger Trips/Vehicle Revenue Hour	3.02

Demand Response

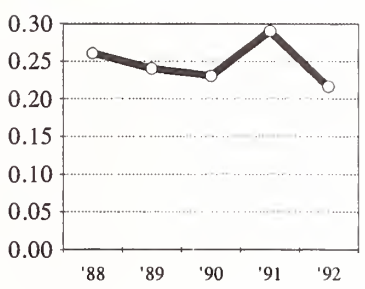
Operating Expense Per Vehicle Revenue Mile



Operating Expense Per Passenger Mile



Passenger Trips Per Vehicle Revenue Mile



Source: 1992 Section 15 Annual Report

Looking back to service supplied as represented by vehicle revenue miles of service provided, the rail modes and demand response show substantial increases in service supplied, while bus shows a minimal increase for the 1983-1992 period. Vehicle revenue miles for bus increased only 8.6 percent during the ten-year period, while heavy rail, commuter rail and light rail vehicle revenue miles increased by 27 percent, 26 percent, and 74 percent, respectively. Demand response grew by 169 percent while Other modes increased by 44 percent.

Operating Expense

When examining operating expenses historically using current-year dollars, the increase in operating expenses for the transit industry over the 1983-1992 period appears dramatic. However, after some seemingly significant increases from 1983 to 1986, the average annual increase since 1986 has been less than five percent annually, and the increase from 1991 to 1992 was only 0.6 percent. However, it should be noted that there have been substantial cost increases from 1983 to 1992 in the operation of light rail and demand response services. Some of this is the effect of an increased base of reporters and enhancements made to the Section 15 data collection requirements. Yet, these two modes also show the most dramatic percentage increases in supply of service as represented by vehicle revenue miles. Thus, some of the significant operating expense increases are the result of new and extended light rail and demand response services during the ten-year period.

Exhibit 4 provides summaries of vehicle revenue miles, unlinked passenger trips and operating expenses by mode from 1983 to 1992.

Performance Indicators

As briefly discussed in the Introduction, certain measures act as indicators of service and cost effectiveness and efficiency utilized for analysis. The efficiency of service is reviewed herein by an examination of operating expense per vehicle revenue mile. The effectiveness of service is considered through use of unlinked passenger trips per vehicle revenue mile. The cost effectiveness of service is reviewed in light of operating expense per unlinked passenger trip. **Exhibits 5**, **6,** and **7** reflect each of these indicators, from 1983 to 1992 for each mode.

Exhibit 5 shows that operating expense per vehicle revenue mile has increased each year from 1983 to 1992 for bus, light rail, and demand response, except for a slight drop from 1983 to 1984 for demand response. Heavy rail demonstrates a drop from 1991 to 1992 of 7.8 percent in operating expense after consistently increasing each year by an average of 3.9 percent from 1983 to 1991 and 2.4 percent on average for each year from 1987 to 1991. It should be noted that this decrease may be the effect of a reporting change by a major heavy rail operator.

Commuter rail has shown slight decreases in operating expense per vehicle revenue mile for the last two years (1.6 percent and 1.2 percent, respectively) of the ten-year period, with 1992's $10.85 per mile very comparable to 1989's operating expense per vehicle revenue mile of $10.87. Part of the decrease may be explained by a reporting change of a major commuter rail operator. This operator began reporting as a heavy rail operator in 1992.

Ten Year Data Summary Tables 1983-1992

Exhibit 4

Vehicle Revenue Miles by Mode (millions)

Year	Mode						Total
	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response	Other	
1983	1,432.6	400.7	159.2	16.0	76.3	22.3	2,107.1
1984	1,419.8	426.6	155.6	16.3	78.5	25.7	2,122.5
1985	1,463.8	443.2	167.1	15.9	90.4	24.7	2,205.1
1986	1,476.1	462.6	170.2	16.7	104.8	24.9	2,255.3
1987	1,497.2	473.9	169.9	18.0	113.4	25.6	2,298.0
1988	1,508.5	503.0	183.5	20.1	132.8	27.1	2,375.0
1989	1,506.4	513.1	190.2	20.5	152.1	23.1	2,405.4
1990	1,534.5	520.8	193.1	23.0	171.2	24.3	2,466.9
1991	1,552.3	508.3	197.9	26.6	185.8	27.8	2,498.7
1992	1,555.9	509.7	199.9	27.8	208.5	32.2	2,534.0

Unlinked Passenger Trips by Mode (millions)

Year	Mode						Total
	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response	Other	
1983	5,442.2	2,167.3	261.6	137.0	21.2	204.9	8,234.2
1984	5,826.8	2,231.4	266.7	152.7	21.6	215.0	8,714.2
1985	5,438.7	2,289.8	275.3	130.7	23.8	191.4	8,349.7
1986	4,959.8	2,332.7	305.8	128.4	27.3	176.3	7,930.3
1987	4,794.0	2,402.1	310.9	131.3	29.2	196.6	7,864.1
1988	4,794.0	2,307.7	324.9	152.6	34.1	199.2	7,812.5
1989	4,838.1	2,541.9	329.6	161.1	36.7	190.6	8,098.0
1990	4,887.1	2,346.3	328.4	174.0	39.7	190.1	7,965.6
1991	4,825.5	2,167.0	323.8	183.6	42.4	192.6	7,734.9
1992	4,748.0	2,207.2	313.6	187.4	45.3	194.2	7,695.7

Operating Expense by Mode (millions)

Year	Mode						Total
	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response	Other	
1983	$5,242.5	$2,241.8	$410.7	$119.9	$125.6	$288.1	$8,428.6
1984	5,652.5	2,594.2	566.4	127.3	126.7	279.2	9,346.3
1985	6,017.2	2,847.5	731.7	140.1	154.4	306.1	10,197.0
1986	6,336.0	3,101.6	1,640.3	158.2	176.2	309.0	11,721.3
1987	6,737.0	3,234.7	1,748.4	171.6	211.2	254.0	12,356.9
1988	6,994.8	3,524.0	1,889.2	197.2	251.6	261.3	13,118.1
1989	7,295.0	3,703.5	2,068.1	209.4	322.5	284.1	13,882.6
1990	7,778.6	3,825.0	2,156.8	236.0	385.5	322.8	14,704.7
1991	8,329.6	3,841.2	2,175.4	289.7	442.6	325.2	15,403.7
1992	8,625.1	3,555.1	2,169.7	307.2	499.8	341.6	15,498.5

Exhibit 5

Operating Expense Per Vehicle Revenue Mile by Mode
1983-1992

Year	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response
1983	$3.66	$5.59	$2.58	$7.49	$1.65
1984	3.98	6.08	3.64	7.81	1.61
1985	4.11	6.42	4.38	8.81	1.71
1986	4.29	6.70	9.64	9.47	1.68
1987	4.50	6.83	10.29	9.53	1.86
1988	4.64	7.01	10.39	9.81	1.89
1989	4.84	7.22	10.87	10.21	2.12
1990	5.07	7.34	11.17	10.26	2.25
1991	5.37	7.56	10.99	10.89	2.38
1992	5.54	6.97	10.85	11.05	2.40

Unlinked passenger trips per vehicle revenue mile is a measure of service effectiveness. As reflected in **Exhibit 6**, unlinked passenger trips per vehicle revenue mile remained relatively stable though there have been slight decreases in recent years in all modes. Heavy rail actually demonstrates a slight increase (1.6 percent) from 1991 to 1992, though the indicator had dropped 5.5 percent from 1990 to 1991 and 8.9 percent from 1989 to 1990. The indicator for commuter rail has decreased annually on average 2.7 percent for the past five years. Light rail declined only 2.3 percent from 1991 to 1992, after an unusually larger drop of 8.9 percent from 1990 and 1991. Demand response and bus have not changed significantly. Unlinked passenger trips per vehicle revenue mile for demand response declined 4.3 percent from 1991 to 1992 after having remained stable for the two years prior to this. For bus, the indicator has decreased only 1.7 percent on average annually since 1989.

Exhibit 6 shows the seemingly higher effectiveness of heavy rail and light rail compared with the other modes. However, the nature of the service itself for each mode must be considered. Heavy and light rail systems are designed to operate within corridors containing high population densities as well as to be served by feeder bus services and park-and-ride facilities to increase capture areas of potential riders. These two modes would carry more ridership per vehicle revenue mile based on their design as higher-capacity modes. Commuter rail differs from the other rail modes because it experiences far fewer stops. Bus reflects a more moderate utilization, because along with routes that travel through highly dense areas of transit-dependent markets and operate during peak hours of ridership, services are also provided during off-peak hours in much less densely populated areas. Thus, vehicle revenue miles remain high while ridership varies by route, day of the week, and time of day. Demand response is designed to have much lower capacity and a greater flexibility and convenience for the user. Thus, it displays lower ridership along with significant miles of operation.

Unlinked Passenger Trips Per Vehicle Revenue Mile by Mode
1983-1992

Exhibit 6

Year	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response
1983	3.78	5.41	1.64	8.56	0.28
1984	4.10	5.23	1.71	9.37	0.28
1985	3.72	5.17	1.65	8.22	0.26
1986	3.36	5.04	1.80	7.69	0.26
1987	3.20	5.07	1.83	7.29	0.26
1988	3.18	4.59	1.77	7.59	0.26
1989	3.21	4.95	1.73	7.86	0.24
1990	3.18	4.51	1.70	7.57	0.23
1991	3.11	4.26	1.64	6.90	0.23
1992	3.05	4.33	1.57	6.74	0.22

Operating expense per unlinked passenger trip is a measure of cost effectiveness made by assessing the relationship of the cost of providing a service to its utilization. This indicator has increased each year for each mode, with the exception of heavy rail, as seen in **Exhibit 7**.

Operating expense per unlinked passenger trip for bus has increased 7.3 percent annually on average from 1983 to 1992. It has increased on average 6.4 percent per year for heavy rail. Data for commuter rail was not fully reported prior to 1986; since then, operating expense per unlinked passenger trip has increase 4.4 percent on average annually for this mode. It has increased 8.9 percent annually for light rail on average from 1983 to 1992, and 7.6 percent annually on average for demand response.

Operating Expense Per Unlinked Passenger Trip by Mode
1983-1992

Exhibit 7

Year	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response
1983	$0.96	$1.03	$1.57	$0.88	$5.92
1984	0.97	1.16	2.12	0.83	5.87
1985	1.11	1.24	2.66	1.07	6.49
1986	1.28	1.33	5.36	1.23	6.45
1987	1.40	1.35	5.62	1.31	7.23
1988	1.46	1.53	5.81	1.29	7.38
1989	1.51	1.46	6.27	1.30	8.79
1990	1.59	1.63	6.57	1.36	9.71
1991	1.73	1.77	6.72	1.58	10.44
1992	1.82	1.61	6.92	1.64	11.03

Ratio of Passenger Fare Revenue to Operating Expense and Passenger Fare Revenue Per Unlinked Trip

The ratios of passenger fare revenue to operating expense and passenger fare revenue per unlinked trip are presented in **Exhibits 8** and **9**, respectively, aggregated for all modes from 1983 to 1992. These indicators are representative of cost efficiency. The ratio of passenger fare revenue to operating expenses has remained relatively stable since 1985, ranging between 36.3 percent and 40 percent. The ratio for 1992 is 36.8 percent. During the 1985-1992 period, passenger fare revenue per unlinked passenger trip has increased 7.7 percent annually on average. However, this indicator has actually proven to be even more stable over the past five years, with fare revenues per passenger trip increasing only 3.9 percent on average annually from 1988 to 1993.

Exhibit 8

Ratio of Passenger Fare Revenue to Operating Expense 1983-1992

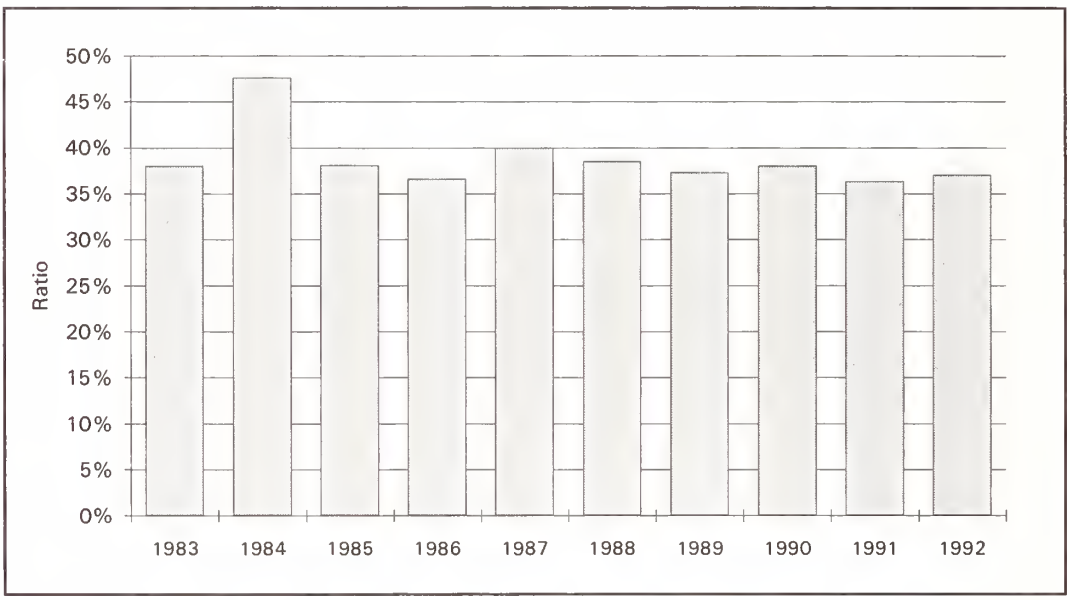
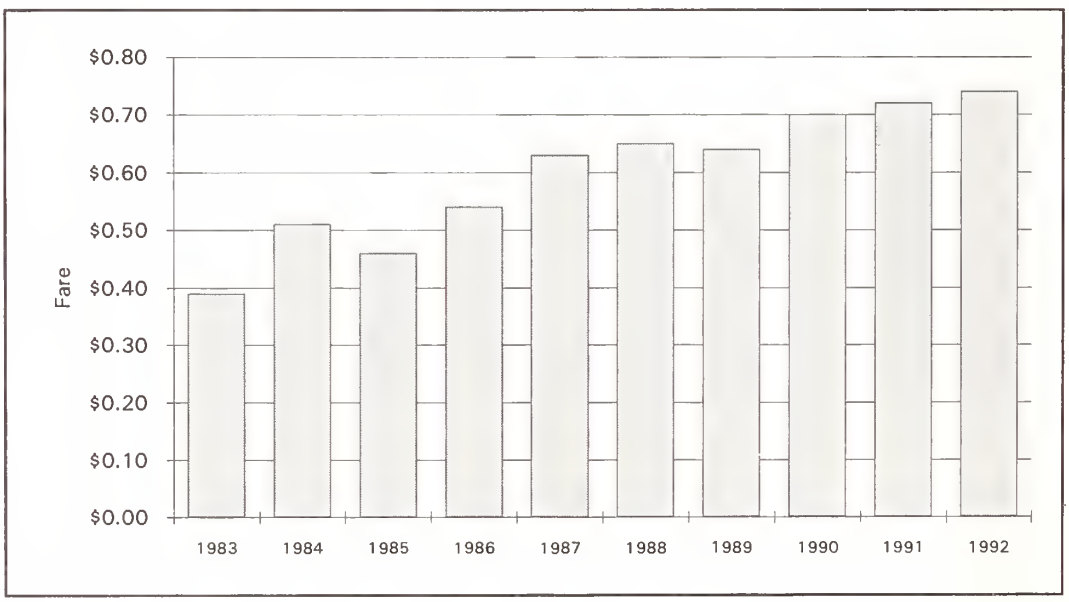


Exhibit 9

Passenger Fare Revenue Per Unlinked Passenger Trip 1983-1992



Analysis of Profiles by Size of Urbanized Area

The profiles by size of urbanized area found in **Exhibits 10**, **11**, and **12** depict the U.S. transit industry aggregated from the perspective of small, medium and large urbanized areas. The information presented herein is designed to show the differing characteristics of transit systems grouped by urbanized area size.

National Transit Profiles by Size of Urbanized Area

It is clear from the information presented that depicting data throughout the *NTST* by size of urbanized area does not add a great deal to the *NTST*. Large urbanized areas (those with over one million residents) by far dominate the transit industry in service supplied and consumed as well as capital investment and operating expenses. This is certainly not surprising given that the very nature of transit service is to primarily transport large numbers of people. Systems in large urbanized areas provide 80 percent of vehicle revenues miles of service operated, account for 88 percent of all unlinked passenger trips made, realize 90 percent of all passenger miles accumulated, receive 84 percent of all Federal financial assistance made available to transit for operating expenses and capital investment, and account for more than one-third of the systems reporting. Thus, discussions of urbanized area size diminish in significance. What does become apparent in these exhibits is the shift away from capital investment in bus expenditures (as a percentage of capital funding) to greater investment in fixed guideway by systems in large urbanized areas. Again, this is not unexpected, as the greater population densities found in large urbanized areas justify the substantial capital expenditures made to build and maintain fixed guideway systems.

Exhibit 10
National Transit Profile for Urbanized Areas With Over 1 Million Population
1992

General Information (System Wide)

Service Consumption*

Annual Passenger Miles	33,550.7
Annual Unlinked Trips	6,770.7
Average Weekday Unlinked Trips	22.6
Average Saturday Unlinked Trips	12.5
Average Sunday Unlinked Trips	7.7

Service Supplied

Annual Vehicle Revenue Miles*	2,021.1
Annual Vehicle Revenue Hours*	132.9
Total Fleet	65,079
Vehicles Operated in Maximum Service	51,254
Base Period Requirement	23,399

Vehicles Operated in Maximum Service

Directly Operated

	Vehicles	Systems **
Bus	29,990	88
Heavy Rail	8,180	13
Commuter Rail	3,598	9
Light Rail	773	14
Demand Response	777	43
Other	1,149	24

Purchased Transportation

	Vehicles	Systems **
Bus	2,262	51
Heavy Rail	0	0
Commuter Rail	339	8
Light Rail	0	0
Demand Response	4,124	58
Other	62	11

Financial Information (System Wide)

Sources of Operating Funds*

Passenger Fares	$5,297.0
Local Funds	4,100.9
State Funds	3,335.0
Federal Funds	586.7
Other Funds	773.9
Total Operating Funds	**$14,093.5**

Summary of Operating Expenses*

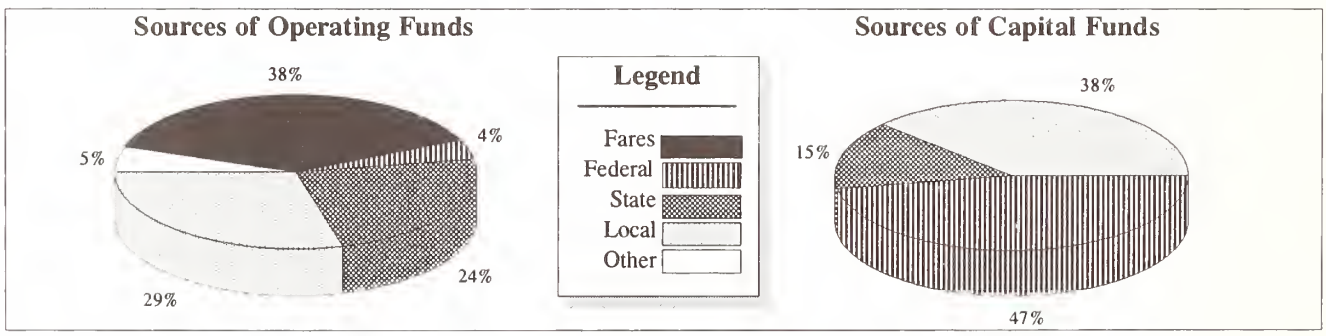
Salaries/Wages/Benefits	$10,166.2
Materials & Supplies	1,198.0
Purchased Transportation	1,059.4
Other Expenses	1,325.5
Total Operating Expenses	**$13,749.1**

Sources of Capital Funds*

Local Funds	$1,831.5
State Funds	714.9
Federal Assistance	2,293.7
Total Capital Funds	**$4,840.1**

Uses of Capital Funds*

Rolling Stock	
Bus	$356.3
Other Modes	655.9
Facilities	
Bus	404.3
Other Modes	2,392.9
Other Capital	1,011.2
Total Uses of Capital Funds	**$4,820.6**



* Millions

** Number of reporters by mode

Exhibit 11
National Transit Profile for Urbanized Areas from 200,000 to 1 Million Population 1992

General Information (System Wide)

Service Consumption*	
Annual Passenger Miles	2,714.4
Annual Unlinked Trips	690.0
Average Weekday Unlinked Trips	2.2
Average Saturday Unlinked Trips	1.1
Average Sunday Unlinked Trips	0.4
Service Supplied	
Annual Vehicle Revenue Miles*	349.9
Annual Vehicle Revenue Hours*	25.2
Total Fleet	14,112
Vehicles Operated in Maximum Service	10,785
Base Period Requirement	7,868

Vehicles Operated in Maximum Service

Directly Operated

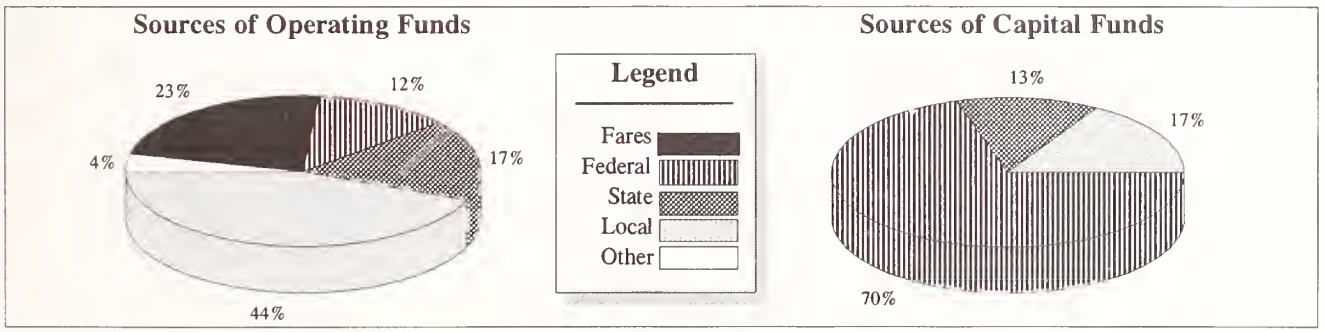
	Vehicles	Systems **
Bus	7,725	96
Heavy Rail	0	0
Commuter Rail	0	0
Light Rail	23	1
Demand Response	805	46
Other	141	10

Purchased Transportation

	Vehicles	Systems **
Bus	446	27
Heavy Rail	0	0
Commuter Rail	12	1
Light Rail	0	0
Demand Response	1,492	74
Other	141	5

Financial Information (System Wide)

Sources of Operating Funds*	
Passenger Fares	$303.6
Local Funds	579.5
State Funds	232.7
Federal Funds	165.4
Other Funds	49.6
Total Operating Funds	**$1,330.8**
Summary of Operating Expenses*	
Salaries/Wages/Benefits	$834.7
Materials & Supplies	151.4
Purchased Transportation	152.0
Other Expenses	151.2
Total Operating Expenses	**$1,289.3**
Sources of Capital Funds*	
Local Funds	$57.5
State Funds	45.9
Federal Assistance	244.5
Total Capital Funds	**$347.9**
Uses of Capital Funds*	
Rolling Stock	
Bus	$126.5
Other Modes	13.6
Facilities	
Bus	59.9
Other Modes	92.2
Other Capital	55.2
Total Uses of Capital Funds	**$347.4**



* Millions

** Number of reporters by mode

Exhibit 12
National Transit Profile for Urbanized Areas With Less Than 200,000 Population 1992

General Information (System Wide)

Service Consumption*	
Annual Passenger Miles	888.4
Annual Unlinked Trips	235.0
Average Weekday Unlinked Trips	0.7
Average Saturday Unlinked Trips	0.3
Average Sunday Unlinked Trips	0.1
Service Supplied	
Annual Vehicle Revenue Miles*	163.0
Annual Vehicle Revenue Hours*	12.6
Total Fleet	7,103
Vehicles Operated in Maximum Service	5,637
Base Period Requirement	2,437

Vehicles Operated in Maximum Service

Directly Operated

	Vehicles	Systems **
Bus	3,107	155
Heavy Rail	0	0
Commuter Rail	0	0
Light Rail	0	0
Demand Response	801	84
Other	138	7

Purchased Transportation

	Vehicles	Systems **
Bus	317	29
Heavy Rail	0	0
Commuter Rail	0	0
Light Rail	2	1
Demand Response	2,069	94
Other	4	2

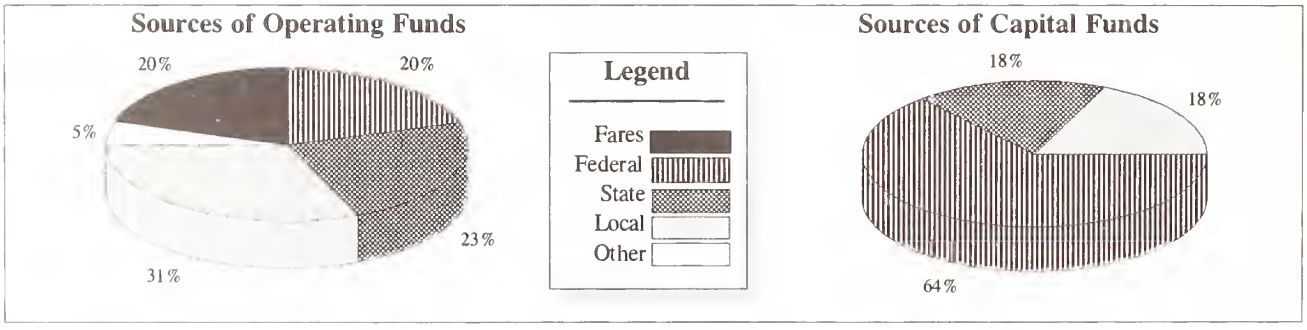
Financial Information (System Wide)

Sources of Operating Funds*	
Passenger Fares	$96.7
Local Funds	152.2
State Funds	113.2
Federal Funds	97.0
Other Funds	24.6
Total Operating Funds	**$483.7**

Summary of Operating Expenses*	
Salaries/Wages/Benefits	$284.7
Materials & Supplies	55.9
Purchased Transportation	57.8
Other Expenses	61.8
Total Operating Expenses	**$460.2**

Sources of Capital Funds*	
Local Funds	$17.2
State Funds	16.9
Federal Assistance	60.5
Total Capital Funds	**$94.6**

Uses of Capital Funds*	
Rolling Stock	
Bus	$60.8
Other Modes	7.9
Facilities	
Bus	16.2
Other Modes	0.7
Other Capital	8.8
Total Uses of Capital Funds	**$94.4**



* Millions

** Number of reporters by mode

Chapter 2
Key Characteristics of Individual Systems

Introduction

This chapter is new to the *NTST*. The exhibits found herein provide data regarding operations, performance, and other significant characteristics.

Chapter Organization

Three exhibits are presented for each of the following modes: bus, heavy rail, commuter rail, light rail and demand response. Information concerning trolleybus and ferryboat systems is also presented to demonstrate that these modes are the predominant ones in the category of Other and to reflect the dominance of certain reporters in these two modes. **Exhibits 13 through 33** provide data concerning service, performance indicators, and infrastructure for each mode.

For each of the modes, three exhibits are presented with discussion preceeding them so as to provide the reader with a two-page synopsis that is easily reproducible. The first exhibit for each mode reflects basic information conncerning each system's operations, such as operating expense, vehicle miles, vehicle hours, unlinked passenger trips, and passenger miles. The second exhibit offers measures of cost and service effectiveness and efficiency. The third exhibit offers infrastructure characteristics such as directional route miles and vehicles operated in maximum service.

For heavy rail, commuter rail, light rail, trolleybus, and ferryboat data for all the reporters for each mode are represented. In the case of bus and demand response, the fifteen largest in terms of number of vehicles operating in maximum service for each mode are reflected.

Bus Systems

The 15 bus systems addressed in **Exhibits 13**, **14**, and **15** are those with the greatest number of vehicles operated in maximum service. These 15 systems dominate the service categories presented in **Exhibit 13**. Particularly noteworthy is that these 15 systems account for over 53 percent of the unlinked bus passenger trips made in the U.S. in 1992, as well as nearly 40 percent of bus revenue miles and over 43 percent of bus revenue hours. Subsequently, the service effectiveness of these systems on average is higher than that of bus systems in total in terms of unlinked passenger trips per vehicle revenue mile and unlinked passenger trips per vehicle revenue hour.

Exhibit 13

Key Operating Characteristics of Individual Bus Systems
1992

System Name	Operating Expense (000s)	Vehicle Revenue Mile (000s)	Vehicle Revenue Hour (000s)	Unlinked Passenger Trips (000s)	Average Weekday Unlinked Passenger Trips (000s)	Passenger Miles (000s)
NY-MTA-NYCTA	$964,358.3	89,908	11,276	650,522	2,170.1	1,331,967
LA-LACMTA / SCRTD	597,701.7	84,456	6,848	402,885	1,270.1	1,539,875
Chicago RTA-CTA	485,442.8	70,803	7,026	370,335	1,198.3	925,680
New Jersey Transit	350,091.1	64,695	4,306	115,815	395.4	726,090
Washington WMATA	291,202.6	40,256	3,547	167,165	564.5	531,648
Philadelphia-SEPTA	272,019.9	35,539	3,416	168,645	555.8	471,317
Seattle-Metro	167,324.8	27,113	1,603	57,991	195.0	386,919
Minneapolis St. Paul-MTC	114,632.9	22,831	1,616	66,303	223.2	286,341
Houston-Metro	156,698.1	37,813	2,372	84,357	284.7	463,099
Boston-MBTA	189,571.8	24,631	2,317	94,040	308.8	248,062
Pittsburgh-PAT	126,322.8	25,820	1,832	65,632	240.0	231,758
Baltimore-MDOT	133,065.4	21,204	1,833	89,072	302.5	299,019
Cleveland-RTA	121,350.4	20,737	1,384	47,471	140.4	169,052
Oakland-AC Transit	137,661.7	24,168	1,909	69,682	224.2	244,097
Atlanta-MARTA	107,188.1	25,372	1,938	76,934	252.4	239,362
Total	$4,214,632.4	615,346	53,223	2,526,849	8,325.4	8,094,286
Percent of National Bus Total	49.0%	39.6%	43.6%	53.2%	53.4%	46.3%

Exhibit 14 demonstrates that 4.11 unlinked passenger trips per vehicle revenue mile are realized on average by the combination of these systems, as compared to 3.05 for all bus systems. However, it should be noted that of the 15 systems, only seven

Exhibit 14

Performance Indicators of Individual Bus Systems
1992

System Name	Operating Expense/ Vehicle Revenue Mile	Operating Expense/ Vehicle Revenue Hour	Operating Expense/ Passenger Mile	Operating Expense/ Unlinked Passenger Trip	Unlinked Passenger Trip/ Vehicle Revenue Mile	Unlinked Passenger Trip/ Vehicle Revenue Hour
NY-MTA-NYCTA	$10.73	$85.52	$0.72	$1.48	7.24	57.69
LA-LACMTA / SCRTD	7.08	87.29	0.39	1.48	4.77	58.84
Chicago RTA-CTA	6.86	69.09	0.52	1.31	5.23	52.71
New Jersey Transit	8.52	81.30	0.48	3.02	1.79	26.90
Washington WMATA	7.23	82.08	0.55	1.74	4.15	47.12
Philadelphia-SEPTA	7.65	79.63	0.58	1.61	4.75	49.37
Seattle-Metro	6.17	104.32	0.43	2.89	2.14	36.15
Minneapolis St. Paul-MTC	5.02	70.89	0.40	1.73	2.90	41.00
Houston-Metro	4.14	66.06	0.34	1.86	2.23	35.56
Boston-MBTA	7.70	81.81	0.76	2.02	3.82	40.58
Pittsburgh-PAT	4.89	68.92	0.55	1.92	2.54	35.81
Baltimore-MDOT	6.28	72.56	0.45	1.49	4.20	48.57
Cleveland-RTA	5.85	87.64	0.72	2.56	2.29	34.29
Oakland-AC Transit	5.70	72.11	0.56	1.98	2.88	36.50
Atlanta-MARTA	4.22	55.30	0.45	1.39	3.03	39.69
Average	$6.85	$79.19	$0.52	$1.67	4.11	4.75

demonstrate greater unlinked passenger trips per vehicle revenue mile than the 3.05 for all bus systems. Also, 42.75 unlinked passenger trips per vehicle revenue hour are realized on average by these 15 bus systems as compared to 38.92 for all bus systems. Again, only nine of the 15 actually exceeded 38.92 unlinked passenger trips per vehicle revenue hour.

Exhibit 15 indicates that the majority of the 15 have at least some exclusive or shared rights-of-way for their bus operations, with seven of the systems having more than 20 directional route miles of such rights-of-way. These 15 systems also account for 17,827 of the 43,847 buses operated in maximum service, over 40 percent of all buses.

Key Infrastructure Characteristics of Individual Bus Systems 1992 **Exhibit 15**

System Name	Fixed Guideway Directional Route Miles	Directional Route Miles Exclusive ROW	Directional Route Miles Controlled ROW	Vehicles Operated in Maximum Service	Vehicles Available for Maximum Service	Average Fleet Age
NY-MTA-NYCTA	35.8	1.5	34.3	3,050	3,659	9.1
LA-LACMTA / SCRTD	24.5	24.5	0.0	1,897	2,429	8.3
Chicago-RTA-CTA	5.4	5.4	0.0	1,791	2,144	7.3
New Jersey Transit	6.7	0.0	6.7	1,608	1,934	8.4
Washington-WMATA	39.3	0.0	39.3	1,436	1,652	12.4
Philadelphia-SEPTA	4.6	2.5	2.1	1,120	1,441	7.9
Seattle-Metro	65.3	50.6	14.7	939	1,124	11.2
Minneapolis-St. Paul MTC	54.4	52.0	2.4	869	969	4.7
Houston-Metro	97.0	93.0	4.0	961	1,165	6.7
Boston-MBTA	0.0	0.0	0.0	838	1,158	9.4
Pittsburgh-PAT	41.3	41.3	0.0	757	876	8.3
Baltimore-MDOT	0.0	0.0	0.0	751	925	6.3
Cleveland-RTA	0.0	0.0	0.0	617	715	5.7
Oakland-AC Transit	4.6	0.1	4.5	614	759	7.8
Atlanta-MARTA	0.2	0.0	0.2	579	691	6.2
Total	379.1	270.9	108.2	17,827	21,641	-

Heavy Rail Systems

The heavy rail systems noted here are the total number of heavy rail operators in the U.S. ranked by the greatest number of vehicles operating in maximum service, providing a combined total of 8,180 vehicles in maximum service. The dominance of the New York City area systems is demonstrated by the data presented. **Exhibit 16** shows that over 57 percent of the heavy rail operating expenses realized in the U.S. in 1992 are accounted for by New York City systems, which also provided 58 percent of the heavy rail vehicle revenue miles operated, 62 percent of the heavy rail vehicle revenue hours operated, realized 57 percent of heavy rail passenger miles, and carried 62 percent of all heavy rail riders.

Exhibit 16

Key Operating Characteristics of Individual Heavy Rail Systems
1992

System Name	Operating Expense (000s)	Vehicle Revenue Miles (000s)	Vehicle Revenue Hours (000s)	Unlinked Passenger Trips (000s)	Average Weekday Unlinked Passenger Trips (000s)	Passenger Miles (000s)
NY-MTA-NYCTA	$2,043,313.1	295,548	14,556.7	1,373,630	4,638.0	6,156,010.0
Chicago-RTA-CTA	298,652.1	51,122	2,260.1	137,373	473.3	791,910.0
Washington-WMATA	295,138.5	38,749	1,448.5	186,780	649.3	1,027,090.0
San Francisco-BART	207,212.2	40,874	1,274.9	77,247	260.0	911,843.0
Boston-MBTA	253,965.0	23,420	1,181.5	180,673	551.0	549,250.0
Philadelphia-SEPTA	114,640.1	15,307	736.3	79,810	271.6	358,100.0
NY-Port Authority-PATH	142,172.0	12,485	624.5	60,143	211.6	265,328.0
Atlanta-MARTA	62,574.0	15,795	621.5	64,080	210.5	334,400.0
Philadelphia-PATCO	25,009.0	4,115	141.9	11,150	40.4	97,530.0
Miami-MDTA	43,195.4	5,231	172.9	13,700	46.2	109,690.0
Baltimore-MDOT	32,831.0	3,192	130.6	12,000	41.4	56,640.0
NY-MTA-SIRTOA	17,490.0	1,761	81.8	5,090	20.1	37,650.0
Cleveland-RTA	18,898.0	2,134	80.3	5,560	19.1	41,280.0
Total	$3,555,090.4	509,733	23,311.5	2,207,236	7,432.5	10,736,721.0

Exhibit 17 demonstrates that five of the reporting transit agencies exceed the average of 4.33 unlinked passenger trips per vehicle revenue hour and the average of 95.96 unlinked passenger trips. This is reflective of a high level of service effectiveness for these operators.

Exhibit 17

Performance Indicators of Individual Heavy Rail Systems
1992

System Name	Operating Expense/ Vehicle Revenue Mile	Operating Expense/ Vehicle Revenue Hour	Operating Expense/ Passenger Mile	Operating Expense/ Unlinked Passenger Trip	Unlinked Passenger Trip/ Vehicle Revenue Mile	Unlinked Passenger Trip/ Vehicle Revenue Hour
NY-MTA-NYCTA	$6.9	$140.4	$0.3	$1.5	4.65	94.36
Chicago-RTA-CTA	5.8	132.1	0.4	2.2	2.69	60.78
Washington-WMATA	7.6	203.8	0.3	1.6	4.82	128.95
San Francisco-BART	5.1	162.5	0.2	2.7	1.89	60.59
Boston-MBTA	10.8	215.0	0.5	1.4	7.71	152.92
Philadelphia-SEPTA	7.5	155.7	0.3	1.4	5.21	108.39
NY-Port Authority-PATH	11.4	227.7	0.5	2.4	4.82	96.31
Atlanta-MARTA	4.0	100.7	0.2	1.0	4.06	103.11
Philadelphia-PATCO	6.1	176.3	0.3	2.2	2.71	78.58
Miami-MDTA	8.3	250.5	0.4	3.2	2.62	79.44
Baltimore-MDOT	10.3	251.5	0.6	2.7	3.76	91.89
NY-MTA-SIRTOA	9.9	213.7	0.5	3.4	2.89	62.18
Cleveland-RTA	8.9	235.4	0.5	3.4	2.60	69.21
Average	$7.0	$154.6	$0.3	$1.6	4.33	95.96

Exhibit 18 again reflects the dominance of New York City systems. Over 35 percent of heavy rail route miles are accounted for by the New York City area and over 38 percent of heavy rail track miles are located there. Nearly 49 percent of all heavy rail stations are served by the New York City systems. Approximately 60 percent of heavy rail vehicles operated in maximum service and 58 percent of heavy rail vehicles available are accounted for by New York City systems.

Key Infrastructure Characteristics of Individual Heavy Rail Systems 1992

Exhibit 18

System Name	Fixed Guideway Directional Route Miles	Miles of Track	Number of Stations	Number of Accessible Stations	Vehicles Operated in Maximum Service	Vehicles Available for Maximum Service	Average Fleet Age
NY-MTA-NYCTA	492.9	697.7	469	22	4,923	5,936	19.8
Chicago-RTA-CTA	191.0	212.6	137	0	924	1,204	14.0
Washington-WMATA	162.1	175.9	70	70	534	668	10.6
San Francisco-BART	142.0	196.5	34	34	415	589	14.7
Boston-MBTA	76.7	107.7	53	27	368	402	16.2
Philadelphia-SEPTA	75.8	102.0	76	4	300	375	25.1
NY-Port Authority-PATH	28.6	43.1	13	6	282	342	19.8
Atlanta-MARTA	67.0	87.4	29	N/R	136	240	8.9
Philadelphia-PATCO	31.5	38.4	13	2	102	121	19.8
Miami-MDTA	42.2	53.2	21	0	82	136	10.0
Baltimore-MDOT	26.6	31.6	12	12	48	100	7.4
NY-MTA-SIRTOA	28.6	32.5	22	1	36	64	21.0
Cleveland-RTA	38.2	41.9	18	0	30	59	9.0
Total	1,403.2	1,820.5	967	178	8,180	10,236	17.8

N/R = Not Reported

Commuter Rail Systems

Exhibits 19, **20**, and **21** present all 18 commuter rail systems ranked by the greatest number of vehicles operating in maximum service. Once again, this mode is dominated by the New York City area systems. **Exhibit 19** reveals that 51 percent of total operating expenses were realized by New York City systems, as were 46 percent of the vehicle revenue miles of service, 29 percent of the vehicle revenue hours of service, 47 percent of the unlinked passenger trips, and 30 percent of the passenger miles.

Exhibit 19

Key Operating Characteristics of Individual Commuter Rail Systems
1992

System Name	Operating Expense (000s)	Vehicle Revenue Miles (000s)	Vehicle Revenue Hours (000s)	Unlinked Passenger Trips (000s)	Average Weekday Unlinked Passenger Trips (000s)	Passenger Miles (000s)
NY-MTA-LIRR	$615,775.2	54,699.9	1,659.4	89,834.0	316.0	2,230,410
NY-MTA-Metro-North	427,639.0	36,775.9	985.8	57,836.8	200.4	1,581,020
New Jersey Transit	327,317.4	38,419.5	960.0	41,687.8	143.6	1,018,040
Chicago-RTA-Metra	462,563.5*	31,135.3	962.1	66,121.0	261.9	1,363,960
Boston-MBTA/Amtrak	99,954.0	14,898.4	501.8	19,949.3	73.8	368,610
Philadelphia-SEPTA	140,947.0	11,655.5	431.5	21,955.0	77.5	322,270
Baltimore-MARC	20,207.4	4,133.7	103.3	4,484.0	17.5	131,780
SF-CALTRANS	28,773.5	2,943.8	88.0	6,058.2	21.0	119,460
NW IN-NICTD	19,186.4	1,946.2	55.3	2,585.1	9.4	72,300
Philadelphia-Penn-DOT	2,637.3	671.2	12.6	171.2	0.5	14,700
Ft. Lauderdale-TCRA	16,249.3	1,800.0	44.2	2,266.5	7.7	76,800
LA-CALTRANS	1,134.2	260.4	5.5	194.5	0.0	7,800
Hartford-Conn-DOT	5,280.6	322.0	8.2	255.9	0.0	5,190
LA-OCTA	1,962.3	142.7	3.4	146.3	0.6	8,020
Total	$1,707,063.6	199,804.5	5,821.1	313,545.6	1,129.9	7,320,360

* This figure may be over stated by approximately $165 million due to a reporting anomaly.

Exhibit 20 demonstrates that the majority of commuter rail systems are operating more effectively than the average. In all categories of service supply, from one-half to two-thirds of the reporters are operating at a cost per mile, hour, and passenger mile and unlinked passenger trip that is better than average. The same is true with service consumption, as two-thirds of the reporters are experiencing better than average service effectiveness.

Exhibit 20

Performance Indicators of Individual Commuter Rail Systems
1992

System Name	Operating Expense/ Vehicle Revenue Mile	Operating Expense/ Vehicle Revenue Hour	Operating Expense/ Passenger Mile	Operating Expense/ Unlinked Passenger Trip	Unlinked Passenger Trip/ Vehicle Revenue Mile	Unlinked Passenger Trips/ Vehicle Revenue Hour
NY-MTA-LIRR	$11.26	$371.09	$0.28	$6.85	1.6	54.1
NY-MTA-Metro-North	11.63	433.79	0.27	7.39	1.6	58.7
New Jersey Transit	8.52	340.96	0.32	7.85	1.1	43.4
Chicago-RTA-Metra	9.59*	310.26*	.22*	4.51*	2.1	68.7
Boston-MBTA/Amtrak	6.71	199.17	0.27	5.01	1.3	39.8
Philadelphia-SEPTA	12.09	326.67	0.44	6.42	1.9	50.9
Baltimore-MARC	6.58	263.47	0.21	6.07	1.1	43.4
SF-CALTRANS	9.77	327.08	0.24	4.75	2.1	68.9
NW IN-NICTD	9.86	346.95	0.27	7.42	1.3	46.7
Philadelphia-Penn-DOT	3.93	208.90	0.18	15.41	0.3	13.6
Ft. Lauderdale-TCRA	9.03	367.07	0.21	7.17	1.3	51.2
LA-CALTRANS	4.36	206.22	0.15	5.83	0.7	35.4
Hartford-Conn-DOT	16.40	640.77	1.02	20.63	0.8	31.1
LA-OCTA	13.75	569.76	0.24	13.41	1.0	42.5
Average	$10.85	$372.73	$0.29	$6.88	1.6	53.1

* Figures are based on an operating expense figure approximately $165 million less than that reflected in Exhibit 19.

Exhibit 21 also demonstrates the dominance of the New York City systems relative to infrastructure. For example, New York City systems account for 42 percent of the vehicles operating in maximum service.

Also of note is that the figures for commuter rail operations in the Chicago area and for New Jersey Transit include both directly operated and purchased transportation. Comparing purchased commuter rail services to directly operated service in Chicago, 57 percent of the vehicle revenue miles operated are provided to Northeastern Illinois Regional Commuter Railroad Corporation (Metra) under contract by several operators. For New Jersey Transit, approximately four percent of the vehicle revenue miles operated are provided by purchased transportation.

Key Infrastructure Characteristics of Individual Commuter Rail Systems 1992 **Exhibit 21**

System Name	Fixed Guideway Directional Route Miles	Miles of Track	Number of Stations	Number of Accessible Stations	Vehicles Operated for Maximum Service	Vehicles Available for Maximum Service	Average Fleet Age
NY-MTA-LIRR	638.2	701.1	134	0	947	1,190	21.4
NY-MTA-Metro-North	535.9	756.5	108	0	702	797	16.8
New Jersey Transit	1,143.6	1,149.3	163	N/R	627	930	18.5
Chicago-RTA-Metra	864.4	1,104.6	222	50	832	888	17.6
Boston-MBTA/Amtrak	529.8	460.3	101	43	291	352	4.8
Philadelphia-SEPTA	442.8	694.8	181	25	263	346	17.9
Baltimore-MARC	373.4	455.1	38	0	96	112	20.0
SF-CALTRANS	93.8	93.8	26	0	75	93	6.8
NW IN-NICTD	138.4	89.0	18	0	39	45	10.0
Philadelphia-Penn-DOT	144.0	144.0	14	4	23	23	N/R
Ft. Lauderdale-TCRA	132.8	136.1	15	15	20	27	9.0
LA-CALTRANS	146.0	109.0	7	N/R	16	48	18.4
Hartford-Conn-DOT	65.6	68.3	7	0	12	25	1.0
LA-OCTA	58.0	0.0	6	1	6	6	7.0
Total	5,306.7	5,961.9	1,040	138	3,949	4,882	18.5

N/R = Not Reported

Light Rail Systems

Exhibits 22, **23**, and **24** provide data for all 16 reporting light rail operators. It should be noted that one new system was added (in Baltimore) for 1992. Several other systems that reported capital investment information (which is discussed in Chapter 3) will commence operation after 1992. These are Denver, St. Louis, Dallas and Memphis. One system did not report in 1992 (McKinney Avenue Trolley in Dallas), and another system was not required to report as it is a private provider (Tandy Trolley in Fort Worth). One private operator did report in 1992 (Galveston-Island Transit).

Exhibit 22 demonstrates that six systems, Massachusetts Bay Transportation Authority (MBTA) in Boston, Southeastern Pennsylvania Transportation Authority (SEPTA) in Philadelphia, San Francisco Municipal Railway (Muni), Port Authority of Allegheny County (PAT) in Pittsburgh, Southern California Regional Transit District (SCRTD) in Los Angeles, and the San Diego Trolley, account for over 75 percent of the unlinked passenger trips made via light rail, and realize 72 percent of the passenger miles.

Exhibit 22

Key Operating Characteristics of Individual Light Rail Systems
1992

System Name	Operating Expense (000s)	Vehicle Revenue Miles (000s)	Vehicle Revenue Hours (000s)	Unlinked Passenger Trips (000s)	Average Weekday Unlinked Passenger Trips (000s)	Passenger Miles (000s)
Boston-MBTA	$25,298.9	1,523.4	92.1	24,937.0	76.6	34,912
Philadelphia-SEPTA	56,960.4	4,171.5	481.6	41,557.8	137.6	95,616
San Francisco-Muni	62,264.0	3,888.0	375.3	39,033.9	128.9	105,810
Pittsburgh-PAT	23,487.2	1,946.3	129.8	8,727.8	32.5	49,488
San Diego-The Trolley	18,923.0	4,507.5	220.2	17,162.6	50.0	116,190
San Jose-SCCTD	19,229.1	2,080.1	130.3	6,134.8	19.7	44,154
Sacramento-RT	11,355.0	1,677.5	83.9	6,781.2	23.4	33,326
LA-SCRTD	41,188.0	2,919.0	160.6	11,306.9	34.2	101,830
Cleveland-RTA	10,910.0	1,170.3	50.5	5,043.5	17.6	31,185
Buffalo-NFTA	12,202.1	915.6	73.4	8,570.3	29.9	19,372
Portland-Tri-Met	11,441.0	1,445.5	95.6	7,702.5	22.5	41,292
New Orleans-RTA	5,301.3	718.2	85.7	6,911.9	18.8	14,919
New Jersey Transit	4,298.0	644.6	45.6	3,057.2	10.4	10,073
Baltimore-MDOT	2,808.0	137.1	9.3	207.7	3.3	1,768
Seattle-Metro	1,270.2	47.9	11.7	186.1	0.5	185
Galveston-Island Transit(PT)	261.2	19.5	4.2	121.2	0.3	272
Total	$307,197.4	27,812.0	2,049.8	187,442.4	606.2	700,392

Exhibit 23 shows that in terms of service consumed, the majority of light rail systems operated more effectively than the average for light rail.

Performance Indicators of Individual Light Rail Systems 1992 **Exhibit 23**

System Name	Operating Expense/ Vehicle Revenue Mile	Operating Expense/ Vehicle Revenue Hour	Operating Expense/ Passenger Mile	Operating Expense/ Unlinked Passenger Trip	Unlinked Passenger Trip/ Vehicle Revenue Mile	Unlinked Passenger Trip/ Vehicle Revenue Hour
Boston-MBTA	$16.6	$274.6	$0.7	$1.0	16.4	270.6
Philadephia-SEPTA	13.7	118.3	0.6	1.4	10.0	86.3
San Francisco-Muni	16.0	165.9	0.6	1.6	10.0	104.0
Pittsburgh-PAT	12.1	181.0	0.5	2.7	4.5	67.2
San Diego-The Trolley	4.2	86.0	0.2	1.1	3.8	78.0
San Jose-SCCTD	9.2	147.5	0.4	3.1	3.0	47.1
Sacramento-RT	6.8	135.3	0.3	1.7	4.0	80.8
LA-SCRTD	14.1	256.4	0.4	3.6	3.9	70.4
Cleveland-RTA	9.3	216.2	0.4	2.2	4.3	100.0
Buffalo-NFTA	13.3	166.1	0.6	1.4	9.4	116.7
Portland-Tri-Met	7.9	119.7	0.3	1.5	5.3	80.6
New Orleans-RTA	7.4	61.9	0.4	0.8	9.6	80.7
New Jersey Transit	6.7	94.2	0.4	1.4	4.7	67.0
Baltimore-MDOT	20.5	301.2	1.6	13.5	1.5	22.3
Seattle-Metro	26.5	108.6	0.7	2.6	3.9	15.9
Galveston-Island Transit (PT)	13.4	62.4	1.0	2.2	6.2	28.9
Average	$11.1	$153.6	$0.4	$1.6	6.7	93.7

Exhibit 24 shows the same six systems mentioned earlier account for 57 percent of vehicles operated in maximum service, and nearly 64 percent of directional route miles.

Key Infrastructure Characteristics of Individual Light Rail Systems 1992 **Exhibit 24**

System Name	Fixed Guideway Directional Route Miles	Miles of Track	Number of Stations	Number of Accessible Stations	Vehicles Operated in Maximum Service	Vehicles Available for Maximum Service	Average Fleet Age
Boston-MBTA	52.0	77.5	77	0	201	229	12
Philadephia-SEPTA	126.7	171.5	64	N/R	147	230	24
San Francisco-Muni	49.7	54.2	9	0	101	128	19
Pittsburgh-PAT	45.2	52.9	14	0	59	71	15
San Diego-The Trolley	41.5	41.5	24	24	59	71	6
San Jose-SCCTD	39.0	41.1	33	33	36	53	12
Sacramento-RT	36.2	32.6	28	0	32	35	4
LA-SCRTD	43.2	46.7	22	22	36	54	3
Cleveland-RTA	26.7	28.9	29	0	26	47	11
Buffalo-NFTA	12.4	14.1	14	0	23	27	8
Portland-Tri-Met	30.2	29.1	27	1	22	26	7
New Orleans-RTA	16.9	12.7	N/R	N/R	21	44	68
New Jersey Transit	8.3	8.3	11	N/R	16	22	46
Baltimore-MDOT	26.0	21.4	15	15	14	18	0
Seattle-Metro	4.2	2.1	14	N/R	3	4	65
Galveston-Island Transit (PT)	4.7	4.7	21	3	2	4	4
Total	562.9	639.3	402	98	798	1,063	17

N/R = Not Reported

Demand Response Systems

The 15 demand response systems listed in **Exhibits 25**, **26**, and **27** are those reporting the most number of vehicles operating in maximum service. As **Exhibit 25** demonstrates, these systems accounted for approximately 35 percent of the total demand response service operated in the U.S. in terms of vehicle revenue miles. These systems carried over 32 percent of the nation's demand response riders, and realized over 31 percent of demand response passenger miles.

Exhibit 25

Key Operating Characteristics of Individual Demand Response Systems 1992

System Name	Vehicle Revenue Miles (000s)	Vehicle Revenue Hours (000s)	Unlinked Passenger Trips (000s)	Average Weekday Unlinked Passenger Trips (000s)	Passenger Miles (000s)
Pittsburgh-PAT-Access	11,826.3	878.3	2,018.7	6.8	10,962.9
Chicago-RTA-Pace	6,282.2	383.9	1,566.4	6.1	8,568.3
Dallas-DART	6,708.2	557.6	803.9	2.7	9,129.4
Seattle-Metro	1,904.5	0.0	352.5	1.3	3,081.1
Miami-MDTA-Comprehensive	6,432.4	514.6	1,110.6	3.8	7,338.2
Chicago-RTA-CTA	5,177.9	0.0	1,011.7	3.3	8,357.3
Milwaukee-Paratransit	4,330.5	383.7	713.3	2.4	3,374.7
LA-LACMTA/LACTC/Metro	7,166.6	488.0	2,365.9	7.3	9,222.9
LA-OCTA	3,909.9	328.0	1,742.6	6.6	8,354.2
Fitchburg-MART	2,042.4	0.0	570.5	2.3	5,568.0
Houston-Metro	5,420.7	301.0	663.0	2.0	5,991.9
Madison-MMT	1,067.2	70.4	206.9	7.0	1,112.6
Boston-MBTA	2,984.5	351.4	459.1	1.6	2,791.4
San Antonio-VIA	5,808.3	329.5	677.8	2.3	8,084.9
Florence-PDRTA	2,189.5	178.2	384.7	1.5	7,777.3
Total	73,251.1	4,764.5	14,647.7	57.0	99,715.2
Percent of National DR Total	35.1%	32.0%	32.3%	41.5%	31.5%

Exhibit 26 demonstrates that the majority of these 15 demand response systems operated more efficiently than the national average in terms of service supplied based on cost per vehicle revenue mile and cost per vehicle revenue hour. However, in terms of cost effectiveness of the service consumed, a majority of these systems were not as effective as the national average. As for the service effectiveness of these systems, only a minority were more effective in terms of unlinked passenger trips per vehicle revenue mile or hour than the national average.

Performance Indicators of Individual Demand Response Systems
1992

Exhibit 26

System Name	Operating Expense/ Vehicle Revenue Mile	Operating Expense/ Vehicle Revenue Hour	Operating Expense/ Passenger Mile	Operating Expense/ Unlinked Passenger Trip	Unlinked Passenger Trip/ Vehicle Revenue Mile	Unlinked Passenger Trip/ Vehicle Revenue Hour
Pittsburgh-PAT-Access	$1.68	$22.66	$1.82	$9.86	0.17	2.30
Chicago-RTA-Pace	2.25	36.77	1.65	9.01	0.25	4.08
Dallas-DART	1.75	21.07	1.29	14.61	0.12	1.44
Seattle-Metro	2.01	0.00	1.25	10.88	0.19	0.00
Miami-MDTA-Comprehensive	2.07	25.86	1.81	11.98	0.17	2.16
Chicago-RTA-CTA	3.41	0.00	2.11	17.46	0.20	0.00
Milwaukee-Paratransit	1.59	17.91	2.04	9.63	0.16	1.86
LA-LACMTA/LACTC/Metro	2.88	42.36	2.24	8.74	0.33	4.85
LA-OCTA	2.78	33.10	1.30	6.23	0.45	5.31
Fitchburg-MART	1.93	39.98	0.71	6.92	0.28	5.78
Houston-Metro	1.53	27.59	1.39	12.53	0.12	2.20
Madison-MMT	2.35	35.59	2.25	12.11	0.11	2.94
Boston-MBTA	3.51	29.80	3.75	22.81	0.15	1.31
San Antonio-VIA	1.44	25.44	1.04	12.37	0.12	2.06
Florence-PDRTA	1.32	16.27	0.37	7.54	0.18	2.16
Average	$2.26	$31.56	$1.49	$10.38	0.22	3.04

Exhibit 27 shows that 3,279 demand response vehicles are operated in maximum service by the 15 systems presented. This represents 35 percent of all demand response vehicles operated nationally in maximum service.

Key Infrastructure Characteristics of Individual Demand Response Systems
1992

Exhibit 27

System Name	Operating Expense (000s)	Vehicles Operated in Maximum Service	Vehicles Available for Maximum Service	Average Fleet Age
Pittsburgh-PAT-Access	$19,900.2	410	466	4.7
Chicago-RTA-Pace	14,118.1	310	349	3.0
Dallas-DART	11,745.3	269	362	1.6
Seattle-Metro	3,836.3	265	319	4.1
Miami-MDTA-Comprehensive	13,308.6	243	243	5.2
Chicago-RTA-CTA	17,667.5	242	577	2.5
Milwaukee-Paratransit	6,871.2	235	411	7.8
LA-LACMTA/LACTC/Metro	20,670.2	233	1,806	4.6
LA-OCTA	10,855.3	205	232	4.0
Fitchburg-MART	3,946.9	172	189	4.7
Houston-Metro	8,305.9	152	510	1.4
Madison-MMT	2,504.3	143	251	2.8
Boston-MBTA	10,472.9	120	151	2.5
San Antonio-VIA	8,382.9	189	208	2.9
Florence-PDRTA	2,898.7	91	120	4.1
Total	$155,484.4	3,279	6,194	-

Trolleybus Systems

Exhibits 28, **29**, and **30** provide data regarding the five trolleybus systems reporting under the Section 15 program. This mode consists of rubber tired vehicles supplied with electric power from overhead lines. The mode has remained relatively stable since 1989 in both service supplied and consumed. As seen in **Exhibit 28**, the San Francisco Muni system accounts for 54 percent of vehicle revenue miles operated, 60 percent of vehicle revenue hours, 68 percent of the trolleybus riders carried, and nearly 62 percent of passenger miles realized.

Exhibit 28

Key Operating Characteristics of Individual Trolleybus Systems
1992

System Name	Operating Expense (000s)	Vehicle Revenue Miles (000s)	Vehicle Revenue Hours (000s)	Unlinked Passenger Trips (000s)	Average Weekday Unlinked Passenger Trips (000s)	Passenger Miles (000s)
San Francisco-Muni	$66,583.4	7,211.6	997.0	85,863.9	269.3	122,366.0
Seattle-Metro	31,608.2	3,291.5	346.6	23,408.6	74.6	44,650.5
Philadelphia-SEPTA	13,677.9	1,287.4	163.4	11,106.9	37.4	18,692.0
Dayton-RTA	5,124.8	864.9	84.6	2,133.5	7.8	5,642.5
Boston-MBTA	7,428.0	747.0	57.3	3,222.5	10.9	7,386.0
Total	$124,422.3	13,402.4	1,648.9	125,735.4	399.9	198,737.0

As demonstrated in **Exhibit 29**, the San Francisco-Muni system is the most cost efficient and cost effective of the trolleybus systems. It also has the highest service effectiveness.

Exhibit 29

Performance Indicators of Individual Trolleybus Systems
1992

System Name	Operating Expense/ Vehicle Revenue Mile	Operating Expense/ Vehicle Revenue Hour	Operating Expense/ Passenger Mile	Operating Expense/ Unlinked Passenger Trip	Unlinked Passenger Trip/ Vehicle Revenue Mile	Unlinked Passenger Trip/ Vehicle Revenue Hour
San Francisco-Muni	$9.23	$66.79	$0.54	$0.78	11.91	86.13
Seattle-Metro	9.60	91.19	0.71	1.35	7.11	67.53
Philadelphia-SEPTA	10.62	83.71	0.73	1.23	8.63	67.97
Dayton-RTA	5.93	60.59	0.91	2.40	2.47	25.22
Boston-MBTA	9.94	129.63	1.01	2.31	4.31	56.24
Average	$9.28	$75.46	$0.63	$0.99	9.38	76.25

Exhibit 30 shows that the San Francisco-Muni system operates nearly 56 percent of the trolleybus vehicles operated in maximum service. Seattle-Metro, however, also provides 23 percent of trolleybuses operating in maximum service, and accounts for nearly 29 percent of trolleybus directional route miles compared to the 30 percent for which San Francisco-Muni accounts.

Key Infrastructure Characteristics of Individual Trolleybus Systems 1992 **Exhibit 30**

System Name	Fixed Guideway Directional Route Miles	Vehicles Operated in Maximum Service	Vehicles Available in Maximum Service	Average Fleet Age
San Francisco-Muni	119.8	261	343.0	16.0
Seattle-Metro	112.6	108	155.0	5.4
Philadelphia-SEPTA	42.5	54	110.0	13.0
Dayton-RTA	97.5	23	32.0	15.0
Boston-MBTA	21.6	23	43.0	17.0
Total	394.0	469	683.0	-

Ferryboat Systems

Exhibits 31, **32**, and **33** offer information on the nation's 14 ferryboat systems reporting under the Section 15 program. Exhibit 31 shows that the Washington Department of Transportation system operating in Seattle accounts for over 43 percent of the vehicle revenue miles operated, nearly 46 percent of the vehicle revenue hours operated, realized 50 percent of the unlinked passenger trips made, and realized 45 percent of passenger miles.

Exhibit 31

Key Operating Characteristics of Individual Ferryboat Systems
1992

System Name	Operating Expense (000s)	Vehicle Revenue Miles (000s)	Vehicle Revenue Hours (000s)	Unlinked Passenger Trips (000s)	Average Weekday Unlinked Passenger Trips (000s)	Passenger Miles (000s)
Seattle-Washington DOT	$96,848.7	886.6	120.7	13,211.9	34.4	113,321.1
Boston-MBTA	3,924.0	90.4	6.9	405.4	1.4	5,478.3
San Juan Port Authority	7,619.4	259.0	46.0	2,572.6	6.7	5,748.5
New Orleans-Cresent City	4,284.9	45.2	22.9	3,487.8	9.9	1,743.8
SF-Golden Gate	8,734.2	137.7	11.3	1,522.2	4.8	16,331.7
New York City DOT	39,042.9	158.7	16.2	1,789.9	61.2	93,079.4
Portland-CBL	1,407.9	60.8	12.4	643.3	2.0	2,251.5
NY-Port Authority-PATH	3,584.0	42.2	5.3	1,823.3	7.1	3,099.7
Hartford-Conn-DOT	574.9	193.9	4.9	0.0	0.0	107.8
Oakland-AOFS	1,606.7	50.2	4.3	236.5	0.7	1,590.7
Norfolk-TRT	618.2	11.7	5.9	489.2	1.0	244.6
Tacoma-Pierce Ferry	1,257.6	28.8	4.5	125.6	0.3	921.6
Oakland Vallejo-Transit	2,218.1	74.0	3.3	236.6	0.6	7,344.6
Bremerton-Kitsap Transit	1.5	0.3	0.2	2.0	0.2	1.5
Total	$171,723.0	2,039.5	264.8	26,546.3	130.3	251,264.8

Exhibit 32 reflects the high cost of ferryboat service, but also demonstrates its high service effectiveness. The Staten Island Ferry operated by the New York City Department of Transportation realized approximately 113 trips per mile and over 1,105 trips per hour.

Exhibit 32

Performance Indicators of Individual Ferryboat Systems
1992

System Name	Operating Expense/ Vehicle Revenue Mile	Operating Expense/ Vehicle Revenue Hour	Operating Expense/ Passenger Mile	Operating Expense/ Unlinked Passenger Trip	Unlinked Passenger Trip/ Vehicle Revenue Mile	Unlinked Passenger Trip/ Vehicle Revenue Hour
Seattle-Washington DOT	$109.23	$802.15	$0.85	$7.33	14.90	109.43
Boston-MBTA	43.40	570.56	0.72	9.68	4.48	58.94
San Juan Port Authority	29.42	165.64	1.33	2.96	9.93	55.93
New Orleans-Cresent City	94.89	187.35	2.46	1.23	77.23	152.49
SF-Golden Gate	63.41	772.46	0.53	5.74	11.05	134.62
New York City DOT	246.09	2,411.69	0.42	2.18	112.82	1,105.68
Portland-CBL	23.18	113.66	0.63	2.19	10.59	51.93
NY-Port Authority-PATH	84.96	671.54	1.16	1.97	43.22	341.64
Hartford-Conn-DOT	29.66	117.68	5.33	0.00	0.00	0.00
Oakland-AOFS	32.04	372.78	1.01	6.79	4.71	54.87
Norfolk-TRT	52.82	105.65	2.53	1.26	41.80	83.59
Tacoma-Pierce Ferry	43.69	276.76	1.36	10.01	4.36	27.65
Oakland Vallejo-Transit	29.98	665.91	0.30	9.38	3.20	71.03
Bremerton-Kitsap Transit	4.79	9.59	1.01	0.73	6.57	13.14
Average	$84.20	$648.50	$0.68	$6.47	13.02	100.25

Exhibit 33 again demonstrates the significance of the Washington Department of Transportation's ferryboat service in terms of infrastructure. One-third of the vehicles operated in maximum service are accounted for by this system.

Exhibit 33

Key Infrastructure Characteristics of Individual Ferryboat Systems
1992

System Name	Fixed Guideway Directional Route Miles	Vehicles Operated in Maximum Service	Vehicles Available for Maximum Service	Average Fleet Age
Seattle-Washington DOT	245.8	21	23	31
Boston-MBTA	11.7	7	8	16
San Juan Port Authority	16.0	6	8	6
New Orleans-Cresent City	3.2	5	6	27
SF-Golden Gate	38.7	4	4	19
New York City DOT	10.4	4	7	16
Portland-CBL	20.0	4	3	19
NY-Port Authority-PATH	3.4	3	4	3
Hartford-Conn-DOT	0.9	2	2	40
Oakland-AOFS	16.5	2	3	11
Norfolk-TRT	1.0	2	3	6
Tacoma-Pierce Ferry	11.1	1	1	62
Oakland Vallejo-Transit	79.6	1	1	6
Bremerton-Kitsap Transit	1.5	1	2	37
Total	459.8	63	75	-

Chapter 3
Capital Funding

Introduction

Capital investment in the transit industry has continued to increase each year since 1988. Such investment grew by over eight percent on average each year between 1988 and 1992, though capital investment between 1991 and 1992 was more stable, with an increase of approximately four percent. The significant transit infrastructure in place in the U.S., along with that under development, continued to require commitments of funds for rehabilitation and construction of fixed guideway systems and facilities, as well as the purchase and restoration of vehicles.

Chapter Organization

This chapter begins with a review of the sources of capital funding. It then discusses the uses of capital funds by mode and category of use. Finally, information concerning uses of capital funds for individual systems is presented for each mode.

Sources of Capital Funds

Federal capital assistance continues to be the single largest source of funds for capital investment in the transit infrastructure. Of the nearly $5.3 billion used in 1992 for capital investment in transit infrastructure expansion and rehabilitation, Federal assistance accounts for 49 percent. Local funds represent 36 percent and State funding contributes 15 percent of the available capital assistance. As reflected in **Exhibit 34**, as capital investment has increased since 1988, Federal assistance has remained stable in the amount of dollars contributed to transit infrastructure. Subsequently, the amounts contributed by State and local sources have increased. In 1988, Federal assistance accounted for 64 percent of capital funding, while local funds represented 23 percent and state funding provided 13 percent. Local funding for capital investment remained stable from 1991 to 1992, after increases of 53 percent from 1990 to 1991 and 40 percent from 1989 to 1990. State funding increased by 22 percent from 1991 to 1992 after remaining relatively stable since 1989.

Distribution of Capital Funds by UZA Size and Source

Urbanized areas (UZAs) above one million account for over $4.8 billion, or nearly 92 percent, of the capital investment made in the transit infrastructure in 1992. This is because of the substantial fixed guideway systems in place or being developed in the nation's large metropolitan areas, as well as the large fleets of vehicles required to maintain such significant capital assets and accommodate the needs of riders.

Exhibit 34

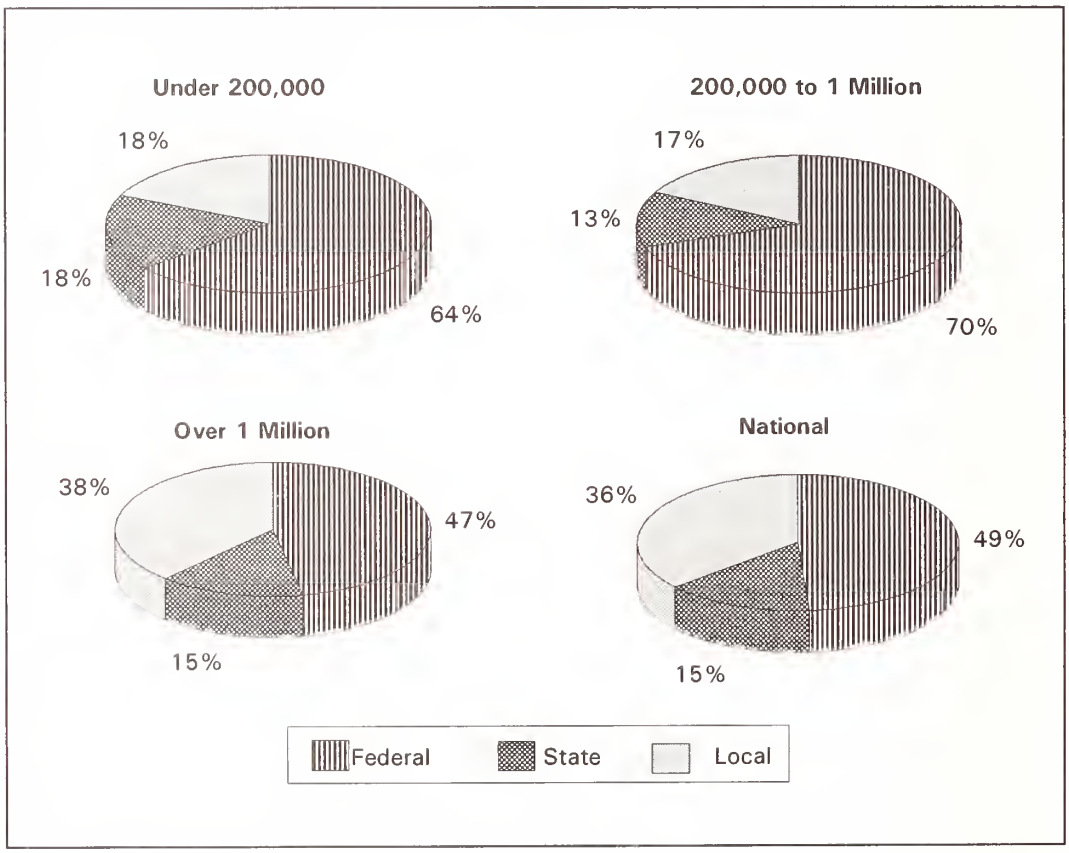
Sources of Capital Funds (Millions)
1988-1992

	1988	1989	1990	1991	1992
Federal	$2,293.9	$2,248.1	$2,636.3	$2,545.0	$2,598.7
State	472.5	623.2	644.6	638.1	777.7
Local	804.4	896.0	1,254.6	1,914.2	1,906.2
Total	$3,570.8	$3,767.3	$4,535.5	$5,097.3	$5,282.6

As presented in **Exhibit 35**, large UZAs rely more heavily than mid-size and small UZAs on local funding sources to meet capital needs. Because of the substantial investment needed to maintain their transit infrastructures, large UZAs must commit more monies from local resources than do mid-size and small UZAs, which have far less transit infrastructure.

Exhibit 35

Distribution of Capital Funds by UZA Size and Source
1992



Uses of Capital Funds

For the 1992 reporting year, reporters identified uses of capital funds by mode and category of use. The categories of use are rolling stock, facilities, and other capital.

Rolling stock includes revenue vehicles used in providing transit service for passengers. Rolling stock expenditures include the acquisition of new and replacement revenue vehicles, as well as major components and parts necessary for returning a revenue vehicle to an operable condition. They also include expenditures for rehabilitation, overhaul or remanufacture of revenue vehicles.

Facilities projects include expenditures for design and construction of new maintenance facilities; rehabilitation of maintenance facilities; passenger and passenger service facilities such as: transit malls, transfer facilities, intermodal transit terminals, stations, depots, passenger shelters, park-n-rides, high occupancy vehicle (HOV) lanes, and transit rights-of-way; purchase and installation of service and operational support equipment; and rail-related items such as track, signals and communications, power equipment and substations, and other line equipment and structures.

Other capital expenditures include items such as: service vehicles, general administration facilities, furniture, equipment not an integral part of buildings and structures, data processing equipment, fare collection equipment, and revenue vehicle movement control equipment (radios).

Exhibit 36 outlines the uses of capital funds by mode and category of use. Fifty-six percent of capital investment is in the form of facilities-related expenditures, whereas only 23 percent is expended for rolling stock. Forty-two percent of capital investment in bus systems is dedicated to rolling stock, whereas 37 percent is expended on facilities. Demand response demonstrates 43 percent of capital investment in rolling stock, and a substantially smaller investment in facilities of only 15 percent of demand response capital investment. Bus systems rely heavily on their revenue vehicles remaining operable, serving riders in a variety of climate and traffic conditions. Buses operate over relatively large geographic areas with many dispersed sites where passengers board and alight. Thus, bus systems are not necessarily required to provide extensive passenger facilities. Rolling stock is a fundamental element of bus service while the facilities required beyond vehicle maintenance facilities, such as passenger shelters, park-n-rides, and transfer facilities do not demand equally substantial investments. As for demand response systems, revenue vehicles are also the fundamental capital element, and facilities investment beyond vehicle maintenance and storage facilities is small, as riders are transported door to door. Substantial investment in other capital items is reflective of the data processing and other support items necessary to scheduling and routing service to passengers.

The emphasis on investment in facilities is most evident upon review of the rail modes. Fifty-four percent of the capital investment by heavy rail systems is in facilities, while facilities account for 72 percent of commuter rail capital investment and 77 percent of light rail investment is in facilities. Again, the nature of rail systems drives the categories of use to which capital investment is made. Passenger facilities in the form of stations, depots, intermodal transfer facilities, and parking facilities require an investment far more substantial for rail modes because of the collection of large groups of riders at selected boarding/alighting sites, typically during finite periods of

Uses of Capital Funds by Mode (Millions) **Exhibit 36**
1992

	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response	Other	Total
Rolling Stock	$543.6	$260.5	$277.5	$68.9	$22.8	$47.8	$1,221.1
Facilities	480.3	1,116.8	836.8	358.4	8.2	165.6	$2,966.1
Other Capital	272.2	677.8	44.8	39.8	22.4	18.2	$1,075.2
Total	$1,296.1	$2,055.1	$1,159.1	$467.1	$53.4	$231.6	$5,262.4

demand for rail service. The need for a specially equipped right-of-way with tracks and wayside equipment requires even greater investment in facilities by rail systems. Also, the high level of technology involved in the safe and efficient movements of trains, and the necessary physical structures required to power the trains, also demand substantial continuing investment.

Exhibit 37 demonstrates the largest 20 users of capital funds and reflects the substantial investment in rail facilities.

Exhibit 37

Twenty Largest Investors of Capital Funds (Thousands)
1992

System Name	Rolling Stock	Facilities	Other	Total
NY-MTA-NYCTA	$109,360	$256,920	$538,488	$904,768
Boston-MBTA	74,375	241,925	22,767	339,067
Chicago-RTA-Metra	148,428	130,442	9,952	288,822
Chicago-RTA-CTA	127,638	113,370	27,482	268,490
Washington-WMATA	16,579	179,336	64,566	260,481
Philadelphia-SEPTA	36,458	209,586	387	246,432
Baltimore-MDOT	38,458	156,468	10,963	205,888
NY-MTA-LIRR	7,945	161,737	20,540	190,222
LA-LACMTA / SCRTD	15,738	162,361	11,096	189,195
New Jersey Transit	37,510	107,905	26,415	171,829
NY-MTA-Metro-North	21,063	113,785	7,173	142,021
San Francisco-BART	931	117,718	11,379	130,028
Atlanta-MARTA	310	123,423	5,714	129,447
Miami-MDTA	14,408	77,118	18,690	110,215
SF-SamTrans	4,248	3,099	91,810	99,156
Houston-Metro	17,997	37,759	15,691	71,448
Seattle Metro	9,235	31,804	16,900	57,939
San Francisco-Muni	18,532	34,415	1,430	54,377
NY-Port Authority-PATH	0	47,098	7,017	54,115
Pittsburgh-PAT	28,374	13,638	2,218	44,230
Total	$727,588	$2,319,905	$910,675	$3,958,168

Exhibit 38

Uses of Capital Funds of Individual Bus Systems (Thousands)
1992

System Name	Rolling Stock	Facilities	Other	Total
NY-MTA-NYCTA	$11,051.9	$70,796.1	$2,462.7	$84,310.7
LA-LACMTA / SCRTD	9,104.4	8,413.0	6,473.3	23,990.7
Chicago-RTA-CTA	4,387.4	16,565.8	13,744.6	34,697.8
New Jersey Transit	2,698.0	28,021.4	20,328.9	51,048.3
Washington-WMATA	11,424.5	9,172.2	4,770.6	25,367.3
Philadelphia-SEPTA	12,970.1	2,976.7	203.1	16,149.9
Seattle-Metro	1,683.9	28,937.2	7,771.5	38,392.6
Minneapolis-St. Paul MTC	6,811.1	2,999.6	710.8	10,521.5
Houston-Metro	17,997.4	37,759.1	15,691.0	71,447.5
Boston-MBTA	26,982.1	12,380.6	0.0	39,362.7
Pittsburgh-PAT	28,374.3	13,637.8	0.0	42,012.1
Baltimore-MDOT	10,212.3	2,130.9	193.2	12,536.4
Cleveland-RTA	14,975.3	4,575.4	3,944.5	23,495.2
Oakland-AC Transit	13,765.9	591.8	866.5	15,224.2
Atlanta-MARTA	166.7	3,529.5	1,865.8	5,562.0
Total	$172,605.3	$242,487.1	$79,026.5	$494,118.9
Percent of National Bus Total	31.8%	50.5%	29.0%	33.2%

Exhibits 38 through 43 provide capital investment information for individual systems by category of use by each mode except demand response. The 15 largest bus systems found in **Exhibit 38** reflect a greater investment of their capital funds in facilities (over 50 percent combined) than bus systems do in total.

Uses of Capital Funds of Individual Heavy Rail Systems **Exhibit 39**
1992

System Name	Rolling Stock (000s)	Facilities (000s)	Others (000s)	Total (000s)
NY-MTA-NYCTA	$98,308.4	$186,123.4	$536,025.7	$820,457.5
Chicago-RTA-CTA	122,800.3	96,804.2	13,737.4	233,341.9
Washington-WMATA	5,154.6	170,163.7	59,795.3	235,113.6
San Francisco-BART	930.7	117,718.2	11,379.3	130,028.3
Boston-MBTA	5,382.2	43,242.5	22,766.5	71,391.2
Philadelphia-SEPTA	18,844.2	89,883.6	183.8	108,911.7
NY-Port Authority-PATH	0.0	47,098.0	7,017.0	54,115.0
Atlanta-MARTA	143.4	119,893.6	3,847.7	123,884.7
Philadelphia-PATCO	839.6	2,090.6	118.1	3,048.3
Miami-MDTA	0.0	2,569.7	3,026.3	5,596.0
Baltimore-MDOT	942.8	70,831.7	1,485.6	73,260.1
NY-MTA-SIRTOA	213.6	4,566.0	0.0	4,779.6
Cleveland-RTA	543.6	10,813.4	699.0	12,056.0
LA-LACMTA/SCRTD*	6,633.5	153,947.8	351.0	160,932.9
Total	$260,736.9	$1,115,746.4	$660,432.7	$2,036,916.8

* Has not commenced operation.

Uses of Capital Funds of Individual Commuter Rail Systems **Exhibit 40**
1992

System Name	Rolling Stock (000s)	Facilities (000s)	Other (000s)	Total (000s)
NY-MTA-LIRR	$7,944.5	$161,737.0	$20,540.0	$190,221.5
NY-MTA-Metro-North	21,063.3	113,784.7	7,172.7	142,020.7
New Jersey Transit	34,812.1	79,883.3	5,569.5	120,264.9
Chicago-RTA-Metra	148,427.9	130,442.3	9,951.6	288,821.8
Boston-MBTA/Amtrak	28,140.7	129,706.8	0.0	157,847.5
Philadelphia-SEPTA	3,443.2	114,655.4	0.0	118,098.6
Baltimore-MARC	14,340.1	11,224.2	0.0	25,564.3
SF-CALTRANS	0.0	9,740.8	0.0	9,740.8
NW IN-NICTD	15,408.1	206.5	476.3	16,090.9
Philadelphia-Penn-DOT	(a)	(a)	(a)	0.0
Ft. Lauderdale-TCRA	3,961.7	6,032.7	1,072.0	11,066.4
LA-CALTRANS	(a)	(a)	(a)	0.0
Hartford-Conn-DOT	0.0	67,266.7	0.0	67,266.7
LA-OCTA	(a)	(a)	(a)	0.0
Total	$277,541.6	$824,680.4	$44,782.1	$1,147,004.1

(a) Lease of AMTRAK rolling stock and facilities through purchased transportation agreement.

Exhibit 41

Uses of Capital Funds of Individual Light Rail Systems
1992

System Name	Rolling Stock (000s)	Facilities (000s)	Other (000s)	Total (000s)
Boston-MBTA	$13,870.3	$50,031.9	$0.0	$63,902.2
Philadephia-SEPTA	1,200.8	2,070.7	0.0	3,271.5
San Francisco-Muni	15,767.7	10,504.0	374.3	26,646.0
Pittsburgh-PAT	0.0	0.0	0.0	0.0
San Diego-The Trolley	0.0	0.0	0.0	0.0
San Jose-SCCTD	0.0	23,415.3	0.0	23,415.3
Sacramento-RT	0.0	8,852.6	1,106.8	9,959.4
LA-SCRTD	0.0	0.0	4,130.8	4,130.8
Cleveland-RTA	393.6	2,557.0	517.6	3,468.2
Buffalo-NFTA	0.0	117.6	0.0	117.6
Portland-Tri-Met	1,588.5	1,259.0	11,418.2	14,265.7
New Orleans-RTA	0.0	0.0	0.0	0.0
New Jersey Transit	0.0	0.0	516.2	516.2
Baltimore-MDOT	27,302.7	83,505.1	9,284.1	120,091.9
Seattle-Metro	164.2	175.1	8,475.4	8,814.7
Galveston-Island Transit (PT)	0.0	1.1	121.2	122.3
Denver - RTD*	8,577.7	9,889.7	0.0	18,467.4
Memphis - MATA*	0.0	20,316.2	0.0	20,316.2
St. Louis - Bi-State*	0.0	137,278.1	3,798.0	141,076.1
Total	$68,865.5	$349,973.4	$39,742.6	$458,581.5

* Revenue operation to start after 1992

Exhibit 42

Uses of Capital Funds of Individual Trolleybus Systems
1992

System Name	Rolling Stock (000s)	Facilities (000s)	Other (000s)	Total (000s)
San Francisco-Muni	$2,530.6	$18,955.0	$352.8	$21,838.9
Seattle-Metro	1,617.3	2,691.7	650.5	4,959.5
Philadelphia-SEPTA	0.0	0.0	0.0	0.0
Dayton-RTA	182.0	984.9	294.1	1,461.0
Boston-MBTA	0.0	6,563.1	0.0	6,563.1
Total	$4,329.9	$29,194.7	$1,297.4	$34,822.5

Exhibit 43

Uses of Capital Funds of Individual Ferryboat Systems
1992

System Name	Rolling Stock (000s)	Facilities (000s)	Other (000s)	Total (000s)
Seattle-Washington DOT	$20,729.4	$19,710.0	$2,227.8	$42,667.2
Boston-MBTA	0.0	3,281.5	0.0	3,281.5
San Juan Port Authority	0.0	1,900.8	0.0	1,900.8
New Orleans-Cresent City	0.0	453.2	0.0	453.2
SF-Golden Gate	0.0	0.0	360.3	360.3
New York City DOT	1,031.6	14,647.6	0.0	15,679.2
Portland-CBL	0.0	90.4	0.0	90.4
NY-Port Authority-PATH	0.0	0.0	0.0	0.0
Hartford-Conn-DOT	0.0	0.0	0.0	0.0
Oakland-AOFS	0.0	979.0	7.8	986.8
Norfolk-TRT	0.0	0.0	42.7	42.7
Tacoma-Pierce Ferry	247.4	0.0	0.0	247.4
Oakland Vallejo-Transit	0.0	0.0	0.0	0.0
Bremerton-Kitsap Transit	0.0	0.0	0.0	0.0
Total	$22,008.4	$41,062.5	$2,638.6	$65,709.5

Current Infrastructure: Fixed Guideway Characteristics

Exhibit 44 reflects the amount of fixed guideway miles by mode, and demonstrates the continuing investment in the development of fixed guideway systems. Both exclusive and controlled access rights-of-way are included. The investment in fixed guideway systems is most prominent for bus, which has increased fixed guideway miles by 32 percent since 1989; in light rail, which has increased by 19 percent since 1989; and in commuter rail, which has grown by eight percent since 1989. The 20 bus systems with the greatest amount of fixed guideway miles displayed in **Exhibit 45** account for nearly 78 percent of bus fixed guideway in the nation.

Exhibit 44

Fixed Guideway Miles by Mode
1989-1992*

Mode	1989	1990	1991	1992
Bus**	757.1	796.5	816.4	998.3
Heavy Rail	1,350.6	1,350.6	1,368.7	1,403.2
Commuter Rail	4,912.8	5,093.9	5,056.3	5,306.7
Light Rail	472.7	487.3	556.0	562.9
Demand Response	-	-	-	-
Other - Ferryboat	898.0	469.6	454.1	459.0
- Trolleybus	385.3	359.5	375.9	394.5
- All other	18.8	19.0	24.1	20.7
Total	8,795.3	8,576.4	8,651.5	9,145.3

* Data for 1988 not complete.
** Exclusive plus Controlled Access Rights-of-Way.

Exhibit 45

Miles of Fixed Guideway for Selected* Bus Systems
1992

System Name	Exclusive Directional Route Miles	Controlled Access-Directional Route Miles	Total Fixed Directional Route Miles
Houston - Metro	93.0	4.0	97.0
San Jose - SCCTD	0.0	94.2	94.2
Phoenix - Phoenix TS/ATC	76.9	0.0	76.9
Seattle Metro	50.6	14.7	65.3
Minneapolis - St Paul - MTC	52.0	0.0	52.0
Pittsburgh - PAT	41.3	0.0	41.3
Washington - WMATA	0.0	39.3	39.3
NY - MTA - NYCTA	1.5	34.3	35.8
New York City DOT	1.5	34.3	35.8
Norfolk - TRT	0.0	27.5	27.5
NJ Transit	0.0	27.0	27.0
LA - LACMTA/SCRTD	24.5	0.0	24.5
LA - Foothill Transit	24.0	0.0	24.0
San Bernardino - OMNITRANS	23.0	0.0	23.0
Honolulu - DOT	1.2	20.0	21.2
SF - Golden Gate	0.0	20.5	20.5
Hartford Conn DOT	19.0	0.0	19.0
Dallas - DART	8.8	9.3	18.1
San Juan - MBA	17.1	0.0	17.1
San Diego Transit	15.6	0.5	16.1
Subtotal	450.0	325.6	775.6
All Other Systems	82.9	139.8	222.7
Total	532.9	465.4	998.3

* Twenty systems with the greatest amount of total fixed guideway directional route miles.

Vehicle Availability

Exhibit 46 shows the number of vehicles available in maximum service by mode and type of service. The use of purchased transportation is evident in bus and especially in demand response, where over 70 percent of the vehicles available in maximum service are operated by purchased transportation providers.

Exhibit 46

Vehicles Available for Maximum Service by Mode and Type of Service
1992

Mode	Directly Operated	Purchased Transportation	Total
Bus	50,009	3,676	53,685
Heavy Rail	10,236	-	10,236
Commuter Rail	4,230	652	4,882
Light Rail	1,059	4	1,063
Demand Response	3,069	11,095	14,164
Other	2,019	245	2,264

Spare Ratio

Exhibit 47 reflects the relative stability of spare ratios for each mode since 1988. Light rail displays the highest spare ratio of the modes at 32.4 percent, while commuter rail has the lowest at 17.6 percent. Bus, heavy rail, and demand response are at 22.5 percent, 25.1 percent, and 25.5 percent, respectively.

Exhibit 47

Spare Ratio by Mode for Directly Operated Service
1988-1992

Mode	1988	1989	1990	1991	1992
Bus	23.6%	22.1%	23.0%	24.1%	22.5%
Heavy Rail	26.3	26.4	23.6	25.5	25.1
Commuter Rail	17.8	19.6	16.7	16.9	17.6
Light Rail	37.9	31.5	35.6	25.3	32.4
Demand Response	28.3	37.4	24.7	25.4	25.5

Average Fleet Age

Exhibit 48 indicates that since 1988, the average fleet age for heavy rail and commuter rail have remained relatively steady at 17.8 years and 18.5 years, respectively. For bus, light rail, and demand response, average fleet age has been reduced considerably. Average bus fleet age was 8.3 years in 1992 compared to 11 years in 1988. For light rail, it was 17.1 years in 1992 versus 22 years in 1988. And for demand response, it was 3.4 years in 1992 while it was seven years in 1988.

Exhibit 48

Average Fleet Age by Mode for Directly Operated Service
1992

Mode	1988	1989	1990	1991	1992
Bus	11.0	10.0	9.0	8.0	8.3
Heavy Rail	18.0	17.0	17.0	17.0	17.8
Commuter Rail	19.0	20.0	18.0	17.0	18.5
Light Rail	22.0	17.0	16.0	16.0	17.1
Demand Response	7.0	5.0	4.0	4.0	3.4

Non-Fixed Guideway Vehicles

Exhibit 49 indicates that nearly 88 percent of vehicles operated in bus service are high-capacity coaches seating greater than 35 passengers. In contrast, about 42 percent of demand response vehicles are vans, while over 36 percent are automobiles. Also, more than 93 percent of bus mode vehicles are directly operated, while over 77 percent of demand response vehicles are operated by purchased transportation providers.

Non-Fixed Guideway Vehicles by Vehicle Type, Mode, and Type of Service
1992

Exhibit 49

Vehicle Type	Bus		Demand Response	
	Directly Operated	Purchased Transportation	Directly Operated	Purchased Transportation
Class A Bus (>35 Seats)	44,148	2,431	4	0
Class B Bus (25-35 Seats)	2,675	362	104	60
Class C Bus (<25 Seats)	952	408	109	48
Articulated Bus	1,691	3	1,148	1,190
School Bus	0	76	28	61
Van	42	249	1,416	3,916
Automobile	0	57	68	4,583
Total	49,508	3,586	2,877	9,858

Exhibit 50 demonstrates that while other forms of propulsion are growing in acceptance, diesel fuel-powered vehicles and gasoline-powered vehicles still account for 82 percent and 17 percent, respectively, of all non-fixed guideway vehicles. Other means of propulsion, including electricity, liquified natural gas, compressed natural gas, and liquified petroleum gas, account for the remaining one percent.

Non-Fixed Guideway Vehicles by Vehicle Type and Propulsion
1992

Exhibit 50

Vehicle Type	Diesel Fuel	Gasoline	Other	Total
Class A Bus (>35 Seats)	45,976	15	364	46,355
Class B Bus (25-35 Seats)	3,089	81	9	3,179
Class C Bus (<25 Seats)	2,349	1,194	153	3,696
Articulated Bus	1,698	0	0	1,698
School Bus	128	12	25	165
Van	1,343	5,385	221	6,949
Automobile	0	4,512	46	4,558
Total	54,583	11,199	818	66,600

New Vehicles Acquired

Exhibit 51 outlines the new vehicles acquired in 1992. Nearly 53 percent are accounted for by bus, whereas over 21 percent are demand response vehicles. The three rail modes combined account for approximately five percent of the acquisition. Other modes account for the remaining 21 percent.

Exhibit 51 *New Vehicles Acquired by Mode and Type of Service 1992*

Mode	Directly Operated	Purchased Transportation	Total
Bus	994	165	1,159
Heavy Rail	54	-	54
Commuter Rail	32	0	32
Light Rail	20	0	20
Demand Response	174	298	472
Other	390	69	459
Total	1,664	532	2,196

Exhibit 52 provides yet another perspective on fleet age. Each of the vehicle types enjoys a different, useful life greatly influenced by use, weather, road conditions, maintenance practices, and local policies regarding rehabilitation and overhaul. Thus, the decline in average age is reflected in the number of standard buses, small buses, and vans that are five years of age or less, while the longer, useful lives of heavy rail, commuter rail, and light rail vehicles are reflected by the large number that are more than 15 years old.

Exhibit 52 *Vehicles by Age and Vehicle Type (Directly Operated Service) 1992*

Vehicle Type	Age in Years						Total
	5 Years or Less	6-11 Years	12-15 Years	16-20 Years	21-25 Years	Over 26 Years	
Buses	16,230	20,624	7,308	3,014	910	510	48,596
Heavy Rail	781	2,949	566	1,631	1,190	3,031	10,148
Commuter Rail	544	452	515	1,206	821	902	4,440
Light Rail	285	199	343	29	0	182	1,038
Van/Auto	1,940	698	32	4	0	5	2,679
Total	19,780	24,922	8,764	5,884	2,921	4,630	66,901

Chapter 4
Operating Funding and Expenses

Introduction

This chapter discusses patterns and trends of funding and expenditures for transit operations. Sources and levels of such funding are outlined, as are general trends in the nature of operating funding and expenses. Operating expenses are presented and discussed by mode and object class. Performance measures regarding the cost effectiveness of operations are also provided.

Chapter Organization

The chapter opens with a review of the various funding sources (Federal, State, and local assistance, as well as passenger fare revenues). Operating expenses are then presented by mode and object class. Finally, performance indicators are offered measuring cost effectiveness of transit services. Current year and five-year data are presented.

Operating Funding

Operating funds include Federal, State, and local financial assistance dedicated to subsidizing the cost of operating transit services, as well as all categories of passenger fare revenues. Federal funds include general grants of operating assistance funds under Section 9 as well as other grants that have an operating assistance component. State funds include direct operating grants and assistance to transit agencies to encourage reduced fares for the elderly and physically challenged. Local assistance incorporates funds available from dedicated taxes (property, sales, income or other), tolls and fees, and other non-fare-based revenue sources such as concessions and advertising.

Sources of Operating Funding

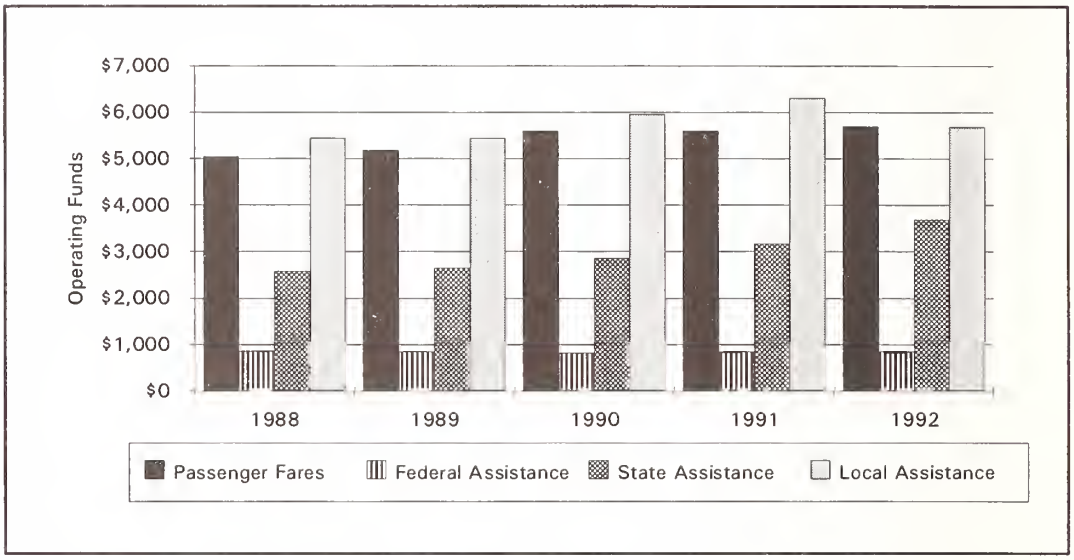
As shown in **Exhibit 53**, passenger fares and local funds compose the bulk of operations funding. In 1992, each contributed slightly less than 36 percent of the available funds for transit operations. State operating assistance accounted for approximately 23 percent, while Federal funds supplied slightly over five percent. While actual dollars have increased each year by source except Federal since 1988, the proportion of funding from each source has remained fairly stable, though State assistance has grown larger in proportion.

Since 1988, the proportion of operating funds realized through passenger fares has declined slightly from 39 percent to 35.8 percent. Local assistance has declined slightly as well as a proportion of operating funds, from 39 percent in 1988 to 35.7 percent in 1992. The proportion of operating funds realized from Federal sources

has declined slightly as well, from 6.2 percent in 1988 to 5.3 percent in 1992. In contrast, the proportion of operating funds accounted for by State assistance has increased from 18.5 percent in 1988 to 23.1 percent in 1992.

Exhibit 53

Sources of Operating Funds (Millions)
1988-1992



Total Operating Expense

Exhibit 54 outlines the distribution of transit operations funding from the various sources available by size of urbanized area. While the general trend in transit operations funding has been toward a decreased role for Federal funding and increases from other sources, there is a variation among the different sizes of urbanized areas. For urbanized areas under 200,000, Federal assistance was four percent greater in 1992 than in 1988. However, the other sources of operating funds increased at more dramatic rates. State assistance increased by 38 percent from 1988 to 1992 and local increased by nearly 17 percent. Thus, while Federal assistance accounted for 20 percent of operating funds for small urbanized areas in 1992, it accounted for nearly 23 percent in 1988.

The same trend is seen with urbanized areas of 200,000 to one million residents, but the increases in State and local assistance are more significant. Federal assistance is nearly four percent greater in 1992 than in 1988, but State assistance is approximately 70 percent greater and local assistance 36 percent more. Federal assistance accounted for 12 percent of operating funds in 1992 as compared to over 15 percent in 1988.

With the large urbanized areas of over one million residents, Federal operating assistance is slightly over three percent less in 1992 than in 1988. State assitance was 43 percent greater in 1992 than in 1988, while local assistance was five percent greater. Federal assistance has, however, represented a relatively consistent portion of overall operating funding, accounting for slightly more than four percent of operating funds in 1992, and slightly less than five percent in 1988.

Exhibit 54

Sources of Operating Funds by UZA Size (Millions)
1992

UZA Size	Year	Passenger Fares	Federal Assistance	State Assistance	Local Assistance	Other	Total
	1988	$87.2	$93.1	$81.9	$130.5	$17.2	$409.9
Under	1989	89.6	97.5	85.3	142.8	18.6	$433.8
200,000	1990	86.9	88.3	92.2	132.6	17.9	$417.9
	1991	93.3	91.7	107.2	140.5	19.8	$452.5
	1992	96.7	97.0	113.2	152.2	24.6	$483.7
	1988	268.4	159.4	136.8	425.6	41.5	$1,031.7
200,000 to	1989	280.8	160.8	144.5	461.1	47.8	$1,095.0
1 Million	1990	288.7	159.5	172.7	472.7	43.4	$1,137.0
	1991	305.6	168.6	270.3	509.6	46.2	$1,300.3
	1992	303.6	165.4	232.5	579.5	49.7	$1,330.7
	1988	4,689.8	605.6	2,354.5	4,036.4	787.8	$12,474.1
Over	1989	4,814.0	588.1	2,418.6	4,011.5	756.3	$12,588.5
1 Million	1990	5,216.7	573.7	2,593.4	4,462.5	833.5	$13,679.8
	1991	5,200.6	589.7	2,796.0	4,741.5	863.1	$14,190.9
	1992	5,297.0	586.7	3,335.0	4,100.9	773.9	$14,093.5
	1988	$5,045.4	$858.1	$2,573.2	$4,592.5	$846.5	$13,915.7
Total	1989	$5,184.5	$846.3	$2,648.5	$4,615.3	$822.7	$14,117.2
Dollars	1990	$5,592.5	$821.5	$2,858.2	$5,067.7	$894.8	$15,234.6
	1991	$5,599.4	$850.0	$3,173.5	$5,391.7	$929.1	$15,943.7
	1992	$5,697.3	$849.1	$3,680.6	$4,832.6	$848.2	$15,907.8

Passenger fares increased at a similar rate between 1988 and 1992 across all urbanized areas. For small urbanized areas, the increase was approximatley 11 percent, while for mid-size urbanized areas it was nearly 13 percent. For large urbanized areas, passenger fares increased by approximately 12 percent. For small and large urbanized areas, the portion of operating funds realized via passenger fares has remained relatively stable between 1988 and 19992. For small urbanized areas, it represents about 20 percent of operating funds, while for large urbanized areas, passenger fares repesent nearly 38 percent of operating funds. For mid-size urbanized areas, however, passenger fares as a portion of operating funds was 23 percent in 1992 compared to 27 percent in 1988.

Operating expenses totalled nearly $15.5 billion in 1992. This is less than the $15.9 billion in operating funds reported, because of reconciling items that are reported but vary in treatment as a result of local ordinances and conditions. These items are used to reconcile Section 15 expenses with public financial reports. Included are such items as depreciation, amortization, interest expense, and base payments.

Operating expenses increased by approximately 5.5 percent, on average each year from 1988 to 1991, as seen in **Exhibit 55**. The Cost Price Index (CPI) increased on average 4.6 percent for the same period. However, in 1992, operating expenses increased by less than one percent from 1991, while the CPI increased by 2.9 percent. **Exhibit 55** also demonstrates the dramatic 67.3 percent increase that occurred in demand response operating expenses in the 1988-1992 period, as well as the substantial 31.4 percent growth of light rail operating expenses during this time. During this period, the number of reporters for demand response increased. Also, the amount of demand response and light rail services grew significantly. Vehicle revenue miles of demand response service increased by 57 percent and light rail vehicle revenue miles grew by 40 percent in the 1988-1992 period.

Exhibit 55

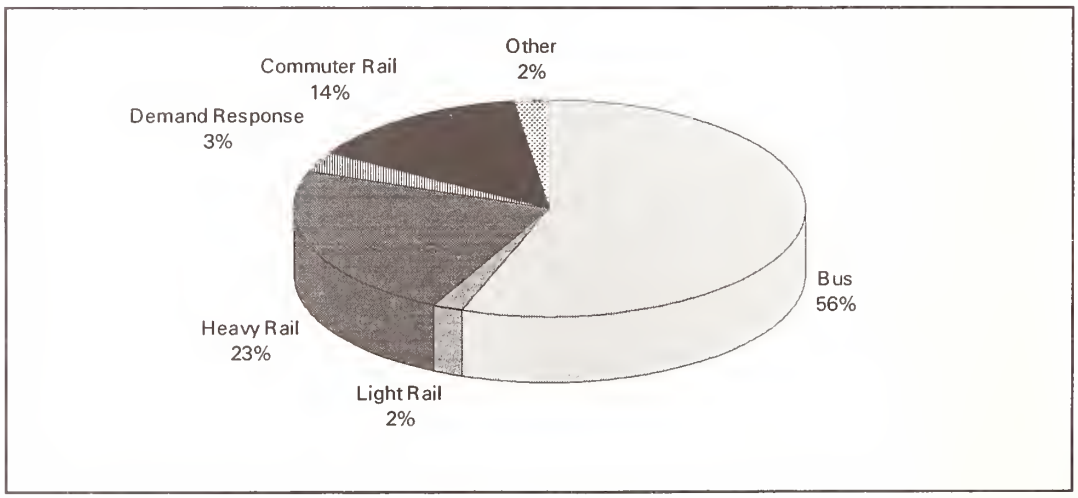
Operating Expense by Mode (Millions)
1988-1992

Mode	1988	1989	1990	1991	1992	Difference 1988-1992
Bus	$6,995	$7,295	$7,789	$8,330	$8,625	23.3%
Heavy Rail	3,524	3,704	3,825	3,841	3,555	0.9%
Commuter Rail	1,889	2,068	2,157	2,175	2,170	14.9%
Light Rail	197	209	236	290	307	55.8%
Demand Response	252	323	386	443	500	98.4%
Other	261	284	323	325	342	31.0%
Total	$13,118	$13,883	$14,716	$15,404	$15,499	18.2%

Exhibit 56 reflects the dominance of bus services, which accounted for nearly 56 percent of 1992's total operating expense. Heavy rail consumed 23 percent and commuter rail represents 14 percent. Demand response and light rail, while increasing in the amount of service supplied and in operating expense, represent only 3.2 percent and two percent, respectively, of 1992's total operating expenses.

Exhibit 56

Share of Total Operating Expense by Mode
1992



Object Classes and Functions

Operating expense is delineated by object class and function. An object class is a grouping of expenses based on goods or services purchased. The ten object classes used for reporting are:

- Labor
- Fringe Benefits
- Services
- Materials and Supplies
- Utilities
- Casualty and Liability Costs
- Taxes
- Purchased Transportation
- Miscellaneous Expense
- Expense Transfers

A function represents the activities associated with accomplishing a certain task. There are four functional categories used for reporting:

- Vehicle Operations
- Vehicle Maintenance
- Non-vehicle Maintenance
- General Administration

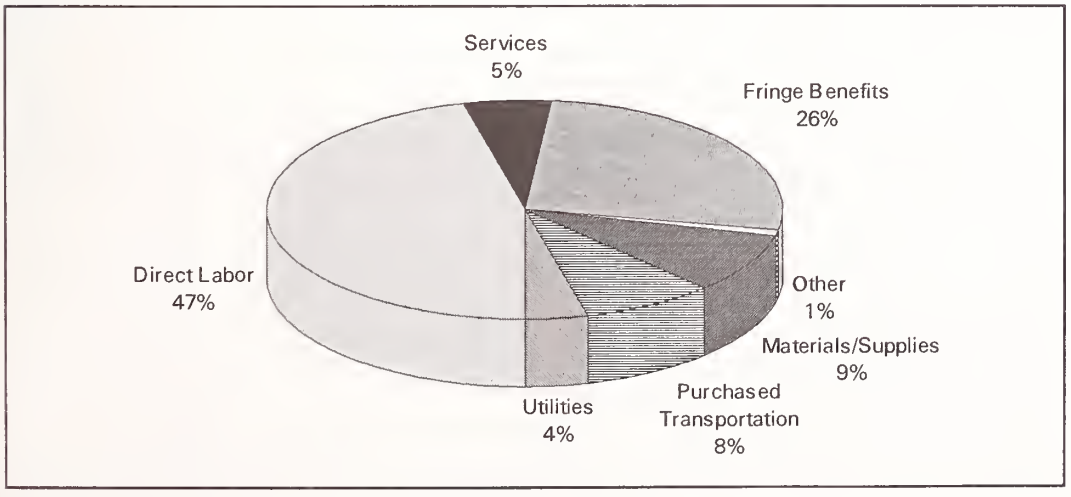
For the *NTST*, casualty and liability costs, taxes, miscellaneous expense, and expense transfers are grouped together as Other when operating expense by object class is discussed. Operating expense by object class and function are compared by mode.

Operating Expense by Object Class

Labor and fringe benefits are the two largest classes of operating expense. As seen in **Exhibit 57**, the two classes total nearly 73 percent of operating expense, indicative of the labor-intensive nature of the transit industry and underscoring the industry's sensitivity to labor cost increases.

Exhibit 57

Share of Total Operating Expense by Object Class
1992



Materials and supplies incorporate fuel and lubricants, tires and tubes, and other miscellaneous materials and supplies. This object class consumed 9.1 percent of operating expense.

Purchased transportation includes payments or accruals to providers operating transit service under contract to transit agencies, fare revenues the providers retain, and any other contract related costs incurred by the purchasing transit agency such as contract administration, customer information services, advertising, fuel, or vehicle maintenance. Purchased transportation absorbed 8.2 percent of operating expenses.

The services object class includes professional and technical services such as legal or audit fees and contracted services such as grounds maintenance or security. Services account for 5.3 percent of operating expense. Utilities represent 3.8 percent of operating expense. These are costs associated with electricity (used to propel transit vehicles), as well as general building and station utilities. Other expenses comprise all remaining object classes accounting for less than one percent of operating expense combined.

Because of a reporting change in 1992, joint expenses (those attributable to more than one mode) must be fully allocated by function and object class by modes. Prior to 1992, joint expenses were allocated by function only. Subsequently, historical analysis of operating expense by object class and by function are not presented in this document.

Operating Expense by Mode and Object Class

Exhibit 58 shows how operating expense is distributed by object class, for lack mode. Direct labor and fringe benefits represent the largest classes of expense for all modes except demand response. With demand response, the significant role of purchased transportation is demonstrated by the 69 percent of demand response operating expense attributable to this object class. As directly operated service is a much smaller portion of demand response operations, direct labor and fringe benefits account for much smaller portions of operating expense than with other modes. Combined, direct labor and fringe benefits account for only 22.5 percent of demand response operating expenses.

Exhibit 58

Operating Expense by Mode and Object Class (Millions)
1992

Object Class	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response	Other
Direct Labor	$4,058.9	$1,956.1	$779.1	$139.3	$80.4	$175.9
Fringe Benefits	2,171.6	1,152.4	587.1	79.6	32.3	72.8
Materials and Supplies	940.1	226.4	168.4	20.5	17.2	32.8
Purchased Transportation	652.7	0.0	260.8	0.0	344.3	11.5
Utilities	109.0	308.7	136.9	26.0	2.4	7.9
Services	393.1	168.8	189.8	35.7	12.6	27.1
Other	299.7	-257.4	47.6	6.1	10.7	13.7
Total	$8,625.1	$3,555.0	$2,169.7	$307.2	$499.9	$341.7

Materials and supplies account for nearly 11 percent of bus operating expense, significantly more than materials and supplies expense for the other modes. Diesel fuel

costs, tires, and other general vehicle maintenance items that bus service commands explain why bus accounted for 67 percent of materials and supplies expense for all modes combined. A negative amount appears for Other expenses for heavy rail due to expense transfers by the major heavy rail operator from operating to capital, as noted earlier.

Operating Expense by Function and Object Class

Exhibit 59 presents operating expense by function and object class, demonstrating how operating expense is spread over the various functions and how the allocations to object classes vary by function.

The labor-intensive nature of vehicle operations and maintenance functions as compared to general administration is reflected by the significant portions of cost for these functions attributed to direct labor and fringe benefits. Seventy-nine percent of vehicle operations expense is consumed by direct labor and fringe benefits, while 74 percent of vehicle maintenance and 78 percent of non-vehicle maintenance expense

Exhibit 59

Operating Expense by Function and Object Class (Millions)
1992

Object Class	Vehicle Operation	Vehicle Maintenance	Non-Vehicle Maintenance	General Administration
Direct Labor	$4,050.7	$1,376.0	$868.8	$894.4
Fringe Benefits	2,201.0	780.0	519.3	595.4
Materials and Supplies	492.6	639.7	183.2	89.9
Purchased Transportation	794.5	17.4	8.8	448.6
Utilities	179.7	12.9	243.9	154.6
Services	147.8	124.4	153.5	401.3
Other	40.8	-48.0	-204.5	331.8
Total	$7,907.1	$2,902.4	$1,773.0	$2,916.0
Percent of Total Expense	51.0%	18.7%	11.5%	18.8%

are so consumed. In contrast, only 51 percent of general administration expense is absorbed by direct labor and fringe benefit costs. This is not only due to the difference in the labor intensiveness between the general administration function and the other functions, but is also indicative of the higher wages commanded by technicians, mechanics and operators (typically negotiated through collective bargaining agreements) versus those wages realized by clerical employees.

General administration reflects much greater proportions of costs attributed to the services and other object classes than is found with the other functions. This is not unusual given that the level of services needed to support such administrative activities as legal services, finance and accounting, purchasing and stores, planning, marketing, and engineering is far greater than the level of services needed to support operations and maintenance functions.

Other expenses such as casualty and liability costs, taxes, interest payments, depreciation, and leases and rentals are also attributed to administrative activities. Thus, 25 percent of general administration expense is accounted for by services and other items, whereas these object classes account for very little operations and maintenance expense.

Purchased transportation accounts for ten percent of vehicle operations expense and slightly more than 15 percent of general administration cost, while accounting for less than one percent of vehicle and non-vehicle maintenance costs. This is the result of purchased transportation providers supplying service under contract typically with their own vehicles and personnel. Vehicle and facilities maintenance are part of the contract cost for operational service and are the responsibility of the purchased transportation providers. Thus, the bulk of the contract cost is allocated to vehicle operations. The proportion of general administrative costs attributable to purchased transportation accounts for the expense realized by transit agencies in procuring the transportation services, administering contracts, and providing planning, marketing, customer services, and advertising in support of such services.

Negative amounts appear in the other object classes for the maintenance functions due to expense transfers created by the adjustment and reclassification of previously recorded expenses to other functions. Also, expense transfers that resulted when non-operating costs temporarily credited to functions were ultimately capitalized are also incorporated into the other object class for purposes of the *NTST*. The vehicle and non-vehicle maintenance functions are more capital-intensive and thus more likely to experience capitalization of non-operating costs resulting in expense transfers.

Operating Expense by Function and Mode

As **Exhibit 60** shows, demand response has a much higher percentage of operating expense consumed by general administration than the other modes. This is because of the significant amount of service operated under contract. Also, the needs for customer service, scheduling, and data processing are very substantial and add to greater administrative expense. Forty-one percent of operating expense for demand response is consumed by general administration.

The rail modes, particularly heavy rail, demonstrate substantial levels of facilities and wayside maintenance required as compared to other modes. Twenty-eight point five percent of heavy rail operating expense is attributable to non-vehicle maintenance while only 15.8 percent is accounted for by vehicle maintenance. In contrast, 20 percent of bus operating expense is consumed by vehicle maintenance while less than four percent is expended for non-vehicle maintenance. This is yet another indication that passenger facilities and wayside equipment necessary to rail operations are not components of bus service.

Exhibit 60

Operating Expense by Function and Mode (Millions)
1992

Mode	Vehicle Operation	Vehicle Maintenance	Non-Vehicle Maintenance	General Administration	Total
Bus	$4,909.7	$1,724.1	$307.5	$1,683.8	$8,625.1
Heavy Rail	1,409.0	560.1	1,012.1	573.9	$3,555.1
Commuter Rail	992.4	470.8	363.7	342.8	$2,169.7
Light Rail	131.7	65.9	59.3	50.3	$307.2
Demand Response	263.5	26.5	2.9	206.9	$499.8
Other	200.8	55.0	27.5	58.3	$341.6
Total	$7,907.1	$2,902.4	$1,773.0	$2,916.0	$15,498.5

Chapter 5
Service Supplied and Consumed

Introduction

This chapter discusses general trends in service supplied and consumed, as well as measures of service effectiveness and efficiency based on certain performance indicators. The amount of service supplied is expressed in terms of the annual vehicle revenue miles and hours operated, as well as total vehicles made available for operating in passenger service. These measures offer an overview of the span, frequency, coverage area served, and capacity of transit services. Assessments of the efficiency of the services supplied are offered by examining operating expense per vehicle revenue mile. The service consumed is measured by annual passenger miles and unlinked passenger trips. Service effectiveness is measured by comparing passenger miles and unlinked passenger trips to the vehicle revenue miles and hours of service supplied. The cost effectiveness of service is measured by comparing unlinked passenger trips and passenger miles to operating expense.

Chapter Organization

The chapter commences with discussions of the service supplied and consumed by mode and type of service from 1988 to 1992. Performance measures are then presented to offer an assessment of the effectiveness and efficiency of the service supplied and consumed.

Vehicle Revenue Miles by Mode and Type of Service

As noted in **Exhibit 61**, over 2.5 billion vehicle revenue miles of transit service were supplied in 1992, ten percent of which were provided through purchased transportation. Fifty-eight and one half percent of the purchased service miles are accounted for by demand response, which supplied 71 percent of its service through purchased transportation.

Bus dominates the service supplied, as over 61 percent of vehicle revenue miles are attributable to bus service. Heavy rail accounts for 20 percent of the vehicle revenue miles operated.

Refer to Exhibit 2 of the Introduction for further explanation of Purchased Transportation Reported as Directly Operated

Exhibit 62 reflects the tremendous growth in service supplied for demand response and light rail. Annual vehicle revenue miles for demand response are 57 percent greater in 1992 than in 1988, and light rail revenue miles are over 38 percent higher than in 1988. Commuter rail has experienced a less substantial increase of nearly nine percent between 1988 and 1992, while bus and heavy rail have remained fairly stable with only 3.1 percent and 1.3 percent increases, respectively, in vehicle revenue miles since 1988.

Exhibit 61

Vehicle Revenue Miles by Mode and Type of Service (Millions)
1992

Mode	Directly Operated	Purchased Transportation	Total
Bus	1,465.9	90.0	1,555.9
Heavy Rail	509.7	0.0	509.7
Commuter Rail	187.3	12.6	199.9
Light Rail	27.8	0.0	27.8
Demand Response	60.4	148.1	208.5
Other	28.7	3.4	32.1
Total	2,279.8	254.1	2,533.9

Exhibit 62

Vehicle Revenue Miles by Mode (Millions)
1988-1992

Mode	1988	1989	1990	1991	1992
Bus	1,508.5	1,506.3	1,534.5	1,552.4	1,555.9
Heavy Rail	503.0	513.1	520.8	508.3	509.7
Commuter Rail	183.5	190.2	193.0	197.9	199.9
Light Rail	20.1	20.5	22.9	26.6	27.8
Demand Response	132.8	152.1	171.2	185.8	208.5
Other	27.0	23.0	24.2	27.8	32.2
Total	2,374.9	2,405.2	2,466.6	2,498.8	2,534.0

Vehicle Revenue Miles by UZA Size and Mode

Exhibit 63 reflects the significant number of vehicle revenue miles provided by the three rail modes in urbanized areas of over one million residents. The three rail modes combined account for 36 percent of vehicle revenue miles in large urbanized areas. Bus accounts for over 56 percent of vehicle revenue miles in large urbanized areas, while demand response provides nearly six percent. Demand response represents a much higher portion of vehicle revenue miles in small and mid-size urbanized areas, however. Demand response accounts for nearly 16 percent of the vehicle revenue miles operated in urbanized areas of 200,000 to one million residents, and 23 percent of vehicle revenue miles on urbanized areas of less than 200,000 residents.

Exhibit 63

Vehicle Revenue Miles by UZA Size and Mode (Millions)
1992

UZA Size	Mode						Total
	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response	Other	
Under 200,000	123.5	-	-	0.0	37.3	2.2	163.0
200,000 to 1 Million	288.8	-	0.3	0.9	54.7	5.1	349.8
Over 1 Million	1,143.6	509.7	199.6	26.9	116.5	24.8	2,021.1
Total	1,555.9	509.7	199.9	27.8	208.5	32.1	2,533.9

Vehicle Revenue Hours by Mode and Type of Service

Exhibit 64 offers the vehicle revenue hours supplied. Bus accounts for 71.5 percent of the hours operated. Heavy rail and commuter rail account for 13.7 percent and 3.4 percent, respectively, of vehicle revenue hours. Operating at greater speeds with much larger passenger capacity, these modes operate greater proportions of total vehicle revenue miles (20.1 percent for heavy rail and 7.9 percent for commuter rail) than total vehicle revenue hours, the opposite of bus.

Vehicle Revenue Hours by Mode and Type of Service (Millions)
1992

Exhibit 64

Mode	Directly Operated	Purchased Transportation	Total
Bus	116.4	5.5	121.9
Heavy Rail	23.3	0.0	23.3
Commuter Rail	5.5	0.3	5.8
Light Rail	2.1	0.0	2.1
Demand Response	4.4	10.5	14.9
Other	2.5	0.1	2.6
Total	154.2	16.4	170.6

In terms of changes over time, **Exhibit 65** shows the growth of demand response and light rail. However, the 56.8 percentage increase in demand response vehicle revenue hours from 1988 to 1992 is almost exactly the same as the 57 percent increase in vehicle revenue miles experienced by demand response over the same period. Light rail has shown a 23.5 percent increase in vehicle revenue hours from 1988 to 1992.

Annual vehicle revenue hours for bus have remained relatively stable since 1990, with only a three percent decrease from 1988. Heavy rail hours have increased 7.4 percent since 1991, but have decreased 8.3 percent since 1988. Commuter rail vehicle revenue hours have remained relatively stable.

Vehicle Revenue Hours by Mode (Millions)
1988-1992

Exhibit 65

Mode	1988	1989	1990	1991	1992
Bus	125.9	116.6	120.1	120.9	122.0
Heavy Rail	25.4	26.2	26.3	21.7	23.3
Commuter Rail	5.9	6.1	6.1	5.9	5.8
Light Rail	1.7	1.7	1.9	2.1	2.1
Demand Response	9.5	10.8	12.3	13.4	14.9
Other	2.4	2.3	2.3	2.5	2.6
Total	170.8	163.7	169.0	166.5	170.7

Vehicles Operated in Maximum Service by Mode

As **Exhibit 66** demonstrates, nearly 65 percent of the vehicles operating in maximum service are buses, while demand response supplies the next greatest number. In terms of growth, however, the emphasis on demand response and light rail is evident, as reflected in **Exhibit 67**. The number of demand response vehicle operating in maximum service is nearly 44 percent higher in 1992 than in 1988. The number of light rail vehicles operating in maximum service has increased by nearly 40 percent since 1988. The number of heavy rail vehicles operating in maximum service is nearly the same as in 1988, while bus is roughly four percent higher and commuter rail is four percent lower. The decline in commuter rail may be explained in part by a reporting change from 1991 to 1992 by a major operator that changed from reporting as a commuter rail operator to a heavy rail operator. However, during the 1988-1992 period, commuter rail miles increased nearly nine percent and hours decreased by less than two percent.

Exhibit 66

Vehicles Operated in Maximum Service by Mode
1992

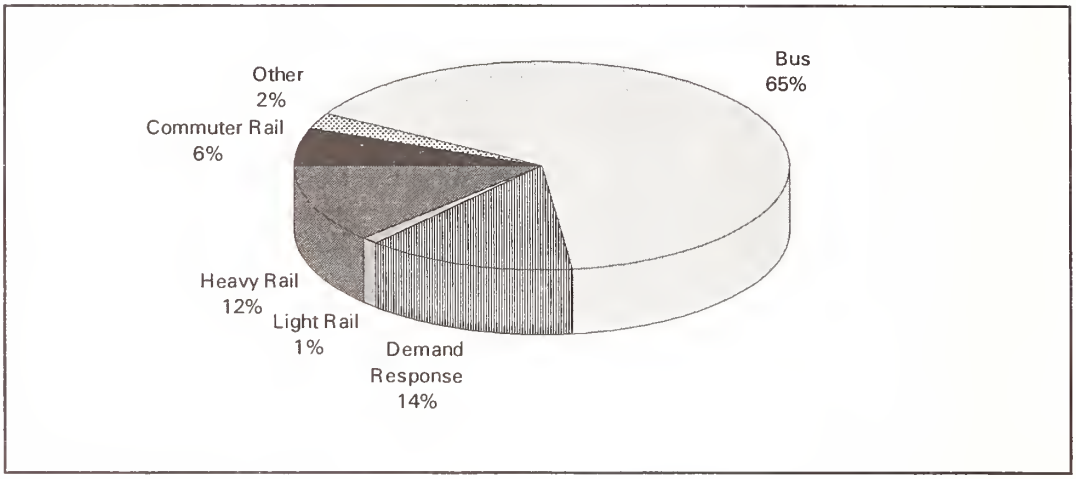


Exhibit 67

Vehicles Operated in Maximum Service by Mode
1988-1992

Mode	1988	1989	1990	1991	1992
Bus	42,068	42,688	42,869	42,940	43,847
Heavy Rail	8,182	8,306	8,347	8,106	8,180
Commuter Rail	4,132	4,114	4,163	3,989	3,949
Light Rail	571	535	665	811	798
Demand Response	6,445	7,115	7,903	8,434	9,267

Vehicles Operated in Maximum Service by UZA Size and Mode

Exhibit 68 shows the large portion of vehicles operated in maximum service in large urbanized areas. Seventy-four percent of all buses, 53 percent of all demand response vehicles, 100 percent of heavy rail trains, nearly all commuter rail trains, and nearly 97 percent of light rail trains operated in maximum service are operating in large urbanized areas.

Exhibit 68

Vehicles Operated in Maximum Service by UZA Size and Mode
1992

UZA Size	Mode						Total
	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response	Other	
Under 200,000	3,424	-	-	2	2,069	142	5,637
200,000 to 1 Million	8,171	-	12	23	2,297	282	10,785
Over 1 Million	32,252	8,180	3,937	773	4,901	1,211	51,254
Total	43,847	8,180	3,949	798	9,267	1,635	67,676

Exhibit 69 offers a modal comparison of the measures of service supplied and shows some of the differences in the various modes.

Service Consumed: Unlinked Passenger Trips by Mode

Unlinked passenger trips, along with passenger miles, offers a measure of the service actually consumed by transit customers. An unlinked passenger trip is a boarding by a passenger of a public transit vehicle. For example, if a passenger transfers from one transit vehicle to another in the course of taking a journey, two unlinked passenger trips are counted. It is not a measure of a passenger's journey from origin to final destination (a linked trip).

Modal Comparison of Service Supplied
1992

Exhibit 69

Mode	Percentage of Vehicle Revenue Miles	Percentage of Vehicle Revenue Hours	Percentage of Vehicles in Maximum Service
Bus	61.4%	71.5%	64.8%
Heavy Rail	20.1	13.7	12.1
Commuter Rail	7.9	3.4	5.8
Light Rail	1.1	1.2	1.2
Demand Response	8.2	8.7	13.7
Other	1.3	1.5	2.4
Total	100.0%	100.0%	100.0%

As **Exhibit 70** demonstrates, nearly 62 percent of the almost 7.7 billion unlinked passenger trips reported in 1992 were made via bus and nearly 29 percent were made via heavy rail.

As **Exhibit 71** indicates, growth in ridership has occurred in demand response and light rail since 1988; bus, heavy rail, and commuter rail ridership have declined slightly. Demand response and light rail have increased in ridership by 32.4 percent and 22.2 percent, respectively. Heavy rail and commuter rail ridership decreased by 4.4 percent and 3.4 percent, respectively, during this period. Bus ridership remained fairly stable, with 1992 ridership decreasing one percent from 1988.

Unlinked Passenger Trips by Mode and Type of Service (Millions)
1992

Exhibit 70

Mode	Directly Operated	Purchased Transportation	Total
Bus	4,627	121	4,748
Heavy Rail	2,207	0	2,207
Commuter Rail	297	17	314
Light Rail	187	0	187
Demand Response	13	32	45
Other	189	5	194
Total	7,520	175	7,695

Unlinked Passenger Trips by Mode (Millions)
1988-1992

Exhibit 71

Mode	1988	1989	1990	1991	1992
Bus	4,794	4,838	4,887	4,826	4,748
Heavy Rail	2,308	2,542	2,346	2,167	2,207
Commuter Rail	325	330	328	324	314
Light Rail	153	161	174	184	187
Demand Response	34	37	40	42	45
Other	199	190	190	192	194
Total	7,813	8,098	7,965	7,735	7,695

Unlinked Passenger Trips by UZA Size and Mode 1988-1992

Exhibit 72 reflects the domination of the industry by consumers of transit services in large urbanized areas. However, the small and mid-size urbanized areas have experienced ridership increases between 1988 and 1992, while large urbanized areas have experienced some ridership loss since 1989, after showing an increase in 1989. While large urbanized areas account for 88 percent of unlinked passenger trips, ridership in 1992 was over two percent less than in 1988. In contrast, small urbanized areas experienced four percent more unlinked passenger trips in 1992 than in 1988, and mid-size urbanized areas experienced five percent greater trips made in 1992 than 1988.

Exhibit 72

Unlinked Passenger Trips by UZA Size and Mode (Millions) 1988-1992

UZA Size	Year	Mode						Total
		Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response	Other	
Under 200,000	1988	217	-	-	0	8	1	226
	1989	221	-	-	0	9	1	231
	1990	211	-	-	0	8	2	221
	1991	217	-	-	0	9	2	228
	1992	223	-	-	0	10	2	235
200,000 to 1 Million	1988	639	-	-	4	9	6	658
	1989	662	-	-	4	9	8	683
	1990	647	-	0	8	10	5	670
	1991	657	-	0	8	10	4	679
	1992	666	-	0	9	11	4	690
Over 1 Million	1988	3,939	2,308	325	149	17	192	6,930
	1989	3,956	2,542	330	157	19	182	7,186
	1990	4,029	2,346	328	166	22	184	7,075
	1991	3,951	2,167	324	175	23	187	6,827
	1992	3,859	2,207	313	179	25	188	6,771
Total Trips	1988	4,795	2,308	325	153	34	199	7,814
	1989	4,839	2,542	330	161	37	191	8,100
	1990	4,887	2,346	328	174	40	191	7,966
	1991	4,825	2,167	324	183	42	193	7,734
	1992	4,748	2,207	314	187	45	194	7,695

Passenger Miles by Mode

Passenger miles act as a measure of the total distance travelled by transit customers. Transit agencies either randomly sample selected trips throughout the year and derive an average trip length which is multiplied by the number of unlinked passenger trips, or they conduct a 100 percent count of boardings and alightings from which a computation of passenger miles is made. As indicated in **Exhibit 73**, bus accounts for the largest number of passenger miles of all the modes, but its proportion of total passenger miles is far smaller than those portions of vehicle revenue miles and unlimited passenger trips attributed to bus. Commuter rail accounts for a much larger portion of total passenger miles (nearly 20 percent) than it does for vehicle revenue miles and unlimited passenger trips.

Exhibit 73

Passenger Miles by Mode and Type of Service (Millions)
1992

Mode	Directly Operated	Purchased Transportation	Total
Bus	16,691	803	17,494
Heavy Rail	10,737	0	10,737
Commuter Rail	6,863	457	7,320
Light Rail	700	0	700
Demand Response	114	202	316
Other	539	47	586
Total	35,644	1,509	37,153

Exhibit 74 indicates that total passenger miles have not significantly changed from 1988 to 1992, with only 1.5 percent fewer passenger miles. However, passenger miles have substantially increased for demand response by 51 percent and for light rail by 47 percent. In contrast, passenger miles for bus and heavy rail have declined slightly since 1988, by 3.8 percent and five percent.

Exhibit 74

Passenger Miles by Mode (Millions)
1988-1992

Mode	1988	1989	1990	1991	1992
Bus	18,182	18,010	18,070	18,104	17,494
Heavy Rail	11,300	12,030	11,475	10,488	10,737
Commuter Rail	6,964	7,212	7,083	7,383	7,320
Light Rail	476	507	570	661	700
Demand Response	210	233	259	274	317
Other	590	541	535	563	585
Total	37,722	38,533	37,992	37,473	37,153

Passenger Miles by UZA Size and Mode 1988-1992

Exhibit 75 demonstrates that passenger miles by urbanized area size and mode are somewhat reflective of the trends in unlinked passenger trips. While large urbanized areas account for the bulk of passenger miles (approximately 90 percent), the decline in passenger miles between 1988 and 1992 is only about one percent. Also, while small urbanized areas experienced nearly nine percent more passenger miles in 1992 than in 1988, mid-size urbanized areas experienced ten percent less passenger miles in 1992 than in 1988.

Exhibit 75

Passenger Miles by UZA Size and Mode (Millions)
1988-1992

UZA Size	Year	Mode						Total
		Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response	Other	
Under 200,000	1988	755	-	-	0	46	15	816
	1989	1,053	-	-	0	52	11	1,116
	1990	748	-	-	0	47	7	802
	1991	780	-	-	0	53	13	846
	1992	815	-	-	0	63	10	888
200,000 to 1 Million	1988	2,915	-	-	20	64	28	3,027
	1989	2,592	-	-	22	67	37	2,718
	1990	2,535	-	-	20	74	29	2,658
	1991	2,553	-	0	20	73	38	2,684
	1992	2,552	-	5	19	91	46	2,713
Over 1 Million	1988	14,511	11,300	6,964	455	99	547	33,876
	1989	14,365	12,030	7,212	486	115	492	34,700
	1990	14,786	11,475	7,082	549	137	499	34,528
	1991	14,771	10,488	7,379	642	147	512	33,939
	1992	14,127	10,737	7,315	681	162	529	33,551
Total Trips	1988	18,181	11,300	6,964	475	209	590	37,719
	1989	18,010	12,030	7,212	508	234	540	38,534
	1990	18,069	11,475	7,082	569	258	535	37,988
	1991	18,104	10,488	7,384	662	273	563	37,474
	1992	17,494	10,737	7,320	700	317	585	37,153

Exhibit 76 offers a modal comparison of unlinked passenger trips and passenger miles.

Exhibit 76

Share of Unlinked Passenger Trips and Passenger Miles
With Average Trip Length by Mode
1992

Mode	Percentage of Total Unlinked Passenger Trips	Percentage of Total Passenger Miles	Average Trip Length in Miles
Bus	61.7%	47.1%	3.7
Heavy Rail	28.7	28.9	4.9
Commuter Rail	4.1	19.7	23.4
Light Rail	2.4	1.9	3.7
Demand Response	0.6	0.9	7.0
Other	2.5	1.5	-
Total	100.0%	100.0%	-

Performance Indicators

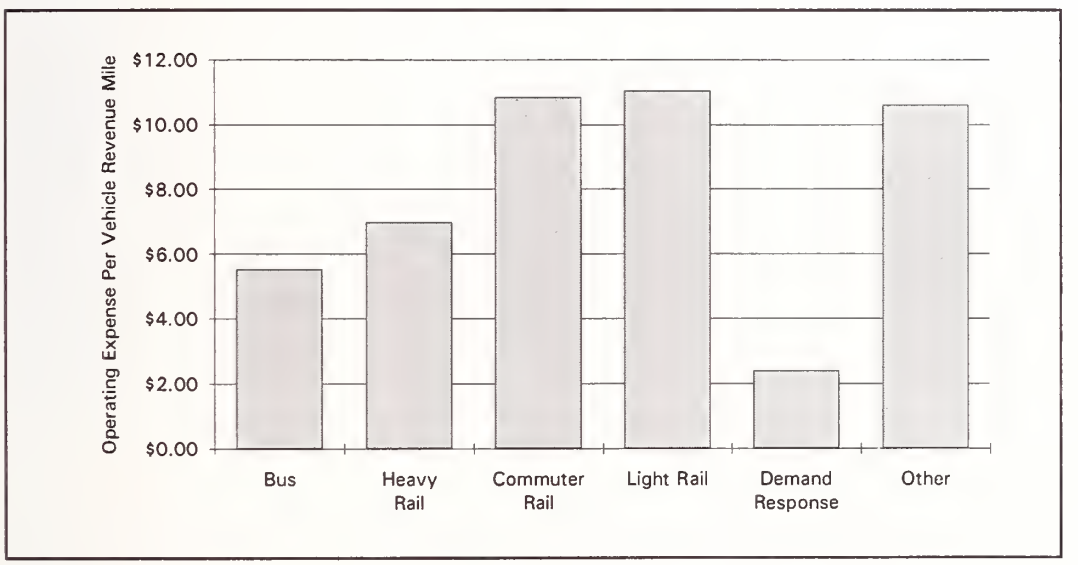
Certain performance indicators are used to assess the effectiveness and efficiency of transit service delivery. Operating expense per vehicle revenue mile is one measure of service efficiency, while operating expense per unlinked passenger trip and operating expense per passenger mile offer measures of cost effectiveness. Service effectiveness may be measured by examining unlinked passenger trips.

Service Efficiency: Operating Expense Per Vehicle Revenue Mile by Mode

Exhibit 77 reflects operating expense per vehicle revenue mile by mode. Demand response provides the most cost efficient service at $2.40 per vehicle revenue mile, with the next most cost efficient mode being bus at $5.54 per vehicle revenue mile. The rail modes are progressively higher in cost. Demand response utilizes purchased transportation to a far greater extent of its service supplied than the other modes. Direct labor and fringe benefits, which compose the greatest elements of cost for bus and rail modes, account for a much smaller portion of demand response. This explains in part the substantially lower cost per vehicle revenue mile for demand response than other modes.

Exhibit 77

Operating Expense Per Vehicle Revenue Mile by Mode
1992



Operating Expense Per Vehicle Revenue Mile by UZA Size and Mode

Exhibit 78 demonstrates the difference in operating expense per vehicle revenue mile by urbanized area size for each mode. The cost per mile for bus and demand response service, for example, increases with urbanized area size. In large urbanized areas, the cost per mile for bus is 56 percent higher than in mid-size urbanized areas and 86 percent greater than in small urbanized areas. The differences are not as great for demand response. The cost per mile in large urbanized areas for demand response is approximately 25 percent greater than in mid-size urbanized areas, and approximately 43 percent greater than in small urbanized areas. For light rail, however, the reverse is true. The cost per mile in large urbanized areas for light rail is approximately 18 percent less than that in mid-size and small urbanized areas.

Exhibit 78

Operating Expense Per Vehicle Revenue Mile by UZA Size and Mode
1992

UZA Size	Mode				
	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response
Under 200,000	$3.17	-	-	$13.43	$1.88
200,000 to 1 Million	3.80	-	$16.40	13.33	2.15
Over 1 Million	5.92	$6.97	10.12	10.97	2.68
Weighted Average	$5.54	$6.97	$10.85	$11.05	$2.40

Exhibit 79 provides operating expense per vehicle revenue mile by mode from 1988 to 1992. Operating expense per vehicle revenue mile for bus has increased by 19.4 percent since 1988. Demand response operating expense per vehicle revenue mile has increased 27 percent since 1988. Heavy rail shows a drop of less than one percent from 1988 to 1992 in operating expense per vehicle revenue mile. Commuter rail's operating expense per vehicle revenue mile for 1992 is 4.4 percent greater than in 1988; light rail's figure for 1992 is 12.6 percent greater than in 1988. The CPI increased by 21.1 percent between 1988 and 1992.

Exhibit 79

Operating Expense Per Vehicle Revenue Mile by Mode
1988-1992

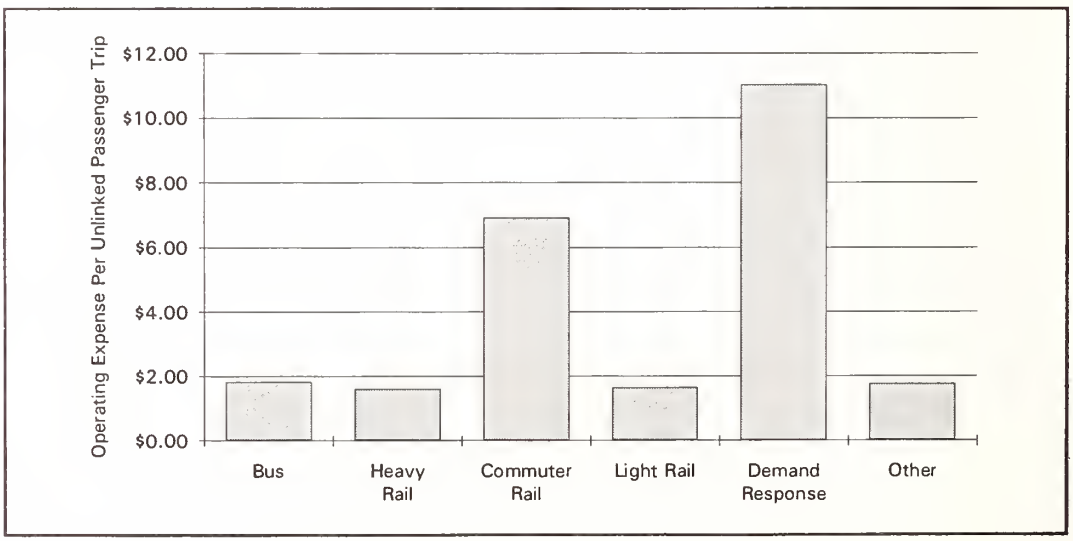
Mode	1988	1989	1990	1991	1992
Bus	$4.64	$4.84	$5.07	$5.37	$5.54
Heavy Rail	7.01	7.22	7.34	7.56	6.97
Commuter Rail	10.39	10.87	11.17	10.99	10.85
Light Rail	9.81	10.21	10.26	10.89	11.05
Demand Response	1.89	2.12	2.25	2.38	2.40

Cost Effectiveness: Operating Expense Per Unlinked Passenger Trip by Mode

Exhibit 80 depicts the relative cost effectiveness of bus, heavy rail, and light rail as compared to commuter rail and demand response. Because of the densely populated corridors served by bus, heavy rail and light rail, the potential for service productivity is greater, i.e., ridership's potential is higher. Also, capacity, particularly on heavy and light rail vehicles, is high.

Exhibit 80

Operating Expense Per Unlinked Passenger Trip by Mode
1992



Operating Expense Per Unlinked Passenger Trip by UZA Size and Mode

Exhibit 81 offers an assessment of cost effectiveness in terms of passengers carried for various modes by size of urbanized areas. Bus service in large and mid-size urbanized areas is more cost effective as higher population densities allow for higher utilization of fixed route transit services. In small urban areas with lower population densities, the cost per trip is seven percent higher than for bus service in mid-size urbanized areas and four percent higher than in large urbanized areas. However, for demand response, cost effectiveness is higher in small urbanized areas. The cost per trip for demand response service in large urbanized areas is 55 percent greater than in small urbanized areas. In mid-size urbanized areas the cost per trip for demand resonse is 50 percent greater than that in small urbanized areas.

Exhibit 81

Operating Expense Per Unlinked Passenger Trip by UZA Size and Mode
1992

UZA Size	Mode				
	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response
Under 200,000	$1.89	-	-	$2.20	$7.73
200,000 to 1 Million	1.76	-	$20.63	1.49	11.60
Over 1 Million	1.82	$1.61	6.88	1.64	12.02
Weighted Average	$1.82	$1.61	$6.88	$1.64	$11.03

Exhibit 82 offers operating expense per unlinked passenger trip by mode from 1988 to 1992. While bus remains a cost effective mode of transit service, its cost per unlinked passenger trip has increased 27.2 percent over the five-year period. The same is true of light rail, as its cost per trip has increased by 27.1 percent. Commuter rail has experienced a more substantial increase of 33.8 percent since 1988, while demand response has experienced a dramatic 56.9 percent increase in cost per trip since 1988. In contrast, heavy rail shows an increase in cost per trip from 1988 to 1992 of only 5.2 percent.

Exhibit 82

Operating Expense Per Unlinked Passenger Trip by Mode
1988-1992

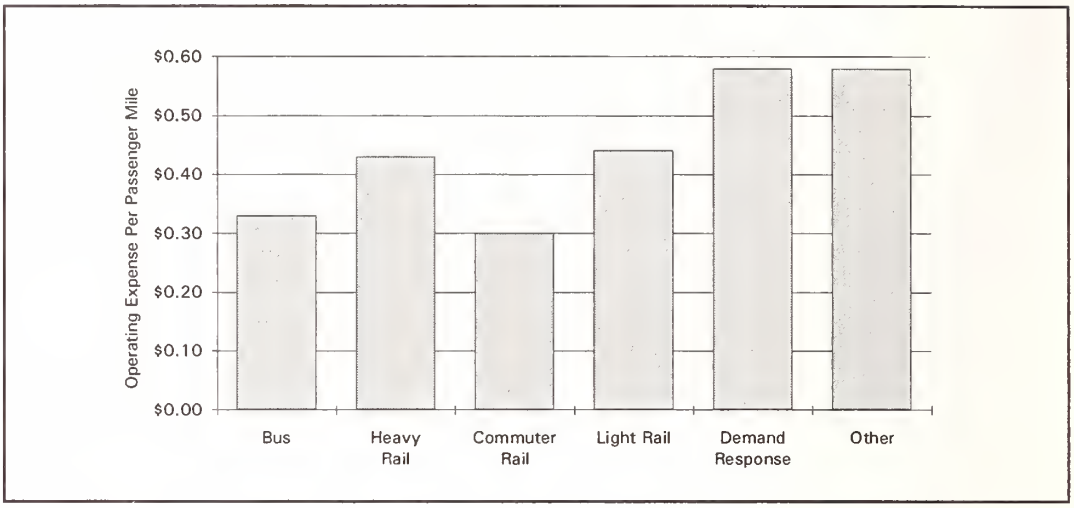
Mode	1988	1989	1990	1991	1992
Bus	$1.43	$1.47	$1.56	$1.65	$1.82
Heavy Rail	1.53	1.46	1.63	1.77	1.61
Commuter Rail	5.17	5.54	5.87	6.01	6.92
Light Rail	1.29	1.30	1.36	1.58	1.64
Demand Response	7.03	7.53	8.53	9.47	11.03

Operating Expense Per Passenger Mile by Mode

Exhibit 83 offers another assessment of cost effectiveness through a comparison of operating expense per passenger mile by mode. The cost effectiveness of service in this instance is considered by examining the costliness of using the service, taking distance travelled as well as passenger capacity into account.

Exhibit 83

Operating Expense Per Passenger Mile by Mode
1992



Operating Expense Per Passenger Mile by UZA Size and Mode

Exhibit 84 reflects the same trend with cost per passenger mile as with cost per trip. Small urban areas operate more cost effective demand response service than mid-size and large urbanized areas, while the opposite is true for fixed-route services. For example, the cost per passenger mile for bus in small urbanized areas is nearly 16 percent greater than in mid-size urbanized areas and is almost eight percent greater than in large urbanized areas. However, for demand response, the cost per passnger mile in large urbanized areas is 50 percent greater than in small urbanized areas. The cost per passenger mile in mid-size urbanized areas for demand response is 22 percent greater than in small urbanized areas.

Exhibit 84

Operating Expense Per Passenger Mile by UZA Size and Mode
1992

UZA Size	Mode				
	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response
Under 200,000	$0.52	-	-	$1.00	$1.21
200,000 to 1 Million	0.45	-	$1.02	0.34	0.48
Over 1 Million	0.48	$0.33	0.29	0.44	1.81
Weighted Average	$0.48	$0.33	$0.29	$0.44	$1.58

Exhibit 85 shows that operating expense per passenger mile bus has increased 22.5 percent from 1988 to 1992. Commuter rail has increased by 20 percent. Heavy rail and light rail actually demonstrate slight increases of 6.5 percent and 7.3 percent, respectively. Demand response has increased by 37.2 percent in terms of operating expense per passenger mile since 1988.

Operating Expense Per Passenger Mile by Mode
1988-1992

Exhibit 85

Mode	1988	1989	1990	1991	1992
Bus	$0.40	$0.40	$0.42	$0.44	$0.49
Heavy Rail	0.31	0.31	0.33	0.37	0.33
Commuter Rail	0.24	0.25	0.27	0.26	0.30
Light Rail	0.41	0.41	0.41	0.44	0.44
Demand Response	1.15	1.18	1.32	1.48	1.58

Service Effectiveness: Unlinked Passenger Trips Per Vehicle Revenue Mile by Mode

The service effectiveness of each mode is expressed in **Exhibit 86** by comparing utilization (unlinked passenger trips) to service supplied (as expressed in vehicle revenue miles). Again, distance travelled and vehicle capacity play significant roles. The lengthy trips operated by commuter rail and the small passenger capacity of demand response vehicles provide substantially different measures of service experienced by other modes.

Unlinked Passenger Trips Per Vehicle Revenue Mile by Mode
1992

Exhibit 86

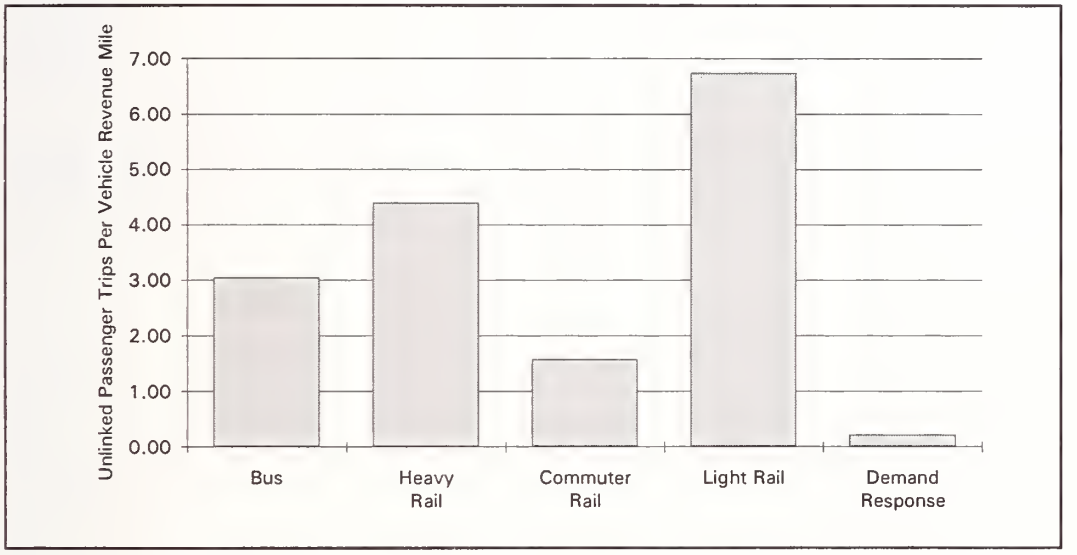


Exhibit 87 demonstrates the decrease in unlinked passenger trips per vehicle revenue mile for all modes from 1988 to 1992. Bus has decreased by four percent, while heavy rail shows six percent fewer unlinked passenger trips by revenue mile. Commuter rail and light rail have decreased by slightly more than 11 percent, while demand response has decreased by more than 15 percent.

Unlinked Passenger Trips Per Vehicle Revenue Mile by Mode
1988-1992

Exhibit 87

Mode	1988	1989	1990	1991	1992
Bus	3.18	3.21	3.18	3.11	3.05
Heavy Rail	4.59	4.95	4.51	4.26	4.33
Commuter Rail	1.77	1.73	1.70	1.64	1.57
Light Rail	7.59	7.86	7.60	6.90	6.74
Demand Response	0.26	0.24	0.23	0.23	0.22

Average Operating Speed

The average operating speed varies greatly among modes. As **Exhibit 88** shows, bus, light rail, and demand response services operate much more slowly than heavy rail or commuter rail. Bus service operates in mixed traffic with frequent stops for boarding and alighting. Light rail trains must also contend with mixed traffic while operating at grade, or must share rights-of-way with other modes of mass transportation. Demand response service also operates in mixed traffic and must also deal with longer boarding and alighting times for its patrons. Heavy rail and commuter rail operate along exclusive fixed guideways, with heavy rail stopping more frequently for boardings and alightings than with commuter rail.

Exhibit 88

Average Operating Speed by Mode
1992

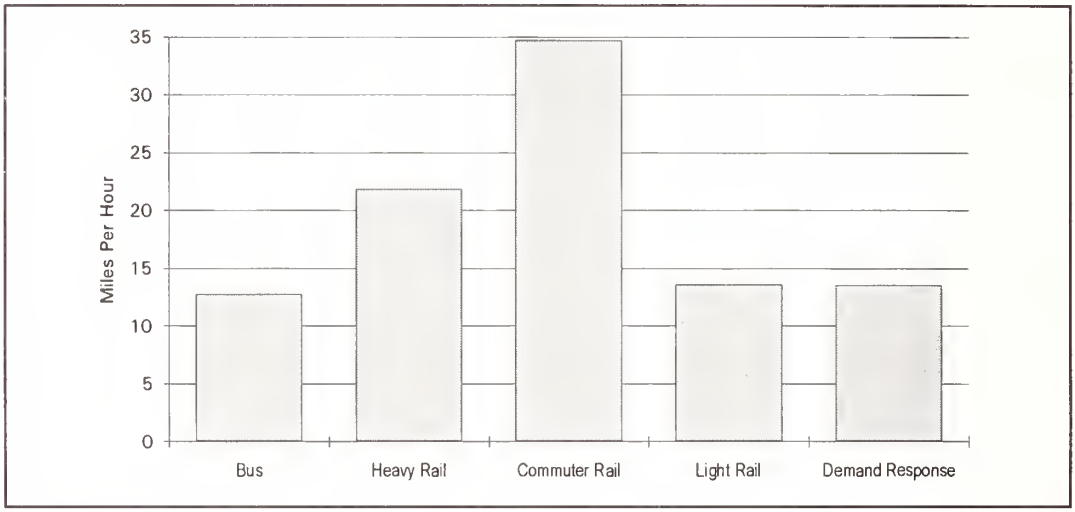


Exhibit 89 reflects higher operating speeds for purchased transportation than for directly operated service except light rail. Purchased bus service operated at an average speed 19 percent higher than directly operated bus services, perhaps as a result of the contracting out of suburban flyer and express services by transit authorities. The difference between the two types of service for commuter rail was an average speed approximately 13 percent higher for purchased service than that which was directly operated. The difference is far less significant for demand response as purchased transportation services operated at an average speed only three percent greater than directly operated service.

Exhibit 90 demonstrates that average operating speed for bus service in small and mid-size urbanized areas is six percent and ten percent greater, respectively, than average bus operting speed in large urbanized areas. However, demand response servicee operates at higher speeds in large and mid-size urbanized areas, as does light rail. Demand response service operates at an average speed in large urbanized areas that is 18 percent greater than achieved in small urbanized areas. Demand response service in mid-size urbanized areas operates at an avergae speed 25 percent greater than in small urbanized areas. The average operting speeds for light rail in large and mid-size urbanized areas is much more dramatically faster than in small urbanized areas.

Average Operating Speed by Mode and Type of Service 1992

Exhibit 89

Mode/Type of Service	Speed
Bus	
Directly Operated	12.0
Purchased Transportation	14.3
Weighted Average	12.7
Heavy Rail	
Directly Operated	21.9
Purchased Transportation	-
Weighted Average	21.9
Commuter Rail	
Directly Operated	33.1
Purchased Transportation	37.5
Weighted Average	34.4
Light Rail	
Directly Operated	13.6
Purchased Transportation	4.6
Weighted Average	13.6
Demand Response	
Directly Operated	13.2
Purchased Transportation	13.6
Weighted Average	13.5

Average Operating Speed by UZA Size and Mode 1992

Exhibit 90

UZA Size	Mode				
	Bus	Heavy Rail	Commuter Rail	Light Rail	Demand Response
Under 200,000	13.3	-	-	4.6	11.6
200,000 to 1 Million	13.7	-	39.1	12.5	14.5
Over 1 Million	12.5	21.9	34.3	13.6	13.7
Weighted Average	12.8	21.9	34.3	13.6	13.5

Chapter 6
Safety, Reliability, and Maintenance Effectiveness

Introduction

This chapter attempts to discuss some possible measures of service quality. This is done by touching on matters that are significant to providing service to transit customers such as transit operations safety, service reliability, and the effectiveness of transit maintenance.

Chapter Organization

The chapter is divided into two sections. The first section discusses safety of transit operations as measured by collision and non-collision incidents per million vehicle revenue miles, as well as by comparing personal injuries and fatalities per ten million passenger miles. The second section reviews service reliability in terms of vehicle revenue miles between roadcalls, and examines maintenance effectiveness by examining maintenance expense per vehicle revenue mile of service for each mode.

General Notes

Before proceeding through this chapter, some items need to be noted. Safety related data is not subjected to time series comparisons because of reporting changes. These changes lead to large variations in data for those years previous to 1990 as compared with data subsequently reported. As for indicators of service reliability, the appropriate definition of roadcalls and their consistent reporting within the transit industry have not been fully resolved. The roadcalls discussed herein are those defined as roadcalls for mechanical failure as described in the *1992 Section 15 Reporting Manual*. Thus, revenue service interruptions, caused by failure of some mechanical element of the revenue vehicle are considered. These include breakdowns of air equipment, brushes, fuel system, engine, steering and front axle, rear axle and suspension, torque convertors, electrical units, heating system and cooling system. They involve revenue service interruptions that prevent a vehicle from running and which require someone other than the vehicle operator or crew to restore the vehicle to an operating condition.

Section 15 reporting deals with maintenance data only for directly operated service. Purchased transportation expenses are not typically split into individual maintenance functions, but are generally reported with total purchased transportation costs, which are reported as either vehicle operations or general administration expense.

Safety Performance Measures: Collision and Non-Collision Incidents Per Million Vehicle Reveue Miles by Mode

Collision incidents are those that involve one or more transit agency vehicles colliding with any other vehicle, obstacle, or person. Non-collision incidents involve derailments; buses or other transit vehicles leaving the roadway; personal injuries received while inside the transit vehicle resulting from sudden braking or unexpected swerving; falls or other mishaps experienced while boarding or alighting; and injuries sustained at stations or bus stops. All incidents resulting in an injury or fatality, and all incidents with property damage in excess of $1,000 are reported.

Exhibit 91 depicts collision and non-collision incidents by mode per million vehicle revenue miles. Heavy rail and commuter rail experienced far fewer collision incidents (1.15 and 0.74, respectively) than bus (23.06), light rail (20.62) and demand response (11.21). On the other hand, there were fewer non-collision incidents for bus (12.66) and demand response (7.73) than for heavy rail (29.16). Light rail experienced a higher rate of non-collision incidents.

Exhibit 91

Collision and Non-Collision Incidents by Mode
1992

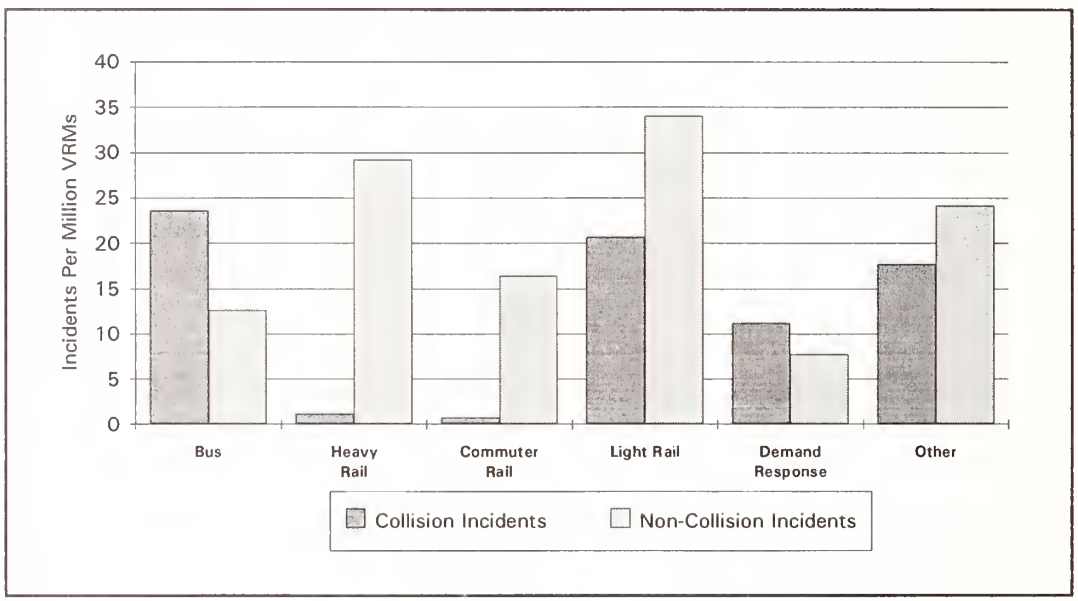
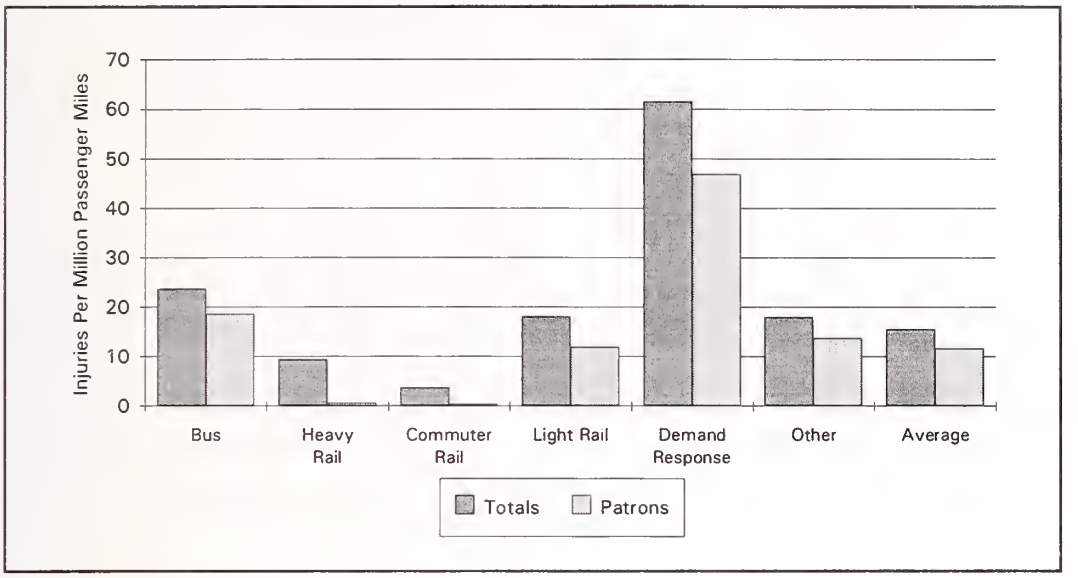


Exhibit 92 reflects personal injuries by mode, both in total and for that proportion accounted for by injuries experienced by transit customers. A rate per ten million passenger miles is established for each mode. For 1992, workers' compensation injuries are now for the first time included in Section 15 reports as part of total personal injuries.

Heavy rail and commuter experienced the lowest rates for total personal injuries of 9.43 and 3.71, respectively, per ten million passenger miles. These two modes also displayed the lowest rates for transit customer personal injuries at 0.58 and 0.27, respectively. Thus, only six percent of heavy rail personal injuries and seven percent of commuter rail personal injuries are experienced by transit customers. Personal injuries for these two modes were more often experienced by workers and others (including trespassers) along the rail rights-of-way. For all modes combined, the average total personal injury rate is 15.47 per ten million passenger miles, while the

Total and Patron Injuries by Mode Per Million Passenger Miles
1992

Exhibit 92



average personal injury rate for transit customers is 11.56 per ten million passenger miles. On average for all modes combined, 75 percent of total personal injuries were experienced by transit customers. As to be expected, because of the need to contend with mixed traffic, bus, light rail, and demand response have significantly higher rates of personal injuries per ten million passenger miles than heavy rail or commuter rail. Bus experienced 23.69 total personal injuries per ten million passenger miles and a rate of 18.6 per ten million passenger miles for transit customers. Light rail experienced rates of 18.11 total and 11.88 customer personal injuries per ten million passenger miles, while demand response experienced the highest rates, 61.56 total and 46.87 customer personal injuries per ten million passenger miles. Customer injuries account for much larger portions of total injuries for these three modes than heavy rail or commuter rail.

Fatalities are extremely low for mass transit. The rate for all modes combined is .06 per ten million passenger miles for total fatalities and .05 for transit patron fatalities. As indicated in **Exhibit 93**, the rail modes do not differ dramatically from bus, though heavy rail experienced a lower total fatality rate per ten million passenger miles (.05) than bus (.06), commuter rail (.07) and light rail (.09). However, the fatality rate for

Total and Patron Fatalities by Mode Per Million Passenger Miles
1992

Exhibit 93

Mode	Patrons	Totals
Bus	0.03	0.50
Heavy Rail	0.01	1.60
Commuter Rail	0.01	1.14
Light Rail	0.01	0.11
Demand Response	0.00	0.00
Other	0.00	0.00
Average	0.05	0.83

bus patrons is .03, so that half of bus fatalities involve customers. In contrast, the rate for patron facilities for the rail modes is .01 for each. Thus, rail customer fatalities account for much smaller percentages of total fatalities than does bus. Accidents involving automobiles and trains colliding at grade crossings and the presence of workers and trespassers along rail rights-of-way create a greater likelihood of injury or death for others than for rail customers.

Maintenance Performance Measures: Maintenance Expense Per Vehicle Revenue Mile

Maintenance costs will vary greatly by mode due to differences in infrastructure, such as vehicle type and complexity and fixed guideway. As reflected in **Exhibit 94**, maintenance expense per vehicle revenue mile for bus and demand response have increased by 14.1 percent and 22.2 percent, respectively, since 1988. The rail modes have experienced steady increases in maintenance expense. Heavy rail maintenance expense increased 6.2 percent from 1988 to 1992, while commuter rail and light rail maintenance expenses increased by 5.0 percent and 7.1 percent, respectively, for the same period. Again, the CPI increased by 21.1 percent over the same period.

Exhibit 94

Maintenance Expense Per Vehicle Revenue Mile by Mode 1988-1992

Mode	1988	1989	1990	1991	1992	Difference 1988-1992
Bus	$1.21	$1.25	$1.33	$1.32	$1.38	14.1%
Heavy Rail	2.90	2.99	2.93	3.00	3.08	6.2%
Commuter Rail	4.17	4.31	4.29	4.25	4.38	5.0%
Light Rail	4.20	4.11	4.30	4.43	4.50	7.1%
Demand Response	0.36	0.34	0.35	0.44	0.44	22.2%
Other	2.80	2.68	3.07	3.15	3.72	32.9%

Vehicle Revenue Miles Per Mechanical Roadcall

Mandatory collecting of roadcall data under Section 15 is done only for directly operated bus and demand response. The other modes may optionally report, but are not required to do so. Thus, data is only available that is sufficient for offering an historical comparison for bus and demand response. Also, it should be noted that due to reporting changes and clarifications to the definition of roadcall, analysis of changes over time is difficult. However, miles between roadcalls is a common measure of maintenance performance within the transit industry.

As is shown in **Exhibit 95**, bus has seen a 36 percent increase in miles between roadcalls since 1989. Demand response had evidenced the same steady improvement from 1988 to 1991, but fell off somewhat in 1992. Between 1988 and 1991, demand response experienced a 49 percent increase in miles between roadcalls, followed by an 8.7 percent decrease from 1991 to 1992.

Vehicle Revenue Miles Per Mechanical Roadcall for Directly Operated Service 1988-1992 **Exhibit 95**