THE UMTA RAIL MODERNIZATION PROGRAM

The Distribution of Capital Grant Funds for Rail Rehabilitation and Modernization, 1965-1977

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U.S. DEPARTMENT OF TRANSPORTATION
URBAN MASS TRANSPORTATION ADMINISTRATION
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I. INTRODUCTION

From the beginning of the UMTA Capital Grant Program through May 31, 1977, Section 3 grant approvals have amounted to approximately $6.2 billion. Of this total, nearly $1.7 billion or 28 percent has been approved for projects concerned with the modernization of existing rail systems.[1] Nearly 45 percent of the Section 3 grant approvals for rail projects have been devoted to rail modernization.

Although rail modernization projects are typically justified on the basis of safety, reliability, cost and/or patronage impacts, projects funded through the Rail Modernization Program are rarely subjected to post-grant analysis which formally evaluates their effect on rail systems. This study of the grant program is intended to provide this analysis and has the following objectives:

- prepare a description of rail modernization projects by type, mode, and city;
- determine the impact(s) of federal investment in the Rail Modernization Program;
- examine how localities plan for rail modernization grants; and
- examine key federal policy issues and make recommendations for change as necessary.

Phase I of this study addressed the first objective described above and included preparation of a detailed study design to achieve the three remaining objectives. The detailed study design describes the activities and projected outcome for Phase II of the study and is described under separate cover.

A. PURPOSE OF THIS REPORT

In order to provide a basis for evaluating the impacts of rail modernization grants, data pertinent to the Rail Modernization Program were incorporated in the Phase I report. Specifically, this report:

- provides an overview of the program at the national level;

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[1] Based on a review of 88 grants in 8 cities. For the purposes of this evaluation, rail modernization is defined as the replacement and upgrading of existing facilities and equipment and excludes major extensions to existing facilities. In the case of systemwide grants involving both bus and rail, the rail portion of the grant was estimated by examining grant files, grant approval memoranda, and project budgets.

- familiarizes the reader with the present scope of rail transit operations in "rail modernization" cities;

- presents an inventory of rail modernization grants received by each city and mode; and

- discusses the functional emphasis given to rail modernization improvements by each city.

B. DATA SOURCES

Under Phase I of the UMTA Rail Modernization Evaluation, a variety of data sources were consulted in order to:

- provide an historical perspective of the UMTA Section 3 Rail Modernization Program;

- document specific rail modernization grants and their purposes;

- understand the rail modernization program as perceived by local transit authorities; and

- identify specific rail modernization projects and/or processes which will allow for a quantitative evaluation of the program.

The data sources reviewed include reports and publications, interviews, and on-site visits.

The primary source of data documenting Section 3 rail modernization grants and describing in detail what these grants purchased was prepared by Messrs. Jack Bennett and Bryan Green (UMTA, UPP-20). Based on a review of grant files, approval memoranda, and project budgets, specific grants were identified, and the dollar amounts of these grants were assigned to a specific mode (light, rapid, or commuter rail) and to a functional category of expenditure (see Exhibit II-4). A report developed by the American Public Transit Association (APTA) in conjunction with Mr. Robert Abrams, Office of Program Analysis (UMTA), details all Section 3 capital grants through May 31, 1977, for rapid, light, and commuter rail. This report was utilized to verify grant data in the Bennett/Green report and to provide a brief description of the projects. More detailed project descriptions were obtained from grant files (grant application and approval memoranda).

Prior to actual on-site visits, interviews were conducted with selected UMTA officials including Mr. D. J. Mitchell, Mr. Rick Richmond, Mr. Dick Doyle, Mr. Robert Abrams, and the following regional directors: Mr. Peter Stowell (Region I, Boston), Mr. Hiram Walker (Region II, New York), Mr. Franz Gimmler (Region III, Philadelphia), Mr. Theodore Weigle (Region V, Chicago), and Mr. Dee Jacobs (Region IX, San Francisco). These officials presented an overview of the systems with which they were familiar and discussed specific grants and potential impacts (if any) on the transit system. On-site visits to New York, Chicago, Boston, Philadelphia, San Francisco, Cleveland, and Pittsburgh resulted in an "arms-length" view of specific rail modernization projects, both past and present. The distribution of grants to these cities is illustrated in Exhibit I-1. Additionally, discussions with local transit authorities allowed for an increased understanding of the transit systems under review, the grant application process, and the availability of data for measurement of grant impacts.

C. STRUCTURE OF THIS REPORT

This report is organized in two sections. Section II, Overview of the UMTA Section 3 Rail Modernization Program, provides a perspective of the program at the national level and then discusses the program for each "rail modernization" city in the following order: New York, Chicago, Boston, Philadelphia, San Francisco, Cleveland, Pittsburgh, and Detroit.

EXHIBIT I-1

SECTION 3 RAIL MODERNIZATION GRANTS BY CITY & BY MODE (000's)

	RAPID RAIL		COMMUTER RAIL		LIGHT RAIL		TOTAL RAIL	
CITY	$ Millions	% City Total	$ Millions	% City Total	$ Millions	% City Total	$ Millions	% Rail Modern-ization Total
New York Region	350	42.1	482	57.9	-	-	832	47.8
Chicago	212	56.2	165	43.8	-	-	377	21.6
Boston	128	58.1	11	5.0	81	36.9	220	12.7
Philadelphia	110	65.6	48	28.7	10	5.7	168	9.6
San Francisco	0	0	0	0	75	100.0	75	4.3
Cleveland	18	37.6	-	-	30	62.4	48	2.8
Pittsburgh	-	-	2	10.3	17	89.7	19	1.1
Detroit	-	-	2	100.0	-	-	2	0.1
TOTAL	818	100.0	710	100.0	214	40.8	1,742	100.0

II. OVERVIEW OF THE UMTA SECTION 3 RAIL MODERNIZATION PROGRAM

This section provides an overview of the UMTA Section 3 Rail Modernization Program from February 1965 to May 31, 1977. Specifically, it discusses the national Rail Modernization Grant Program, documents the approval and purpose of rail modernization grants, and presents the scope of mass transit operations in "rail modernization" cities.

A. THE NATIONAL RAIL MODERNIZATION PROGRAM

The Urban Mass Transportation Act of 1964 was enacted by Congress to provide federal financial assistance for the development of comprehensive and coordinated mass transit systems in metropolitan and other urban areas. A discussion of the UMTA legislative authority is presented in Appendix A. Section 3 of the UMTA Act provides capital grants for the acquisition, construction, and improvement of facilities and equipment for use in mass transportation service. Exhibit II-1 shows the amount and modal distribution of all Section 3 capital grant approvals from February 1, 1965, to May 31, 1977. These grants total approximately $6.2 billion. Of this amount, nearly $1.7 billion (or 28 percent) has been approved to modernize existing rail systems. As previously noted, rail modernization excludes major extensions to existing facilities and concentrates on the replacement and upgrading of existing facilities and equipment.

EXHIBIT II-1
UMTA SECTION 3 CAPITAL GRANTS[1]
(000s)

MODE	AMOUNT	PERCENT OF SECTION 3
RAIL	$3,893,232	62.9
-New Starts	2,152,573	34.8
-Modernization	1,740,939	28.1
BUS	2,108,411	34.0
BOAT AND OTHER	191,683	3.1
TOTAL	$6,193,606	100.0

[1]February 1, 1965 through May 31, 1977.

Rail modernization grant approvals totalling $1.7 billion for the years 1965-1977 are summarized in Exhibit II-2. These expenditures are segregated for each of the three rail modes: light, rapid, and commuter. A total of 88 Section 3 grants to eight cities were identified as involving rail modernization improvements. The eight cities and the total amount received by each are also shown in Exhibit II-2.

Rail modernization grant approvals increased 484 percent in current dollars from 1965 to 1976 (the last full year in which grant approvals were analyzed). However, the increase in grant approvals was not a gradual one as shown by Exhibit II-3. Average yearly grant aprovals from 1965 to 1969 and from 1970 to 1976 were $49 million and $205 million, respectively. For 1965 to 1976, they averaged $139 million. It is noted that the level of grant approvals in a given year (obligations) does not necessarily coincide with the actual disbursement of funds (outlays) during the same year. The outlay of funds is not provided because the data are not readily available.

Exhibit II-4 summarizes the distribution of total project costs (federal and local shares) of all rail modernization projects from February 1965 through May 1977.[1] The purchase of new rolling stock accounts for $1.2 billion (49.6 percent) of all rail modernization costs. Way & Structures improvements total $660 million (26.9 percent) and were in the following major areas: power ($270 million), track ($172 million), and signals ($135 million). Station modernization costs from 1965 to 1977 were approximately $151 million (6.1 percent). The remaining functional categories - yards and buildings (2.7 percent) and operational improvements (3.5 percent) - do not figure prominently.

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[1] Total project costs less anticipated revenues, derived from engineering studies, studies of economic feasibility, and data showing the nature and extent of the expected utilization of facilities and equipment, determines net project cost. Because revenues derived from rail modernization projects have been negligible, this study uses the terms "total project costs" and "net project cost" interchangeably.

EXHIBIT II-2

UMTA SECTION 3 RAIL MODERNIZATION GRANT APPROVALS BY MODE AND BY YEAR, 1965-1977 (000s)

YEAR	LIGHT RAIL	RAPID RAIL	COMMUTER RAIL	TOTAL RAIL (CURRENT YEAR $)	TOTAL RAIL (1977 CONSTANT $)[1]
1965	$ 0	$ 42,375	$ 4,826	$ 47,201	89,776
1966	0	0	6,661	6,661	12,262
1967	0	289	98,615	98,904	176,741
1968	0	62,163	26,957	89,120	152,484
1969	0	2,764	1,780	4,544	7,402
1970	16,608	1,867	113,752	159,184	246,258
1971	53,867	94,104	14,040	162,011	238,318
1972	76,000	200,369	125,645	402,014	568,045
1973	18,108	77,778	27,607	122,993	164,072
1974	6,960	124,701	128,297	259,958	316,368
1975	3,671	28,145	69,879	101,695	113,695
1976	8,290	171,398	48,727	228,415	241,435
1977[2]	30,366	11,583	42,747	84,699	84,699
TOTAL	$213,870	$817,536	$709,533	$1,740,939	$2,411,555

[1] GNP Implicit Price Deflator Used.

[2] January 1, 1977 through May 31, 1977.

UMTA SECTION 3 RAIL MODERNIZATION GRANT APPROVALS BY CITY, 1965-MAY 31, 1977 (000s)

CITY	AMOUNT	PERCENT OF TOTAL
New York (Tri-State region)	$ 832,261	47.8
Chicago	376,462	21.6
Boston	220,262	12.7
Philadelphia	167,235	9.6
San Francisco	75,462	4.3
Cleveland	48,460	2.8
Pittsburgh	19,191	1.1
Detroit	1,606	0.1
TOTAL	$1,740,939	100.0

EXHIBIT II-3

FLUCTUATIONS IN UMTA SECTION 3 RAIL MODERNIZATION GRANT APPROVALS TOTAL RAIL, 1965-1976

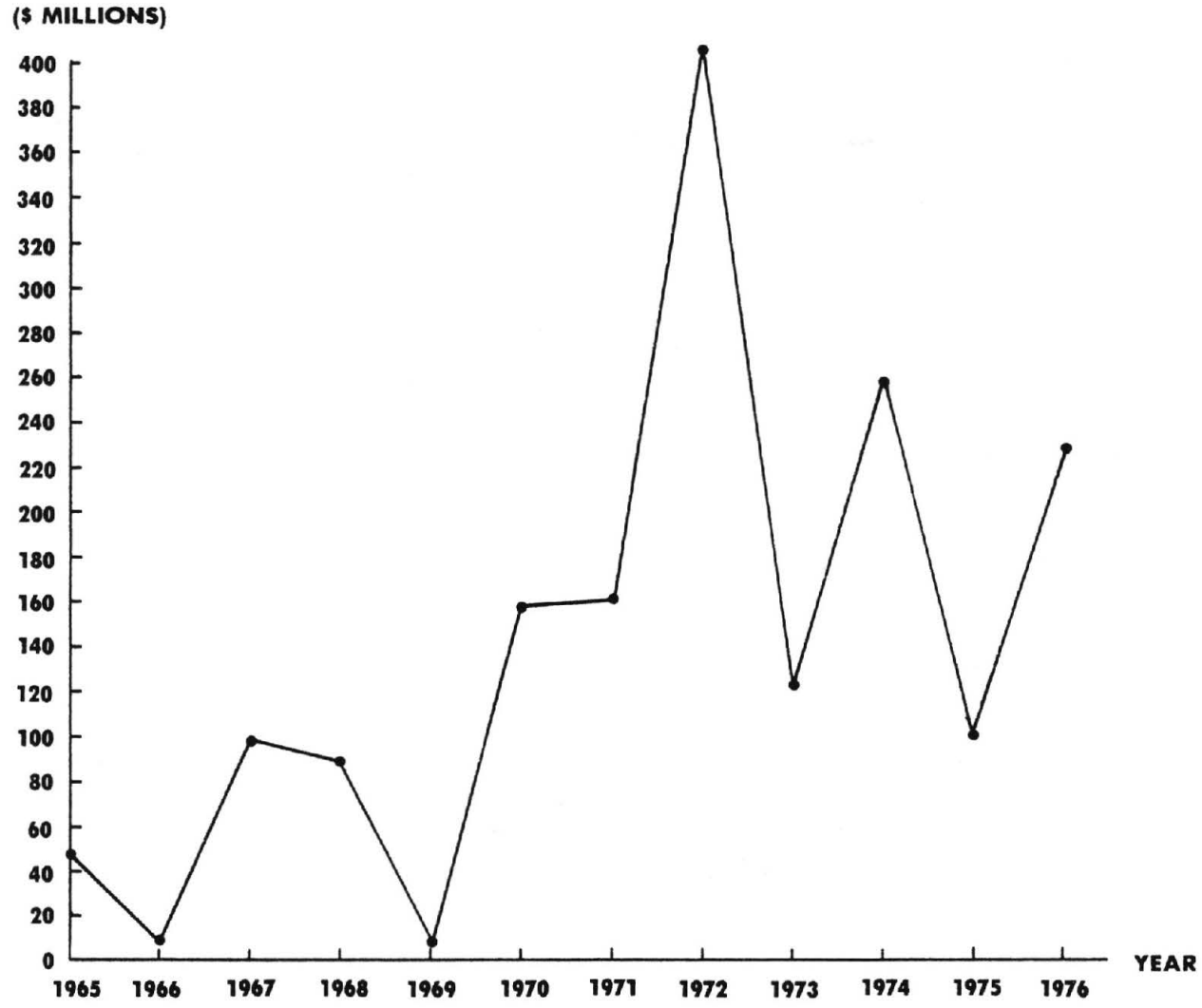

EXHIBIT II-4

UMTA SECTION 3 RAIL MODERNIZATION PROJECTS
ALL MODES
FEBRUARY 1965-MAY 1977
TOTAL COST (FEDERAL AND LOCAL SHARES)

ITEM	TOTAL RAIL	
	$ (000s)	% of TOTAL
1. Rolling Stock		
A. Modernization, Rehabilitation	58,879	2.4
B. New	1,216,816	49.6
C. Other	45,439	1.9
2. Way & Structures		
A. Track	172,085	7.0
B. Power	269,515	11.0
C. Signals	135,431	5.6
D. Structures	77,927	3.2
E. Other	3,911	0.2
3. Stations, Terminals		
A. Modernization, Rehabilitation	150,876	6.1
B. Expansion	29,654	1.2
C. New	78,428	3.2
D. Park and Ride	15,565	0.6
4. Yards and Buildings		
A. Modernization	46,050	1.9
B. New	19,931	0.8
5. Operational Improvements		
A. Maintenance Equipment	39,575	1.6
B. Fare Collection	10,572	0.4
C. Communications	14,532	0.6
D. Surveillance	1,496	0.1
E. Information	110	-
F. Safety	20,561	0.8
6. Other	46,755	1.9
TOTALS:		
1. Rolling Stock	1,321,134	53.8
2. Way & Structures	659,869	26.9
3. Stations and Terminals	274,523	11.2
4. Yards and Buildings	65,981	2.7
5. Operational Improvements	86,846	3.5
6. Other	47,013	1.9
GRAND TOTAL	2,455,366	100.0

A.1 Rapid Rail

UMTA Section 3 grants to modernize raid (heavy) rail systems total approximately $817.5 million.[1] As defined in the APTA Transit Fact Book, rapid (heavy) rail systems formerly known as "subway" or "elevated (railway)" include "subway-type transit vehicle railway constructed on exclusive private right-of-way with high-level platform stations." The following cities received UMTA grants:

CITY	AMOUNT (000s)	PERCENT OF RAPID RAIL TOTAL
New York	$350,139	42.8
Chicago	211,534	25.9
Boston	128,071	15.7
Philadelphia	109,698	13.4
Cleveland	18,094	2.2
TOTAL	$817,536	100.0

Grant approvals increased 404 percent in current dollars from 1965 to 1976. Annual fluctuations in grant approvals are illustrated in Exhibit II-5. Average yearly grant approvals during this period were $65 million. However, yearly grant approvals since 1971 have averaged $109 million, thereby raising the yearly average between 1965 and 1976. The functional distribution of total costs (federal and local share) is indicated in Exhibit II-6. Approximately 38 percent ($441.9 million) of all rapid rail project costs are for the purchase of new rapid rail cars. Modernization of stations and terminals (11.9 percent) and power systems (11.0 percent) constitute, respectively, the second and third greatest areas of UMTA investment in rapid rail modernization projects. Improvements to signals, totalling $96.3 million, represent 8.43 percent of total costs. Operational improvements (4.5 percent) and yards and buildings improvements (4.1 percent) are not as significant relative to total rapid rail project costs.

[1] A discussion of the scope of current rapid rail operations and the national aggregate impacts of the Rail Modernization Program is presented in Appendix A.

EXHIBIT II-5

FLUCTUATIONS IN UMTA SECTION 3 RAIL MODERNIZATION GRANT APPROVALS BY MODE AND BY YEAR, 1965-1976

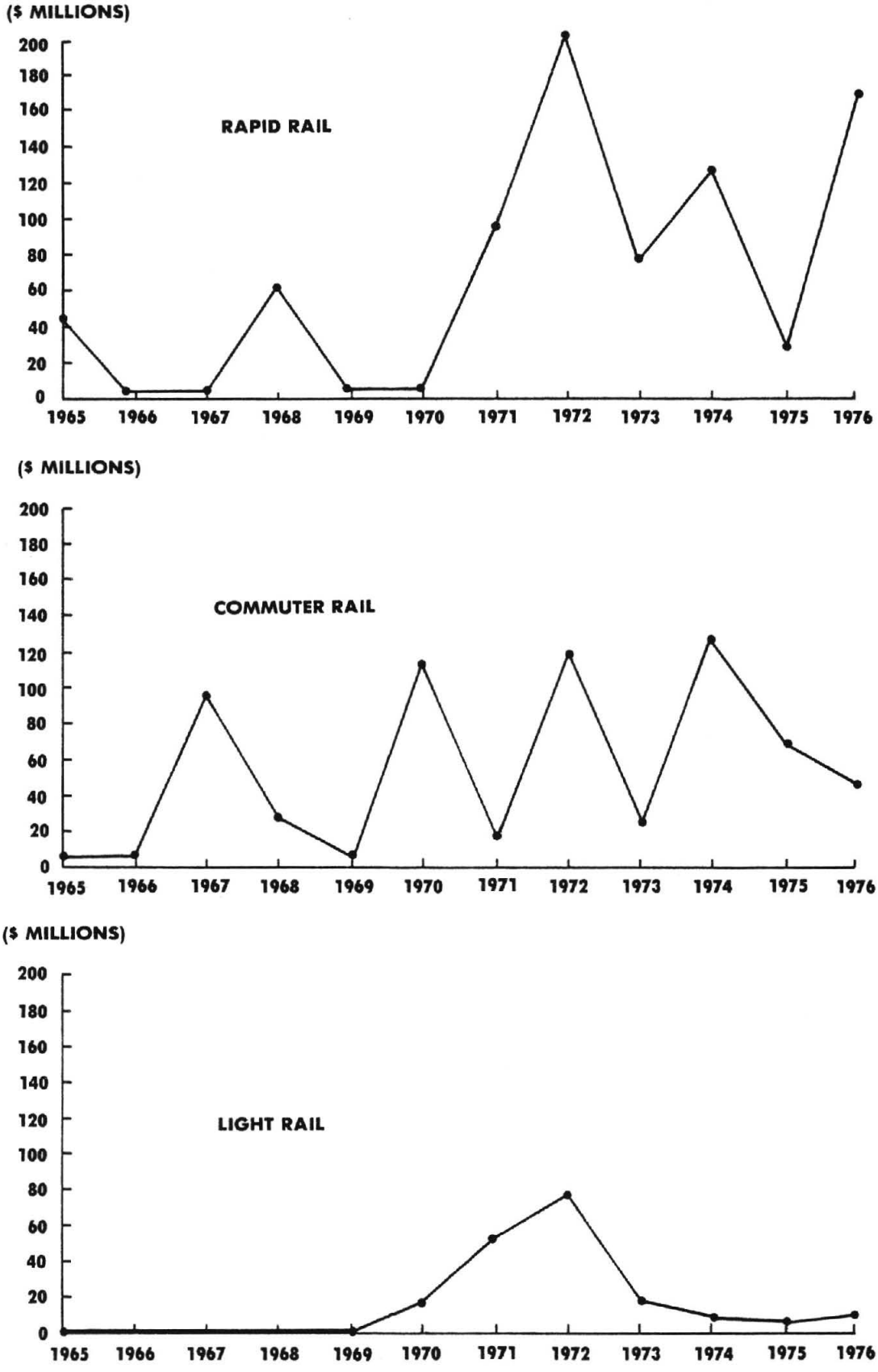

EXHIBIT II-6

UMTA SECTION 3 RAPID RAIL MODERNIZATION PROJECTS FEBRUARY 1965-MAY 1977 TOTAL COST (FEDERAL AND LOCAL SHARES)

ITEM	RAPID RAIL	
	$ (000s)	% of TOTAL
1. Rolling Stock		
A. Modernization, Rehabilitation	30,939	2.7
B. New	441,947	38.3
C. Other	-	-
2. Way & Structures		
A. Track	59,889	5.2
B. Power	126,348	11.0
C. Signals	96,259	8.3
D. Structures	58,454	5.1
E. Other	-	-
3. Stations, Terminals		
A. Modernizaton, Rehabilitation	136,849	11.9
B. Expansion	11,187	1.0
C. New	68,163	5.9
D. Park and Ride	1,093	0.1
4. Yards and Buildings		
A. Modernization	45,863	4.0
B. New	1,383	0.1
5. Operational Improvements		
A. Maintenance Equipment	27,821	2.4
B. Fare Collection	200	-
C. Communications	4,390	0.4
D. Surveillance	1,004	0.1
E. Information	-	-
F. Safety	18,817	1.6
6. Other	23,206	2.0
TOTALS:		
1. Rolling Stock	472,886	41.0
2. Way & Structures	340,950	29.5
3. Stations and Terminals	217,292	18.8
4. Yards and Buildings	47,246	4.1
5. Operational Improvements	52,232	4.5
6. Other	23,206	2.0
GRAND TOTAL	1,153,812	100.0

A.2 Commuter Rail

UMTA grants for commuter railroad modernization amounted to approximately $709 million between 1965 and May 31, 1977.[1] Appendix A includes a discussion of current commuter rail operations and national aggregate impacts of the Rail Modernization Program. Cities that have received UMTA commuter rail modernization grants include:

CITY	TOTAL SECTION 3 RAIL MODERNIZATION GRANTS (000s)	PERCENT OF TOTAL COMMUTER RAIL GRANTS
New York Tri-State region	$482,122	67.9
Chicago	164,928	23.2
Philadelphia	47,987	6.8
Boston	10,907	1.5
Pittsburgh	1,983	0.4
Detroit	1,606	0.2
TOTAL	$709,533	100.0

Total Section 3 rail modernization grants to the New York Tri-State region include funds for commuter rail projects in New Jersey and Connecticut.

Yearly commuter rail grant approvals between 1965 and 1969 averaged $27.8 million. This figure contrasts with the yearly average of $75.4 million between 1970 and 1977. The fluctuations in yearly grant approvals are shown in Exhibit II-5. The functional distribution of costs is presented in Exhibit II-7. The greatest single cost category is new rolling stock which accounts for over $646.6 million or 64.6 percent of total costs. No other single category comprises over 10 percent of total costs except power system improvements (10.3 percent, or $103.3 million). The entire way and structures category represents 22.2 percent ($221.6 million) of total commuter rail costs,

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[1] For the purposes of this study, commuter railroad operations include those "main-line railroad" transportation operations that encompass urban passenger train service for local short-distance travel between a central city and adjacent suburbs; suburban rail passenger service - using both locomotive-hauled and self-propelled railroad passenger cars - is characterized by multi-trip tickets, specific station-to-station fares, railroad employment practices, and usually only one or two stations in the central business district (APTA definition).

EXHIBIT II-7

UMTA SECTION 3 COMMUTER RAIL MODERNIZATION PROJECTS FEBRUARY 1965-MAY 1977 TOTAL COST (FEDERAL AND LOCAL SHARES)

ITEM	COMMUTER RAIL	
	$ (000s)	% of TOTAL
1. Rolling Stock		
A. Modernization, Rehabilitation	25,527	2.6
B. New	646,622	64.6
C. Other	45,439	4.5
2. Way & Structures		
A. Track	58,157	5.8
B. Power	103,255	10.3
C. Signals	38,701	3.9
D. Structures	17,732	1.8
E. Other	3,761	0.4
3. Stations, Terminals		
A. Modernization, Rehabilitation	10,231	1.0
B. Expansion	-	-
C. New	5,331	0.5
D. Park and Ride	14,472	1.4
4. Yards and Buildings		
A. Modernization	22	-
B. New	-	-
5. Operational Improvements		
A. Maintenance Equipment	4,282	0.4
B. Fare Collection	1,839	0.2
C. Communications	189	-
D. Surveillance	492	0.1
E. Information	85	-
F. Safety	861	0.1
6. Other	23,430	2.3
TOTALS:		
1. Rolling Stock	717,588	71.7
2. Way & Structures	221,606	22.2
3. Stations and Terminals	30,034	3.0
4. Yards and Buildings	22	-
5. Operational Improvements	7,748	0.8
6. Other	23,688	2.4
GRAND TOTAL	1,000,686	100.0

while the remaining functional categories - stations and terminals (3.0 percent), yards and buildings and operational improvements (0.8 percent) - are insignificant in the overall commuter rail modernization picture.

A.3 Light Rail

UMTA grants to modernize light rail systems total $213,870,000 (see Exhibit II-2). The national aggregate impacts of the UMTA light rail modernization program are presented in Appendix A. In light rail transit systems, a streetcar-type transit vehicle travels over railway constructed on public, semi-private, or private right-of-way. Light rail systems are also referred to as "streetcars," "trolley cars," or "subway-surface" cars. The following cities received UMTA capital grants between 1965 and May 1977 for light rail improvements:

CITY	AMOUNT (000s)	PERCENT OF LIGHT RAIL TOTAL
Boston	$81,284	38.0
San Francisco	75,462	35.3
Cleveland	30,366	14.2
Pittsburgh	17,208	8.0
Philadelphia	9,550	4.5
TOTAL	$213,870	100.0

During the first 5 years (1965-1969) of the UMTA Capital Grant Program, no grants were approved under Section 3 for improvements to light rail systems. In 1970, however, $16.6 million was approved for light rail modernization projects. Grant approvals for light rail modernization during the period 1970-1977 averaged $30.6 million per year. Yearly fluctuations in grant approvals are shown in Exhibit II-5. The distribution of costs is shown in Exhibit II-8. The purchase of new rolling stock comprises a significant portion (42.6 percent) of total costs. Improvements to Way & Structures represent approximately 32.3 percent of total project costs (18.0 percent for track and 13.3 percent for power system improvements). The remainder of the costs of light rail modernization projects is spread among the new yards and buildings, expansion of stations and buildings, and operational improvements categories.

EXHIBIT II-8

UMTA SECTION 3 LIGHT RAIL MODERNIZATION PROJECTS FEBRUARY 1965-MAY 1977 TOTAL COST (FEDERAL AND LOCAL SHARES)

ITEM	LIGHT RAIL	
	$ (000s)	% of TOTAL
1. Rolling Stock		
A. Modernization, Rehabilitation	2,413	0.8
B. New	128,247	42.6
C. Other	-	-
2. Way & Structures		
A. Track	54,039	18.0
B. Power	39,912	13.3
C. Signals	1,471	0.5
D. Structures	1,741	0.6
E. Other	150	0.1
3. Stations, Terminals		
A. Modernization, Rehabilitation	3,796	1.3
B. Expansion	18,467	6.1
C. New	4,934	1.6
D. Park and Ride	-	-
4. Yards and Buildings		
A. Modernization	165	0.1
B. New	18,548	6.2
5. Operational Improvements		
A. Maintenance Equipment	7,472	2.5
B. Fare Collection	8,533	2.8
C. Communications	9,953	3.3
D. Surveillance	-	-
E. Information	25	-
F. Safety	883	0.3
6. Other	119	-
TOTALS:		
1. Rolling Stock	130,660	43.4
2. Way & Structures	97,313	32.3
3. Stations and Terminals	27,197	9.0
4. Yards and Buildings	18,713	6.2
5. Operational Improvements	26,866	8.9
6. Other	119	-
GRAND TOTAL	300,868	100.0

A.4 Employment Impacts of the Rail Modernization Program

One frequently cited justification for federal participation in rail modernization projects is job creation. The expenditure of federal funds for rail modernization projects creates a demand for goods and services, and ultimately provides employment opportunities. However, the paucity of primary research estimating employment impacts of federally-funded projects precludes any definitive assessment of the number of jobs created by the UMTA Rail Modernization Program. A review of primary and secondary research on employment impacts was conducted to provide rough estimates of employment impacts, and these estimates were subsequently applied to the Rail Modernization Program.

Four separate studies on the person-years of employment generated per billion dollars of expenditure for mass transit construction have been identified, and are summarized below.

PERSON-YEARS EMPLOYMENT GENERATED
PER BILLION DOLLARS OF EXPENDITURE[1]
(MASS TRANSIT CONSTRUCTION)

Study	On-site	Off-site	Total
A. Bureau of Labor Statistics, Factbook for Estimating the Manpower Needs of Federal Programs	-	-	44,750
B. Eliahu Romanoff, "Impact of Mass Transit Construction Projects on the Massachusetts Economy"	32,500	46,800	79,300
C. U.S. Congress, Office of Tech nology Assessment, Energy, the Economy, and Mass Transit	-	-	79,400
D. Roger Bezdek, "Energy, Manpower, and the Highway Trust Fund"	-	-	84,000

[1] Gerrard, Michael, "How Public Works Projects Affect Employment: A Case Study of Westway and Its Transit Alternatives, "New York, New York, November 1977, p. 13.

Although these studies base their respective estimates on input-output analysis, they are not directly comparable for several reasons, including the time periods represented by the data, definitions of what kind of employment is on-site and off-site, sources of data, and geographical coverage. A similar study on the person-years of employment generated per billion dollars spent on freight car purchases for Conrail estimates that 106,000 direct and indirect jobs are created.[1] Additionally, the above-mentioned employment study by the U.S. Congress, Office of Technology Assessment, estimates that $1 billion spent for manufacturing rapid transit vehicles creates 79,900 jobs.

Before the employment estimates from these studies were applied to rail modernization expenditures from 1965 to 1976, the expenditures were separated into rolling stock purchases and general mass transit construction and then indexed to a constant dollar figure.[2] The index used to translate rolling stock purchases into 1976 constant dollars was developed by the Bureau of Labor Statistics and is one of many components of the Wholesale Price Index (WPI). This index measures increases in the cost of railroad equipment, including freight cars, locomotives, wheels, couplers, etc. Although the index does not specifically account for increasing costs associated with commuter cars and rapid transit vehicles, it represents the most appropriate index currently available. UMTA funds not approved for rolling stock purchases are classified into a general mass transit construction category. The annual composite index developed by the Department of Commerce for all types of construction was used to inflate these mass transit construction costs into 1976 constant dollars. This index represents the cost of new construction and only serves as a crude indicator of the increasing costs associated with the "lighter" mass transit construction (rehabilitation/modernization). The application of these indices to the rolling stock category and to the urban mass transit construction category show that UMTA expenditures for the period 1965-1977 total $1.44 billion and $1.09 billion, respectively, in 1976 constant dollars.

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[1] Rowan, Ruth E., "Industry Employment Projections: A MR10 Model Simulation," Boston, Massachusetts, December 1976, pp. 45-46.

[2] It is assumed that the yearly functional distribution of total project costs equals the functional distribution of all costs during the period 1965-1977. Additionally, the approval of rail modernization grants during a given year is assumed to result in the expenditure of these grants during the same year.

The final step in estimating the person-years employment generated involves applying figures derived from the employment impact studies cited above to total rail modernization expenditures for rolling stock purchases and mass transit construction.[1] Because of the crudeness of measures used, they provide the following range of person-years employment generated:

	Low	High
Rolling Stock Expenditures (Billions)	$1.44	$1.44
Employment Generated Per Billion	79,900*	106,000**
Jobs Created	115,056	152,640
Mass Transit Construction (Billions)	$1.09	$1.09
Employment Generated Per Billion	44,750	84,000
Jobs Created	48,778	91,560
Total Jobs Created by UMTA Rail Modernization Program (1965-1977)	163,834	244,200

It appears that a reasonable estimate of the person-years of employment generated over the life of the UMTA program (February 1965 to May 1977) would be between roughly 164,000 and 244,000 direct and indirect jobs. Furthermore, these estimates seem conservative for two reasons. First, the employment coefficients used to indicate jobs created per billion dollars of expenditures represent the employment impacts of new mass transit construction. However, "repair and rehabilitation projects tend to employ substantially more people per dollar than new construction does, and more than half of the project cost usually goes to labor - far higher than the proportion for new construction."[2]

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[1]The employment generated per billion dollars of expenditure is assumed to be constant over time.

* U.S. Congress, Office of Technology Assessment, Energy, the Economy, and Mass Transit.

**Rowan, Ruth E., "Industry Employment Projections: A MR10 Model Simulation."

[2]Gerrard, Michael, "How Public Works Projects Affect Employment: A Case Study of Westway and Its Alternatives," New York, New York, 1977, p. 12.

Second, these employment estimates do not account for jobs created as a result of respending wages and profits throughout the economy (multiplier effect). These secondary employment impacts can be substantial and, as Mr. Gerrard points out in his analysis of the Westway alternatives, a typical region's multiplier is 2.5 (i.e., $100 million in local wages will generate a total of $250 million in local income). As such, the number of person-hours of employment generated per billion dollars of expenditure may even double in some cases.

B. PROGRAM OVERVIEW BY CITY

In order to provide a basis for evaluating the impacts of specific rail modernization grants, this report presents an overview of the Rail Modernization Program for each city receiving UMTA Section 3 rail modernization funds. Specifically, this section familiarizes the reader with the present scope of transit operations in "rail modernization" cities, presents an inventory of rail modernization grants received by each city, and discusses the functional emphasis given by each city to rail modernization improvements. Exhibit II-9 shows the transit operations that have directly benefitted from UMTA Section 3 rail modernization grants, and Exhibit II-10 summarizes operating data as they relate to the light rail and rapid rail systems. Exhibit II-11 summarizes similar data for relevant commuter rail systems.

As previously noted, specific rail modernization grants have been identified and respective dollar amounts provided by UMTA reference documents. Because certain grants involved both bus and rail modernization projects, the rail portion of the grant was extracted. In some cases, this extraction was necessarily somewhat arbitrary, but in most instances the grant files, approval memoranda, and project budgets provided enough information to isolate the rail modernization portion with some confidence.

EXHIBIT II-9

TRANSIT OPERATIONS DIRECTLY BENEFITING FROM UMTA SECTION 3 RAIL MODERNIZATION FUNDS BY CITY AND BY MODE

CITY

New York:

- rapid rail
  - New York City Transit Authority (NYCTA)
  - Port Authority Trans-Hudson (PATH)
- commuter rail
  - Long Island RailRoad (LIRR)
  - Conrail ex-New York, New Haven and Hartford (NH)
    - ex-New York Central (NYC)
    - ex-Erie Lackawanna (EL)
    - ex-Central Railroad Company of New Jersey (CNJ)
    - ex-Pennsylvania Railroad (PRR)
    - ex- New York and Long Branch (NY & LB)

Chicago:

- rapid rail
  - Chicago Transit Authority (CTA)
- commuter rail
  - Burlington Northern (BN)
  - Chicago & North Western Transportation Co. (C & NW)
  - Chicago, Milwaukee, St. Paul & Pacific Railroad Co. (MILW)
  - Illinois Central Gulf (ICG)
  - Chicago, Rock Island & Pacific Railroad Company (RI)
  - Norfolk and Western Railroad Company (NW)

Boston:

- rapid rail
  - Massachusetts Bay Transportation Authority (MBTA)
- light rail
  - Massachusetts Bay Transportation Authority (MBTA)
- commuter rail
  - Massachusetts Bay Transportation Authority (MBTA)

Philadelphia:

- rapid rail
  - Southeastern Pennsylvania Transportation Authority (SEPTA)
- light rail
  - Southeastern Pennsylvania Transportation Authority (SEPTA)
- commuter rail
  - Conrail ex-Reading
    - ex- Pennsylvania (PRR)

EXHIBIT II-9 (Continued)

CITY

San Francisco:

- light rail
  - San Francisco Municipal Railway (MUNI)

Cleveland:

- rapid rail
  - Greater Cleveland Regional Transit Authority (GCRTA)
- light rail
  - Greater Cleveland Regional Transit Authority (GCRTA)

Pittsburgh:

- light rail
  - Port Authority of Allegheny County (PAT)
- commuter rail
  - Baltimore & Ohio (B&O)

Detroit:

- commuter rail
  - Grand Trunk Western (GTW)

EXHIBIT II-10

OPERATING STATISTICS OF RAPID AND LIGHT RAIL SYSTEMS RECEIVING UMTA RAIL MODERNIZATION FUNDS, 1977

	PASSENGER VEHICLE MILES OPERATED	PASSENGERS (MILLIONS)	ROUTE MILES[a] (ONE WAY)	VEHICLES ACTIVE	MAXIMUM VEHICLES OPERATED IN P.M. PEAK SERVICE	MINIMUM VEHICLES OPERATED IN DAY BASE SERVICE	STATIONS
RAPID RAIL							
New York							
NYCTA	261,489,463	1,002.8	230.6	6,296	4,862	510[b]	456
PATH	9,614,132	40.5	13.8	297	246	72	13
Chicago							
CTA	50,775,435	120.8	88.9	1,138	800	296	142
Boston							
MBTA	33,896,860	45.0	41.7	313	216	88	52
Philadelphia[c]							
SEPTA	12,002,828	79.3	56.7	458	324	125	54
Cleveland							
GCRTA	3,104,348	10.64	19.0	104	75	12	18
LIGHT RAIL[d]							
Boston							
MBTA	5,822,077	33.0	32.6	230	165	109	95
Philadelphia[c]							
SEPTA (Red Arrow)	6,264,172	5.2	54.2	55	33	11	65
SEPTA (CTD)		41.9	154.9	300	190	81	-
San Francisco[e]							
MUNI	3,073,220	15.3	34.8	105	95	70	-
Cleveland							
GCRTA	1,341,808	4.9	19.2	57	49	7	29
Pittsburgh							
PAT	1,794,480	6.2	52.6	95	66	19	120

a total miles of route may include some double counting

b minimum vehicles operated in night service

c data affected by 42-day strike in 1977

d stations for light rail systems include total number of stops

e FY 1977

EXHIBIT II-11

OPERATING STATISTICS OF COMMUTER RAILROADS RECEIVING UMTA RAIL MODERNIZATION FUNDS 1977

CITY	ROUTES	TOTAL ROUTE-MILES	PASSENGERS (000s)	CARS	WEEKDAY TRAINS	STATIONS (STOPS)
New York Tri-State:						
LIRR	9	322.0	69,400.0	1,026	714	144
NH	4	120.0	18,900.0	268	210	42
NYC	2	137.0	22,100.0	367	310	62
EL	6	248.9	17,700.0	336[a]	266	107
CNJ	2	116.4	3,700.0	82[a]	55	26
PRR	2	90.9	10,500.0	147[a]	145	19
NY&LB	2	123.3	4,700.0	109[a]	34	18
Chicago						
C&NW	3	164.3	25,259.0	283	192	54
ICG	3	75.6	14,335.0	164	233	58
BN	1	38.0	12,627.0	141	68	26
MILW	2	110.1	8,409.0	103	84	42
RI	1	46.8	5,675.0	106	63	17
NW	1	23.5	336.0	8	2	12
Philadelphia						
SEPTA	13	415.0	33,592.0	407	787	219
Boston						
MBTA	11	204.7	7,843.0	187	331	83
Pittsburgh						
B&O	1	18.2	347.0	9	16	5
Detroit						
GTW	1	26.0	323.0	17	6	11

[a]peak service requirements

B.1 New York Tri-State Region

Commuter Rail

The commuter rail system in the New York Tri-State region (New York, New Jersey, Connecticut) encompasses the following operators:

- Long Island RailRoad (LIRR) - The LIRR is the largest suburban railroad in the New York metropolitan region in terms of volume. The LIRR has nine outlying branches which total 322 route-miles and feed into three terminals on the New York City end. Average weekday passenger volume approximates 225,000 on about 700 trains.

- Conrail, ex-New York, New Haven, and Hartford (NH) - Primarily providing service between New York's Grand Central Terminal and New Haven, Connecticut, this line is financially assisted by the Connecticut Department of Transportation and the New York Metropolitan Transportation Authority (MTA). Four routes totaling 120 miles carry 64,000 riders each weekday on 210 trains.

- Conrail, ex-New York Central (NYC) - Presently referred to as the Harlem and Hudson lines, ex-NYC service consists of 2 routes totaling 137 miles and carries 79,000 riders each weekday on 310 trains.

- Conrail, ex-Erie Lackawanna - Six routes that total 248 miles out of Hoboken Terminal carry 67,000 passengers each weekday on 266 trains. Commuter service is financially assisted by the New Jersey Department of Transportation (NJDOT) and the MTA.

- Conrail, ex-Central of New Jersey (CNJ) Service includes two routes (totaling 116 miles) and carried 3.7 million passengers in 1977.

- Conrail, ex-Pennsylvania Railroad (PRR) - two routes (from New York's Penn station to Trenton and to south Amboy, New Jersey), totaling 90.9 miles, carried 10.5 million passengers in 1977. Service is financially assisted by the NJDOT.

- Conrail, ex-New York & Long Branch (NY&LB) - Providing service between New York's Penn Station and Bay Head Junction, New Jersey, and between Newark Penn station and Bay Head Junction, New Jersey; 34 weekday trains carried 4.7 million passengers in 1977.

Exhibit II-12 presents the 16 grants approved for improvements to the commuter rail system in the New York Tri-State region. The first three grants listed are part of a major capital improvement program undertaken by the MTA for the Long Island RailRoad to increase the capacity, dependability, and comfort of the commuter service. These closely related projects involve tracks (NY-24), cars (NY-14), and power (NY-3). The UMTA investment in these projects amounts to approximately $109.5 million, or 22.9 percent of the total UMTA investment in commuter rail in New York. Other rail modernization projects involving the LIRR include track and signal work in NY-96, and structural and track rehabilitation under NY-85.

The 11 remaining UMTA Section 3 grants for improvements to New York's commuter rail system were primarily for the purchase of new commuter cars (representing 92.4 percent of the federal share of these grants). Two new stations, power and signal improvements on the New Haven line, and implementation of the Aldene Plan account for the remaining 7.6 percent. It is noted that 31.7 percent ($153.0 million) of commuter rail modernization funds in New York were for improvements to the Conrail New Haven line, including 244 new multiple-unit (M-Us) commuter cars.

Exhibit II-13 shows the functional distribution of costs of commuter rail modernization projects. Approximately 66 percent are for the purchase of new rolling stock. A total of 968 new commuter cars were purchased (389 for the LIRR, 244 for Conrail New Haven, 180 for Conrail Erie-Lackawanna, and 155 for Conrail PRR and for Conrail CNJ). Rolling stock and passenger stations and terminals for New York amount to $462.7 million, or 67.5 percent of total costs. The only significant category of commuter rail improvements receiving funds is the Way & Structures category, which amounts to $207.6 million (30.3 percent) in total costs. Power improvements account for almost 50 percent ($103.0 million) of costs in this category.

EXHIBIT II-12

COMMUTER RAIL MODERNIZATION PROJECTS

NEW YORK TRI-STATE REGION

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
NY-03	MTA	MAY 31 '67	$ 69,260	$ 40,792	Rehabilitation of LIRR electrification
NY-14	MTA	JUN 10 '70	83,713	55,708	389 M-Us for LIRR
NY-24	MTA	MAY 14 '71	18,210	13,026	Track improvements - 50 miles LIRR
NY-96	MTA	OCT 22 '76	17,050	13,640	Track and signal work - LIRR, signal work Harlem & Hudson Line
NY-13	MTA	DEC 15 '67	57,397	34,811	122 M-Us for Conrail New Haven Line
NY-85	MTA	NOV 21 '75	18,934	15,147	Rehabilitation of Park Ave. viaduct, track rehabilitation on LIRR Port Washington
NJ-01	NJDOT	JUN 29 '65	9,111	4,826	Implementation of Aldene Plan
NJ-02	NJDOT	OCT 12 '66	9,991	6,661	35 electric M-Us for Conrail North Jersey Service
NJ-04	NJDOT	MAY 13 '70	28,100	18,733	70 electric M-Us for Conrail North Jersey Service
NJ-06	NJDOT	MAR 30 '77	50,955	40,764	50 M-Us for Conrail New York and Long Branch Service
NJ-08	NJDOT	FEB 08 '71	1,521	1,014	New station at Metuchen
NJ-14	NJDOT	JUN 27 '74	148,940	118,836	180 M-Us for Conrail
CT-01	Conn. DOT	DEC 15 '67	43,624	21,812	72 electric M-Us for Conrail New Haven Line
CT-04	Conn. DOT	FEB 10 '72	102,005	76,080	50 M-Us for New Haven Division re-electrification Danbury
CT-05	Bridgeport	MAR 12 '73	3,060	2,040	New station for New Haven Division
CT-13	Conn. DOT	SEP 03 '75	22,791	18,232	Power system changes, signal station, track modernization of New Haven Division
TOTAL:			$684,662	$482,122	

EXHIBIT II-13
NEW YORK

TOTAL UMTA SECTION 3 RAIL MODERNIZATION PROJECTS THROUGH MAY 1977, TOTAL COST BY TYPE OF RAIL AND BY COMPONENT ($ 000s)

ITEM	RAPID RAIL		COMMUTER RAIL		TOTAL RAIL	
	$	% OF RR TOTAL	$	% OF CR TOTAL	$	% OF TOTAL
1. Rolling Stock						
A. Modernization Rehabilitation	24,818	4.8	3,606	0.5	28,424	2.4
B. New	266,591	51.9	447,885	65.4	714,476	59.6
C. Other						
2. Way & Structures						
A. Track	19,990	3.9	53,553	7.8	73,543	6.1
B. Power	51,622	10.1	102,982	15.0	154,604	12.9
C. Signals	47,900	9.3	35,164	5.1	83,064	6.9
D. Structures	15,710	3.1	15,932	2.3	31,642	2.6
E. Other						
3. Stations, Terminals						
A. Modernization, Rehabilitation	88,967	1.8	6,649	1.0	15,616	1.3
B. Expansion	775	0.2			775	0.1
C. New	59,219	11.5	4,581	0.7	63,800	5.3
D. Park and Ride						
4. Yards and Buildings						
A. Modernization						
B. New	5,257	1.0			5,257	0.4
5. Operational Improvements						
A. Maintenance Equipment	9,740	1.9	3,756	0.6	13,496	1.1
B. Fare Collection			1,444	0.1	1,444	0.1
C. Communications						
D. Surveillance						
E. Information						
F. Safety	2,171	0.4			2,171	0.2
6. Other	900	0.2	9,110	1.3	10,011	0.8
TOTALS:						
1. Rolling Stock	291,409	56.7	451,491	65.9	742,900	62.0
2. Way & Structures	135,222	26.3	207,631	30.3	342,853	28.6
3. Stations and Terminals	68,961	13.4	11,230	1.6	80,191	6.7
4. Yards and Buildings	5,257	1.0	-	-	5,257	0.4
5. Operational Improvements	11,911	2.3	5,200	0.8	17,111	1.4
6. Other	900	0.2	9,110	1.3	10,010	0.8
GRAND TOTAL	513,660	100.0	684,662	100.0	1,198,322	100.0

Rapid Rail

The New York City rapid transit system represents one of the largest systems in the world and virtually dwarfs other rapid transit systems in the U.S. (see Exhibit II-10). This system is comprised of two divisions: Interborough Rapid Transit (IRT) and the Independent System-Brooklyn Manhattan Transit Corporation (IND-BMT). Although the IND-BMT Division initially operated as two separate divisions, operations were merged in 1967 following the opening of the Chrystie Street subway connection. The operations, directed by the New York City Transit Authority (NYCTA), comprise 230 route-miles and 459 stations, while transporting over 1 billion passengers with 6,498 cars in 1977.

A second rapid rail system operating in New York is the Port Authority Trans-Hudson Corporation (PATH). PATH operates a rapid rail service between New York City's Penn Station and Newark, New Jersey. The PATH system consists of 13 stations, 13.8 route-miles, and 297 vehicles. During 1977, over 40 million passengers were transported by PATH.

The eight UMTA rail modernization grants for improvements to the rapid rail system in New York total approximately $350 million (see Exhibit II-14). Over 95 percent of funds received by NYCTA were for the purchase of 1,145 new rapid rail cars for the IND-BMT Division. Other UMTA-funded projects for NYCTA operations include modernization of the 49th Street station in Manhattan ($1.0 million), a subway noise abatement program ($7.5 million), and various systemwide improvements in grant NY-95 ($124.5 million). These rail modernization projects funded by UMTA are in addition to a significant number of projects funded by the City of New York prior to 1965.

UMTA rail modernization grants to PATH (IT-1 and IT-4), amounting to $44.3 million, provided for a variety of improvements, including the purchase of 44 new cars, rehabilitation of 47 existing cars, construction of the Journal Square Transportation Center in Jersey City, and improvements to some of the 12 remaining stations. Additionally, signal and interlocking and track improvements resulted from the initial UMTA grant to PATH.

The distribution of costs of UMTA rail modernization projects is shown in Exhibit II-13. The majority of funds (70.2 percent) have resulted in improvements to the rapid rail system which directly benefit the average rail transit rider. Projects involving new cars and stations appear to improve the marketability of a transit system and, as such, may have a positive impact on transit patronage. The remaining functional improvement category in New York benefitting from UMTA funds is the Way & Structures category. Total costs in this category were approximately $135.2 million. Most of these costs are attributable to power systems (38.1 percent) and signal improvements (35.4 percent).

EXHIBIT II-14

RAPID RAIL MODERNIZATION PROJECTS

NEW YORK

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
NY-01	NYCTA	SEP 27'65	$ 46,840	$ 23,420	400 new cars (IND-BMT Division)
NY-07	NYCTA	SEP 27 '68	2,046	1,023	Modernization - BMT 49th St. Station (Manhattan)
NY-46	NYCTA	JUN 20 '72	213,412	142,232	745 new cars (IND-BMT Division)
NY-74	NYCTA	MAY 12 '75	12,499	7,499	Subway noise abatement program
NY-86	NYCTA	MAR 09 '76	9,000	7,200	Power Supervisory Center
NY-95	NYCTA	MAR 09 '76	155,624	124,499	Systemwide improvement
IT-01	PATH	JUN 29 '65	15,020	5,100	44 new cars; signal, track, and station modernization
IT-04	PATH	MAR 26 '68	59,219	39,166	Construction of Journal Square (Jersey City) Transportation Center
TOTAL RAPID RAIL GRANTS - NEW YORK			$513,660	$350,139	

Exhibit II-13 also provides the functional distribution of costs of all UMTA rail modernization projects in New York. Approximately 57 percent of total costs were for commuter rail modernization projects. The greater proportion of these costs attributed to commuter rail derives primarily from the higher level of investment in new commuter cars than in new rapid rail cars ($447.9 million versus $266.6 million). Other less significant areas of difference in investment between the two modes include stations and terminals, where rapid costs ($69.0 million) exceed commuter rail costs ($11.2 million).

B.2 Chicago

Rapid Rail

The Chicago Transit Authority (CTA) is the principal mass transportation carrier within the six-county Chicago metropolitan area. Service is provided on six rapid transit routes using 1,138 cars (see Exhibit II-10). On a typical weekday there are nearly 400,000 revenue passengers originating on the six rapid transit lines.

As shown in Exhibit II-15, six UMTA grants have been approved for improvements to the CTA rapid transit system. The federal cost of these projects exceeds $211 million. These funds provided for the purchase of 350 rapid transit cars, systemwide improvements to the CTA Way & Structures and to stations and terminals, and modernization of four substations.

The distribution of costs is depicted in Exhibit II-16. The following functional categories account for significant percentages of costs: new rolling stock ($81.8 million, or 28.9 percent); modernization of stations and terminals ($65.4 million, or 23.2 percent); signal modernization ($47.0 million, or 16.6 percent); track improvements ($28.6 million, or 10.1 percent); and power system improvements ($28.5 million, or 10.1 percent). A major effort by the CTA to modernize the entire signal system is the reason this functional category comprises such a relatively high percentage of total costs. Other major improvements within the Way & Structures category include the conversion from overhead trolley to third rail in Evanston and numerous track improvements along the North-South line.

EXHIBIT II-15

RAPID RAIL MODERNIZATION PROJECTS

CHICAGO

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
IL-03	Chicago	JUN 19 '67	$ 433	$ 289	"Northwest Passage" (CTA-C&NW Rwy. Station connection)
IL-05	Chicago	MAY 27 '68	19,620	13,080	150 new cars[1]
IL-18	CTA	MAR 31 '71	267	178	Modernization of substations (E. 63rd; 62nd; Haymarket; Skokie Swift)
IL-24	CTA	DEC 23 '71	97,409	66,043	100 new cars, new signals, track maintenance, station rehabilitation
IL-40	CTA	JUN 23 '74	129,245	103,396	100 new cars, power, track, and station modernization
IL-62	CTA	SEP 28 '76	35,686	28,548	Operational improvements, track and car rehabilitation
TOTAL:			$282,660	$211,534	

[1] These cars provided for a major extension of service along the Kennedy-Dan Ryan expressway corridors.

EXHIBIT II-16
CHICAGO

TOTAL UMTA SECTION 3 RAIL MODERNIZATION PROJECTS THROUGH MAY 1977, TOTAL COST BY TYPE OF RAIL AND BY COMPONENT ($ 000s)

ITEM	RAPID RAIL		COMMUTER RAIL		TOTAL RAIL	
	$	% OF RR TOTAL	$	% OF CR TOTAL	$	% OF TOTAL
1. Rolling Stock						
A. Modernization Rehabilitation	4,925	1.7	19,126	8.4	24,051	4.8
B. New	81,784	28.9	139,770	61.9	221,554	43.4
C. Other			44,463	19.5	44,463	8.7
2. Way & Structures						
A. Track	28,647	10.1	2,060	0.9	30,707	6.0
B. Power	28,544	10.1	273	0.1	28,817	5.7
C. Signals	46,974	16.6	3,537	1.6	50,511	9.9
D. Structures	3,092	1.1			3,272	0.6
E. Other						
3. Stations, Terminals						
A. Modernization, Rehabilitation	65,437	23.2	222	0.1	65,659	12.9
B. Expansion						
C. New			566	0.3	566	0.1
D. Park and Ride	617	0.2	13,972	6.1	14,589	2.9
4. Yards and Buildings						
A. Modernization			22		22	
B. New						
5. Operational Improvements						
A. Maintenance Equipment	10,020	3.5	526	0.2	10,546	2.1
B. Fare Collection	200	0.1	395	0.2	595	0.1
C. Communications	1,492	0.5	189	0.1	1,681	0.3
D. Surveillance			492	0.2	492	0.1
E. Information			85	-	85	-
F. Safety			861	0.4	861	0.2
6. Other	10,928	3.9	944	0.4	11,872	2.3
TOTALS:						
1. Rolling Stock	86,709	30.7	203,359	89.4	290,068	56.7
2. Way & Structure	107,257	38.0	5,870	2.6	113,127	22.1
3. Stations and Terminals	66,054	23.4	14,760	6.5	80,814	15.8
4. Yards and Buildings			22	-	22	-
5. Operational Improvements	11,712	4.1	2,548	1.1	14,260	2.8
6. Other	10,928	3.9	944	0.4	11,872	2.3
GRAND TOTAL	282,660	100.0	227,503	100.0	510,163	100.0

Commuter Rail

Commuter rail service in Chicago is provided by eight railroads: Burlington Northern (BN); Chicago and North Western Transportation Co. (C&NW); Chicago, Milwaukee, St. Paul and Pacific Railroad Company (The Milwaukee Road or MILW); Chicago, Rock Island and Pacific Railroad Company (RI); Chicago, South Shore and South Bend Railroad (CSS); Illinois Central Gulf (ICG); Norfolk and Western Railway Company (NW); and Conrail (CR). However, neither the Chicago, South Shore and South Bend Railroad nor Conrail has received UMTA rail modernization grants. The scope of commuter rail operations directly benefitting from such grants is summarized below:

- Chicago and North Western Transportation Co. (C&NW) - As the largest commuter railroad in the Chicago metropolitan area, the C&NW provides weekday service on three routes (North Line, West Line, and Northwest Line) totaling 164.3 miles. Daily patronage is approximately 98,000.

- Illinois Central Gulf Railroad (ICG) - The second largest commuter rail carrier in the region, the ICG operates two separate lines: the electrified Commuter Division, which is the main line of the system, and the Joliet Line, which was formerly operated by the Gulf, Mobile, and Ohio Railroad. Approximately 61,000 passengers are transported daily in a total system comprising 75.6 route-miles, 164 cars, and 58 stations (see Exhibit II-11).

- Burlington Northern (BN) - The BN operates over one route (Chicago to Aurora, Illinois) totaling 38 route-miles. Over 46,000 passengers are carried daily in 141 bi-level cars (68 weekday trains).

- Chicago, Milwaukee, St. Paul and Pacific (MILW) - The Milwaukee Road operates two routes (North Line and West Line) totaling 110.1 route-miles. Commuter service includes 84 daily trains (103 bi-level cars) through 42 stations and serves 30,000 passengers daily.

- Chicago, Rock Island and Pacific Railroad (RI) - The Rock Island provides service between downtown Chicago and Joliet, Illinois. The Main Line extends 40.2 miles and contains a branch which loops west of the Main Line for a total of 6.6 miles. The system carries 26,000 passengers per day and encompasses 17 stations, 46.8 route-miles, and 106 cars.

- Norfolk and Western Railway (NW) - Operating out of Chicago's Union Station, the NW schedules two trains each weekday for the 23.5 mile route between Orland Park, Illinois, and Chicago. Total daily ridership approximates 1,600.

Commuter rail modernization grants to Chicago are listed in Exhibit II-17. The following public agencies were established in the Chicago metropolitan area so that the private railroads providing commuter service in each district could benefit from federal financial assistance through contractual arrangements: South Suburban Mass Transit District (SSMTD); West Suburban Mass Transit District (WSMTD); North-West Suburban Mass Transit District (N-WSMTD); and North Suburban Mass Transit District (NSMTD).

Nine grants totaling $164.9 million have been approved for Chicago's commuter rail system. The first three grants listed (IL-7, IL-23, and IL-48) provided for the purchase of new rolling stock (165 electric cars) for the ICG and for parking facilities at the ICG Park Forest South Station. These grants exceed $53.2 million and account for 32 percent of all UMTA commuter rail grants to Chicago. Under IL-15, UMTA funds totaling $28.6 million enabled the WSMTD to purchase and rehabilitate the existing BN fleet of 94 cars, purchase 25 new cars, install electrical standby equipment, and rebuild 21 BN locomotives. A subsequent grant (IL-44) of $12.4 million enabled the WSMTD to purchase an additional 22 cars and rebuild 4 diesel locomotives. UMTA grants IL-22 and IL-34 similarly made possible the purchase of 41 bi-level cars and 15 diesel locomotives for commuter service on the Milwaukee Road. The remaining two grants listed in Exhibit II-17 were approved for increased parking facilities at commuter rail stations in the Chicago metropolitan area and for the purchase of 50 bi-level cars and 21 diesel locomotives for the Rock Island.

The distribution of total costs of commuter rail modernization projects in Chicago is heavily slanted toward improvements in the rolling stock category (Exhibit II-16). These costs amount to nearly $203 million and constitute 89.4 percent of total costs of commuter rail modernizations in Chicago. Modernization of parking facilities at commuter rail stations equals 6.1 percent ($14.0 million) of total commuter rail net project costs. Projects involving rolling stock and stations represent almost 96 percent of total commuter rail costs.

EXHIBIT II-17

COMMUTER RAIL MODERNIZATION PROJECTS

CHICAGO

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
IL-07	SSMTD	DEC 27 '68	$ 40,766	$ 26,957	130 M-Us for ICG
IL-23	SSMTD	JAN 29 '73	33,731	25,567	35 M-Us for ICG
IL-48	SSMTD	JUN 30 '75	872	698	Parking facilities - Park Forest South Station (ICG)
IL-15	WSMTD	MAR 31 '72	43,034	28,689	25 bi-levels for BN, modernization of existing equipment including 21 diesel locomotives
IL-44	WSMTD	JUN 30 '75	15,539	12,431	22 bi-levels and 4 rebuilt diesel locomotives for BN
IL-22	N-WSMTD	DEC 13 '72	31,425	20,876	36 bi-levels and 13 diesel locomotives for Milwaukee RR
IL-34	NSMTD	MAY 23 '74	7,965	6,373	5 bi-levels and 2 diesel locomotives for Milwaukee RR, station-signal modernization
IL-31	IDOT	JUN 30 '75	14,072	11,258	Parking facilities at commuter stations (BN, ICG, C&NW, etc.)
IL-49	RTA	MAR 09 '76	40,099	32,079	50 bi-levels and 21 diesel locomotives for Rock Island
TOTAL:			$227,503	$164,928	

B.3 Boston

Rapid Rail

Boston's rapid rail system is part of the Massachusetts Bay Transportation Authority (MBTA) and consists of three lines lines: Blue Line (Wonderland-Bowdoin); Orange Line (Oak Grove-Forest Hills); and Red Line (Harvard-Quincy Center and Harvard-Ashmont). The Red Line branches out to Ashmont and Quincy Center south of the Andrew station. This rapid rail system embraces a total of 41.7 route-miles, 52 stations, and 313 rapid rail cars (see Exhibit II-10). Total annual passengers approximate 45 million.

Fifteen grants to Boston have been identified and are listed in Exhibit II-18. The rapid rail portions of these grants total $128.1 million and provide for various improvements on each of the three rapid rail lines. Specific rail modernization improvements on the Orange Line are station and signal modernization (MA-17), 44 new rapid rail cars (MA-24), and improvements to the Orange Line elevated structures (MA-29). Similar improvements to the Red Line include a new equipment maintenance center at South Bay (MA-7) and 76 new rapid rail cars (MA-4). Under project MA-24, 36 new rapid transit cars were purchased for the Blue Line. Other rapid rail modernization projects that benefit the entire rapid rail system are the purchase of new service vehicles (MA-21), power system improvements (MA-19 and MA-37), safety improvements (MA-25), and other "systemwide" improvements (MA-10, MA-26, MA-31).

The widespread distribution among different functional categories of modernization grants is reflected in the distribution of rapid rail costs shown in Exhibit II-19. No one functional improvement category accounts for over 25 percent of rapid rail costs. The costs are divided among each of the following functional categories: rolling stock (22.9 percent); Way & Structures (24.1 percent); stations and terminals (16.4 percent); yards and buildings (20.2 percent); and operational improvements (10.7 percent). Rapid rail projects involving rolling stock and stations approximate 39 percent of rapid rail modernization funds.

EXHIBIT II-18

RAPID RAIL MODERNIZATION PROJECTS

BOSTON

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
MA-01	MBTA	FEB 08 '65	$ 9,116	$ 6,077	Station modernization
MA-04	MBTA	MAR 04 '68	13,341	8,894	76 new cars (Red Line)
MA-07	MBTA	APR 21 '71	30,280	21,152	South Bay Maint. Center (Red Line)
MA-10	MBTA	APR 22 '71	2,200	1,466	Systemwide modernization
MA-13	MBTA	MAY 16 '72	14,618	9,745	Additional station modernization
MA-17	MBTA	DEC 27 '72	9,514	7,296	Station and signal modernization (Orange Line)
MA-19	MBTA	JUN 28 '74	18,346	14,677	Power system improvements
MA-21	MBTA	DEC 23 '71	427	284	New service vehicles
MA-24	MBTA	MAY 31 '73	27,626	18,411	80 new cars (44 Orange Line; 36 Blue Line)
MA-25	MBTA	MAY 31 '73	16,178	10,822	Safety improvements
MA-26	MBTA	MAY 31 '73	5,881	3,940	Systemwide modernization
MA-29	MBTA	OCT 12 '73	5,827	4,661	Improvements to Orange Line elevated structure
MA-31	MBTA	JAN 22 '75	9,532	7,626	Various plant, facility, power, and signal improvements
MA-36	MBTA	JUN 30 '75	3,158	2,626	Rebuilding and improvements to structures
MA-37	MBTA	JUN 09 '75	12,993	10,394	Improvements to power system
TOTAL:			$179,037	$128,071	

EXHIBIT II-19
BOSTON

TOTAL UMTA SECTION 3 RAIL MODERNIZATION PROJECTS THROUGH MAY 1977, TOTAL COST BY TYPE OF RAIL AND BY COMPONENT ($ 000s)

ITEM	LIGHT RAIL		RAPID RAIL		COMMUTER RAIL		TOTAL RAIL	
	$	% OF LR TOTAL	$	% OF RR TOTAL	$	% OF CR TOTAL	$	% OF TOTAL
1. Rolling Stock	650	0.6					650	0.2
A. Modernization, Rehabilitation	55,973	47.2	40,967	22.9			96,940	31.1
B. New								
C. Other								
2. Way & Structures								
A. Track	14,715	12.4	(1)				(1)	
B. Power	13,037	11.0	34,176	19.1			47,213	15.2
C. Signals	1,471	1.2	(1)				(1)	
D. Structures			8,985	5.0			8,985	2.9
E. Other	150	0.1					150	0.1
3. Stations, Terminals								
A. Modernization, Rehabilitation	3,567	3.0	29,434	16.4			33,001	10.6
B. Expansion	18,467	15.6					18,467	5.9
C. New								
D. Park and Ride								
4. Yards and Buildings								
A. Modernization	165	0.1	36,214	20.2				
B. New	50	-						
5. Operational Improvements								
A. Maintenance Equipment	5,403	4.6	(1)				(1)	
B. Fare Collection	1,663	1.4					1,663	0.5
C. Communications	3,120	2.6	2,898	1.6			6,618	1.9
D. Surveillance								
E. Information	25	-					25	-
F. Safety	61	0.1	16,178	9.0			16,239	5.2
6. Other	119	0.1	10,185	5.7	13,634	100.0	23,858	7.7
TOTALS:								
1. Rolling Stock	56,623	47.7	40,967	22.9			97,590	31.4
2. Way & Structures	29,373	24.8	43,161	24.1			72,534	23.3
3. Stations and Terminals	22,034	18.6	29,434	16.4			51,468	16.5
4. Yards and Buildings	215	0.2	36,214	20.2			36,429	11.7
5. Operational Improvements	10,272	8.7	19,076	10.7			29,348	9.4
6. Other	119	0.1	10,185	5.7	13,634	100.0	23,858	7.7
GRAND TOTAL	118,636	100.0	179,037	100.0	13,634	100.0	311,307	100.0

Light Rail

Light rail operations in Boston are conducted on the Green Line, which has its northern most station at Lechmere. Proceeding south from the Lechmere station, the Green Line operates underground until after the Kenmore station, where upon it operates at grade, eventually branching into four lines ending in Boston College, Cleveland Circle, Riverside, and Arborway. Light rail operations also include the southern tip of the Red Line between Ashmont and Mattapan. The light rail system encompasses approximately 32.6 route-miles, 95 stops (10 subway stations), and 230 active vehicles.

The five rail modernization grants that provide for improvements to the light rail system total $81.2 million and are presented in Exhibit II-20. Capital improvements arising from these grants are varied and include: a new equipment maintenance facility at Riverside; 175 new light rail vehicles; rehabilitation of existing equipment; track improvements; station modernization; and power system improvements. The diversity of these improvements represents a complete service package on a single line and is further highlighted by the distribution of costs for light rail projects, shown in Exhibit II-19.

Light rail costs fall primarily in the following functional categories: rolling stock (47.7 percent, or $56.6 million); Way & Structures (24.8 percent, or $29.4 million); and stations and terminals (18.6 percent, or $22.1 million). It is noted that over $10 million was invested in operational improvements, primarily for maintenance equipment. Light rail projects involving rolling stock and stations represent roughly 66 percent of total costs.

EXHIBIT II-20

LIGHT RAIL MODERNIZATION PROJECTS

BOSTON

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
MA-10	MBTA	APR 22 '71	$ 2,020	$ 1,346	Systemwide modernization
MA-15	MBTA	FEB 10 '72	50,583	33,729	Improvements to LR system (Green Line)
MA-22	MBTA	SEP 29 '72	59,617	41,313	Purchase 175 LRVs
MA-26	MBTA	MAY 31 '73	1,828	1,225	Continuation of systemwide improvements
MA-31	MBTA	JAN 22 '75	4,588	3,671	Various plant, facility, power, and signal modernization
TOTAL:			$118,636	$81,284	

Commuter Rail

The Boston and Maine Railroad (B&M) conducts commuter rail operations in Boston under contract to the MBTA which owns the right-of-way. Six routes out of North Station (former B&M right-of-way) and five routes out of South Station (former Penn Central] Railroad right-of-way) total 204.7 route-miles and carry 30,700 passengers daily on 331 trains. Only one UMTA grant has been approved for commuter rail operations in Boston:

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)
MA-40	MBTA	June 30, 1975	$13,634	$81, 284

Funds from this grant are designated for upgrading of the Franklin Branch (out of South Station), equipment rehabilitation, and radios for the Boston and Maine.

As shown in Exhibit II-19, the distribution of total costs across all modes in Boston is as follows: rapid rail ($179.0 million, or 57.5 percent); light rail ($118.6 million, or 38.1 percent); and commuter rail ($13.6 million, or 4.3 percent). As a percentage of total costs, light rail investment in rolling stock is significantly higher than rapid rail investment in rolling stock (47.7 percent versus 22.9 percent). Conversely, the percent of total rapid rail costs attributable to yards and buildings (20.2 percent) is higher than similar costs in light rail (0.2 percent).

B.4 Philadelphia

Rapid Rail

The rapid rail system in Philadelphia is part of the Southeastern Pennsylvania Transportation Authority (SEPTA) and consists of two lines. The Market-Frankford line is essentially an east-west line that is an elevated railway at each end and operates as a subsurface line through the Central Business District (CBD). The Broad Street line runs from the sports stadiums in South Philadelphia through the CBD at City Hall (where it intersects the Market-Frankford line) to the Fern Rock Station in North Philadelphia. The Broad Street line and the Market-Frankford line are also connected by the Broad-Ridge Spur which travels north from the 8th Street station (Market-Frankford line) to Ridge Avenue, whereupon it moves northwest until terminating at the Fairmont Avenue Station (Broad Street line). A third rapid rail line included in the analysis of UMTA rail modernization grants for rapid rail improvements in Philadelphia is the Port Authority Transit Corporation (PATCO). PATCO operates 14.2 route-miles of rapid rail service linking SEPTA's system with Southern New Jersey. PATCO transported 10.9 million passengers in 1977, with 75 active vehicles. There are 13 stations in the PATCO system.

Modernization grants for rapid rail projects in Philadelphia are indicated in Exhibit II-21. Twelve grants totaling $109.7 million were identified as involving rapid rail projects; two of these (IT-10 and IT-11) were for improvements on PATCO. Improvement projects on SEPTA's system fall primarily into two categories: modernization of stations and terminals on the Market-Frankford line (PA-2, PA-36, and PA-50) and structural improvements on the Franford elevated (PA-35). The major rapid rail project on the PATCO system came under IT-10, when 46 new rapid rail cars were purchased. No rapid transit cars were purchased for the SEPTA system with UMTA funds.

The distribution of costs of rapid rail projects in Philadelphia reflects a relatively low level of investment in rapid rail rolling stock (see Exhibit II-22). The majority of costs fall into the Way & Structures ($53.1 million, or 34.6 percent) and the stations and terminals ($51.3 million, or 33.5 percent) categories. Rolling stock projects account for less than $36 million, or 23.2 percent of total rapid rail costs.

EXHIBIT II-21

RAPID RAIL MODERNIZATION PROJECTS

PHILADELPHIA

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
PA-02	PHILADELPHIA	JUN 02 '65	$ 8,270	$ 5,513	Station modernization (15th & Market Subway Station)
PA-24	PHILADELPHIA	DEC 31 '70	2,800	1,867	Modernization of six Broad St. substations
PA-36	PHILADELPHIA	OCT 25 '72	28,839	21,134	Modernize 2nd St. station and relocate Frankford El
PA-23	SEPTA	MAR 25 '71	5,846	4,037	Modernize 2 Market St. subway stations
PA-31	SEPTA	MAR 06 '72	12,196	8,131	Systemwide improvements
PA-33	SEPTA	MAY 25 '72	4,600	3,293	Modernize 2 Market St. subway stations
PA-35	SEPTA	DEC 27 '72	12,807	8,538	Rehabilitate Frankford El structure
PA-37	SEPTA	MAY 07 '73	1,621	1,081	Improvement to lines in Market-Frankford corridor
PA-50	SEPTA	JUN 28 '74	7,890	6,312	Improvements to Market-Frankford stations
PA-62	SEPTA	APR 20 '76	12,481	9,985	Systemwide modernization
IT-10	PATCO	JUN 01 '73	54,395	38,863	46 new cars; miscellaneous improvements
IT-11	PHILADELPHIA	DEC 06 '71	1,416	944	New substation for PATCO line
TOTAL:			$153,161	$109,698	

EXHIBIT II-22
PHILADELPHIA

TOTAL UMTA SECTION 3 RAIL MODERNIZATION PROJECTS THROUGH MAY 1977, TOTAL COST BY TYPE OF RAIL AND BY COMPONENT ($ 000s)

ITEM	LIGHT RAIL		RAPID RAIL		COMMUTER RAIL		TOTAL RAIL	
	$	% OF LR TOTAL	$	% OF RR TOTAL	$	% OF CR TOTAL	$	% OF TOTAL
1. Rolling Stock								
A. Modernization Rehabilitation			1,196	0.8			1,196	0.5
B. New			34,323	22.4	58,967	83.8	93,295	39.6
C. Other								
2. Way & Structures								
A. Track	8,328	68.0	11,252	7.4	2,513	3.6	22,093	9.4
B. Power	105	0.9	11,226	7.3			11,331	4.8
C. Signals			225	0.2			225	0.1
D. Structures	242	2.0	30,349	19.8	1,800	2.6	32,391	13.7
E. Other					3,761	5.3	3,761	1.6
3. Stations, Terminals								
A. Modernization, Rehabilitation	56	0.5	33,011	21.6	3,360	4.8	36,371	15.4
B. Expansion			8,954	5.9			8,954	3.8
C. New			8,894	5.8			8,894	3.8
D. Park and Ride			476	0.3			476	0.2
4. Yards and Buildings								
A. Modernization			4,392	2.9			4,392	1.9
B. New								
5. Operational Improvements								
A. Maintenance Equipment	1,332	10.9	7,686	5.0			9,019	3.9
B. Fare Collection	1,727	14.1					1,727	0.7
C. Communications	463	3.8					463	0.2
D. Surveillance			1,004	0.7			1,004	0.4
E. Information			168	0.1			168	0.1
F. Safety								
6. Other								
TOTALS:								
1. Rolling Stock			35,524	23.2	58,967	83.8	94,491	40.1
2. Way & Structures	8,675	70.8	53,052	34.6	8,074	11.5	69,801	29.6
3. Stations and Terminals	56	0.5	51,335	33.5	3,360	4.8	54,751	23.2
4. Yards and Buildings			4,392	2.9			4,392	1.9
5. Operational Improvements	3,522	28.7	8,858	5.9			12,380	5.3
6. Other								
GRAND TOTAL	12,253	100.0	153,161	100.0	70,401	100.0	235,815	100.0

Commuter Rail

Commuter rail service in Philadelphia is operated on ex-Reading and ex-Pennsylvania Railroad lines by Conrail. Thirteen routes totaling 415 route-miles carry 130,000 riders each weekday (55,000 on ex-Reading and 75,000 on ex-Pennsylvania) on 787 trains. SEPTA has purchase-of-service agreements with Conrail for these operations. Five UMTA grants to Philadelphia have been approved for commuter rail projects:

	UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
COMMUTER RAIL:	PA-4	SEPTA	JAN 04 '67	$ 1,800	$ 1,200	Rehabilitation of ex-Reading Co. viaduct
	PA-9	SEPTA	DEC 23 '69	2,513	1,780	Extension of Conrail service Hatboro to Warminster
	PA-10	SEPTA	MAR 03 '70	58,967	39,311	14 M-Us for ex Reading, 130 M-Us for ex Pennsylvania Railroad
	PA-50	SEPTA	JUN 28 '74	3,360	2,688	Station and parking improvements, Conrail lines
	PA-68	SEPTA	APR 20 '76	3,761	3,008	Purchase of equipment not included in Conrail system
TOTAL:				$70,401	$47,987	

Commuter rail projects in Philadelphia have not been significant as measured by total costs, except for project PA-10. Accounting for greater than 80 percent ($59.0 million) of the costs listed above, this project provided for the purchase of 144 multiple-unit electrics for commuter operations. The remaining commuter rail projects in Philadelphia include the rehabilitation of the ex-Reading viaduct (PA-04), extension of ex-Reading service from Hatboro to Warminster (PA-9), construction of commuter parking facilities along both ex-Reading and ex-Pennsylvania lines (PA-50), and purchase of equipment not included in the Conrail system. The distribution of costs arising from these grants is shown in Exhibit II-22.

Light Rail

The light rail system in Philadelphia is operationally separated into the SEPTA-City Transit Division and the SEPTA-Red Arrow Divison. The City Transit Divison comprises the majority of light rail operations (see Exhibit

II-10), with 154.9 route-miles and 300 active vehicles which carried 41.9 million passengers in 1976. In comparison, the Red Arrow Division operates 54.2 route-miles and 55 active vehicles which carried a modest 5.2 million passengers in 1977. The three UMTA rail modernization grants for light rail projects are summarized below:

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)
PA-31	SEPTA	Mar. 06 '72	$ 1,437	$ 958
PA-37	SEPTA	May 07 '73	453	302
PA-62	SEPTA	Apr. 20 '76	10,363	8,290
TOTAL			$12,253	$9,550

Project PA-31 represent the first phase of a comprehensive modernization program to provide the power facilities, shop equipment, and service and storage facilities necessary for light rail operations for SEPTA City Transit and Red Arrow Divisions. Project PA-37 was approved for assorted improvements along the Media-Sharon Hill corridor, and project PA-62 will furnish various systemwide improvements, including new maintenance facilities, fare collection equipment, rehabilitation of bridges on the Norristown line, and track, coverboard, pole, and overhead improvements. The distribution of light rail costs shown in Exhibit II-22 indicates the emphasis given to Way & Structures ($8.7 million, or 70.8 percent) and to operational improvements ($3.5 million, or 28.7 percent). A modest $56,000, or 0.5 percent of total costs, was invested in station modernization projects.

Exhibit II-22 also indicates the functional distribution of costs of all UMTA rail modernization projects in Philadelphia. Projects involving rolling stock and stations exceed 63 percent and are composed of $94.5 million for rolling stock and $54.8 million for stations. Total costs of $235.8 million are split among the three modes as follows: light rail ($12.3 million, or 5.2 percent); rapid rail ($153.2 million, or 64.9 percent); and commuter rail ($70.4 million, or 29.9 percent).

B.5 San Francisco

Light Rail

The San Francisco Municipal Railway (MUNI) conducts light rail operations within the city. The present structure of the system includes five radial

routes and 105 streetcars. Nearly 15 million revenue passengers were accommodated in 1977. Four UMTA grants (listed in Exhibit II-23) were approved for light rail projects in San Francisco, and amounted to $75.4 million.

Significant improvements under CA-43 were a new rail car storage and service facility, safety train control for subway operation, rerailing of track in the Twin Peaks Tunnel, and rehabilitation of the overhead wire system. Under project CA-56, MUNI rebuilt the power system for light rail vehicles. The purchase of 100 new light rail vehicles under CA-22 and CA-78 will allow MUNI to retire the fleet of PCC light rail cars. The purchase of these cars represents 32.8 percent of the total costs presented in Exhibit II-24. Other functional categories that constitute a significant percentage of total costs are power system improvements ($26.6 million, or 25.0 percent); new yards and buildings ($18.5 million, or 17.4 percent); operational improvements ($12.3 million, or 11.6 percent); and track improvements ($10.5 million, or 9.8 percent).

EXHIBIT II-23

LIGHT RAIL MODERNIZATION PROJECTS

SAN FRANCISCO

	UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
	CA-22	MUNI	MAR 31 '71	$ 27,447	$18,060	80 new light rail vehicles, 11 used PCC cars
	CA-43	MUNI	OCT 26 '71	47,863	34,461	Improvements to LR system re-rail track, rebuild cars
	CA-56	MUNI	APR 04 '73	23,223	16,581	Improvements to power system
	CA-78	MUNI	JUN 07 '74	7,950	6,360	Purchase 20 LRVs, miscellaneous equipment
TOTAL:				$106,483	$75,462	

EXHIBIT II-24
SAN FRANCISCO

TOTAL UMTA SECTION 3 RAIL MODERNIZATION PROJECTS THROUGH MAY 1977, TOTAL COST BY TYPE OF RAIL AND BY COMPONENT ($ 000s)

ITEM	LIGHT RAIL		TOTAL RAIL	
	$	% OF LR TOTAL	$	% OF TOTAL
1. Rolling Stock				
A. Modernization Rehabilitation	110	0.1	110	0.1
B. New	34,894	32.8	34,894	32.8
C. Other				
2. Way & Structures				
A. Track	10,471	9.8	10,471	9.8
B. Power	26,626	25.0	26,626	25.0
C. Signals				
D. Structures	1,499	1.4	1,499	1.4
E. Other				
3. Stations, Terminals				
A. Modernization, Rehabilitation				
B. Expansion			2,050	1.9
C. New	2,050	1.9	2,050	1.9
D. Park and Ride				
4. Yards and Buildings				
A. Modernization				
B. New	18,498	17.4	18,498	17.4
5. Operational Improvements				
A. Maintenance Equipment				
B. Fare Collection	5,143	4.8	5,143	4.8
C. Communications	6,370	6.0	6,370	6.0
D. Surveillance				
E. Information				
F. Safety	822	0.8	822	0.8
6. Other				
TOTALS:				
1. Rolling Stock	35,004	32.9	35,004	32.9
2. Way & Structures	38,596	36.3	38,596	36.3
3. Stations and Terminals	2,050	1.9	2,050	1.9
4. Yards and Buildings	18,498	17.4	18,498	17.4
5. Operational Improvements	12,335	11.6	12,335	11.6
6. Other	-	-	-	-
GRAND TOTAL	106,483	100.0	106,483	100.0

B.6 Cleveland

Rapid Rail

The rapid rail system in Cleveland is operated by the Greater Cleveland Regional Transit Authority (GCRTA) and consists of a single line which totals 19.0 miles from the Cleveland airport, through downtown Cleveland, to the Windemere station in east Cleveland. A fleet of 104 cars serves 18 stations and carries 10.6 million passengers per year (see Exhibit II-10). Five UMTA grants involving rapid rail modernization projects in Cleveland are identified in Exhibit II-25.

The purchase of 50 new cars under OH-2,OH-7, and OH-54 accounts for nearly 72 percent of the costs of all rapid rail projects in Cleveland. Other improvements resulting from rapid rail projects include a new station at E. 34th Street and renovations to the Airport station. Signal improvements in the Brookpark yard and other power system improvements were performed under OH-7, as well as the installation of a new washhouse for rapid transit vehicles. Systemwide improvements under OH-54 include the purchase of rapid transit support equipment, construction of two track crossovers, and purchase and installation of security fencing along right-of-way. The distribution of costs is shown in Exhibit II-26.

EXHIBIT II-25

RAPID RAIL MODERNIZATION PROJECTS

CLEVELAND

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)	PURPOSE
OH-02	CTS	JUN 03 '65	$ 3,434	$ 2,265	Miscellaneous improvements,[1] 20 new cars
OH-07	CTS	JUN 17 '69	5,528	2,764	10 new cars, new E. 34th St. Station, miscellaneous modernization
OH-22	CTS	JUN 11 '74	395	316	Miscellaneous equipment
OH-37	CTS	JUN 27 '76	1,458	1,166	Renovations to Airport Station
OH-54	GCRTA	JAN 11 '77	14,479	11,583	20 new cars, systemwide modernization
TOTAL:			$25,294	$18,094	

[1] Includes extension of rapid transit service to Cleveland airport.

EXHIBIT II-26
CLEVELAND

TOTAL UMTA SECTION 3 RAIL MODERNIZATION PROJECTS THROUGH MAY 1977, TOTAL COST BY TYPE OF RAIL AND BY COMPONENT
($ 000s)

ITEM	LIGHT RAIL		RAPID RAIL		TOTAL RAIL	
	$	% OF LR TOTAL	$	% OF RR TOTAL	$	% OF TOTAL
1. Rolling Stock						
A. Modernization Rehabilitation						
B. New	37,380	98.5	18,277	72.3	55,657	88.0
C. Other						
2. Way & Structures						
A. Track	144	0.4			144	0.2
B. Power	144	0.4	780	3.1	924	1.5
C. Signals			1,160	4.6	1,160	1.8
D. Structures			318	1.3	318	0.5
F. Other						
3. Stations, Terminals						
A. Modernization, Rehabilitation	145	0.4			145	0.2
B. Expansion			1,458	5.8	1,458	2.3
C. New			50	0.6	50	0.3
D. Park and Ride						
4. Yards and Buildings						
A. Modernization						
B. New			1,383	5.5	1,383	2.3
5. Operational Improvements						
B. Maintenance Equipment	145	0.4	375	1.5	520	0.8
Fare Collection						
C. Communications						
D. Surveillance						
E. Information						
F. Safety			300	1.2	300	0.5
6. Other			1,193	4.7	1,193	1.9
TOTALS:						
1. Rolling Stock	37,380	98.5	18,277	72.3	55,657	88.0
2. Way & Structures	288	0.8	2,258	8.9	2,546	4.0
3. Stations and Terminals	145	0.4	1,508	6.0	1,653	2.6
4. Yards and Buildings	-	-	1,383	5.5	1,383	2.3
5. Operational Improvements	145	0.4	675	2.7	820	1.3
6. Other	-	-	1,193	4.7	1,193	1.9
GRAND TOTAL	37,958	100.0	25,294	100.0	63,252	100.0

Light Rail

Cleveland's light rail transit system consists of a single line originating out of Union Terminal that eventually splits into two branches: the Shaker Line and the Van Aken Line. Fifty-seven vehicles operating over 19.2 route miles carried 4.86 million revenue passengers in 1977 (see Exhibit II-10). The GCRTA has received the following UMTA grant for improvements to the light rail system:

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)
OH-54	GCRTA	Jan. 11 '77	$37,958	$30,366

This grant will enable the GCRTA to purchase 48 new light rail vehicles as well as provide the engineering funds for the complete renovation and rehabilitation of the Shaker Line.

B.7 Pittsburgh

Light Rail

The Port Authority of Allegheny County (PAT) directs light rail operations in Pittsburgh. A maximum of 66 light rail vehicles are operated during peak service to cover 4 routes with a total of 120 stops. The four routes are almost entirely on private right-of-way. PAT has been the recipient of the two grants summarized below:

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)
PA-12	PAT	Jun. 08 '70	$24,788	$16,608
PA-41	PAT	Apr. 30 '74	750	600
TOTAL			$25,538	$17,208

The rehabilitation of the South Hills car lines is the primary focus of PA-12, and represents 79.8 percent ($20.4 million) of total light rail net project costs in Pittsburgh (see Exhibit II-27). Also included under PA-12 are a new station along the South Hills line and engineering funds for additional improvements to the line. Project PA-41 designated funds for the rehabilitation of existing PCC light rail vehicles.

EXHIBIT II-27
PITTSBURGH

TOTAL UMTA SECTION 3 RAIL MODERNIZATION PROJECTS THROUGH MAY 1977, TOTAL COST BY TYPE OF RAIL AND BY COMPONENT
($ 000s)

ITEM	LIGHT RAIL		COMMUTER RAIL		TOTAL RAIL	
	$	% OF LR TOTAL	$	% OF CR TOTAL	$	% OF TOTAL
1. Rolling Stock						
A. Modernization Rehabilitation	1,653	6.5	2,294	92.6	3,947	14.1
B. New						
C. Other						
2. Way & Structures						
A. Track	20,381	79.8			20,381	72.8
B. Power						
C. Signals						
D. Structures						
E. Other						
3. Stations, Terminals						
A. Modernization, Rehabilitation	28	0.1			28	0.1
B. Expansion						
C. New	2,884	11.3	184	7.4	3,068	11.0
D. Park and Ride						
4. Yards and Buildings						
A. Modernization						
B. New						
5. Operational Improvements						
A. Maintenance Equipment	592	2.3			592	2.1
B. Fare Collection						
C. Communications						
D. Surveillance						
E. Information						
F. Safety						
6. Other						
TOTALS:						
1. Rolling Stock	1,653	6.5	2,294	92.6	3,947	14.1
2. Way & Structures	20,381	79.8			20,381	72.8
3. Stations and Terminals	2,912	11.4	184	7.4	3,096	11.1
4. Yards and Buildings					-	-
5. Operational Improvements	592	2.3			592	2.1
6. Other						
GRAND TOTAL	25,538	100.0	2,478	100.0	28,016	100.0

Commuter Rail

The Baltimore & Ohio Railroad (B&O) provides commuter rail service between Pittsburgh and Versailles under "purchase-of-service" contracts with PAT. Sixteen weekday trains carry about 1,600 passengers over the 18-mile route. UMTA grant PA-59 is the only grant approved for a commuter rail modernization project in Pittsburgh, and it provides for the rehabilitation of existing B&O equipment and the purchase of two new diesel locomotives. The total cost is roughly $2.5 million, with a federal cost of $2.0 million. A small portion of this grant (7.4 percent, or $.184 million) is designated for new stations.

B.8 Detroit

Commuter Rail

The Grand Trunk Western Railroad (GTW) operates a single route totaling 26 miles between Detroit and Pontiac, Michigan. Six trains are used to carry 1,600 riders each weekday. The GTW provides these commuter rail services under a "purchase-of-service" agreement with the Southeastern Michigan Transportation Authority (SEMTA). The following two UMTA grants have been approved for commuter rail projects on the GTW:

UMTA GRANT NO.	GRANTEE	APPROVAL DATE	TOTAL COST (000s)	FEDERAL COST (000s)
MI-30	SEMTA	Dec. 26 '74	$ 500	$ 400
MI-45	SEMTA	Mar. 08 '75	1,508	1,206
TOTAL			$2,208	$1,606

The initial UMTA Section 3 grant resulted in additional parking facilities at GTW commuter stations, while project MI-45 provided funds for the purchase and rehabilitation of existing GTW rolling stock by SEMTA and for the purchase of one new diesel locomotive. Additionally, minor track improvements resulted from this grant. The distribution of costs of commuter rail modernization projects in Detroit is presented in Exhibit II-28 and indicates that 73.6 percent ($1.5 million) of total costs are assignable to rolling stock, while 24.9 percent ($.5 million) of costs are attributable to station and terminal improvements.

C. OTHER SOURCES OF FEDERAL FUNDS FOR RAIL MODERNIZATION

Although UMTA Section 3 monies have provided most of the federal funding for rail modernization, three other sources have provided an additional $344 million (of which the federal share has been $273.3 million) to New York, Boston, Philadelphia, and San Francisco. These sources are the following:

- Federal Aid Urban Systems (FAUS) Grants - New York and San Francisco have used $70.3 million (federal share $49.2 million) for rail modernization projects. New York spent $69.9 million (99.3 percent) for systemwide modernization, while San Francisco purchased a new fare collection system for $.4 million.

EXHIBIT II-28
DETROIT

TOTAL UMTA SECTION 3 RAIL MODERNIZATION PROJECTS THROUGH MAY 1977, TOTAL COST BY TYPE OF RAIL AND BY COMPONENT ($ 000s)

ITEM	COMMUTER RAIL		TOTAL RAIL	
	$	% OF CR TOTAL	$	% OF TOTAL
1. Rolling Stock				
A. Modernization Rehabilitation	501	25.0	501	25.0
B. New	976	48.6	976	48.6
C. Other				
2. Way & Structures				
A. Track	31	1.5	31	1.5
B. Power				
C. Signals				
D. Structures				
E. Other				
3. Stations, Terminals				
A. Modernization, Rehabilitation				
B. Expansion				
C. New				
D. Park and Ride	500	24.9	500	24.9
4. Yards and Buildings				
A. Modernization				
B. New				
5. Operational Improvements				
A. Maintenance Equipment				
B. Fare Collection				
C. Communications				
D. Surveillance				
E. Information				
F. Safety				
6. Other				
TOTALS:				
1. Rolling Stock	1,477	73.6	1,477	73.6
2. Way & Structures	31	1.5	31	1.5
3. Stations and Terminals	500	24.9	500	24.9
4. Yards and Buildings				
5. Operational Improvements				
6. Other				
GRAND TOTAL	2,008	100.0	2,008	100.0

- Interstate Transfers - Boston and Philadelphia have used $245.7 million (federal share: $196.5 million) for six different projects. In Boston, $167.9 million has been used to purchase 110 rapid transit cars, rehabilitate 88 others, and purchase the PC Midland Branch and 270 miles of Boston and Maine ROW and equipment. In Philadelphia, $77.8 million has been used for purchasing 88 M-Us and for engineering work on light rail vehicles and maintenance facilities.

- Loans - About $28 million has been loaned by UMTA to Boston and Philadelphia for purchases of rights-of-way ($25 million), while another $3 million has been loaned to Philadelphia to purchase 12 rail diesel cars for the Reading Lines.

APPENDIX A

NATIONAL OVERVIEW

DATA AND INFORMATION

UMTA LEGISLATIVE AUTHORITY

The Urban Mass Transit Act of 1964 was enacted by Congress to provide federal financial assistance for the development of comprehensive and coordinated mass transit systems in metropolitan and other urban areas. Because large segments of the American population are concentrated in urban areas, the viability of these areas and the effectiveness of other federally aided programs require satisfactory urban transportation facilities and services. As such, the Act was designed to serve the following purposes:[1]

- assist in the development of improved mass transportation facilities, equipment, techniques, and methods, with the cooperation of mass transportation companies, both public and private;

- encourage the planning and establishment of areawide urban mass transportation systems needed for economical and desirable urban development, with the cooperation of mass transportation companies, both public and private; and

- provide assistance to state and local governments and their instrumentalities in financing such systems, to be operated by public or private mass transportation companies as determined by local needs.

Of the various UMTA programs providing financial assistance, the Capital Grants and Loan Program was established under Section 3 of the Urban Mass Transportation Act of 1964. As part of this program, the Secretary of Transportation is authorized to:

- make grants or loans to assist states and local public bodies and agencies thereof in financing (1) the acquisition, construction, reconstruction, and improvement of facilities and equipment for use, by operation or lease or otherwise, in mass transportation service in urban areas and in coordinating such service with highway and other transportation in such areas, and (2) the establishment and organization of public or quasi-public transit corridor development corporations or entities.[2]

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[1] Department of Transportation, Urban Mass Transit Act of 1964 and Related Laws, February 5, 1976, Washington, D.C., p. 2.

[2] Ibid.

Section 5 of the Act also provides capital grants for the acquisition, construction, and improvement of facilities and equipment for use in mass transportation service. However, capital grants approved under Section 5 comprise an insignificant percentage of total UMTA capital grants and, as such, are not considered herein.

Exhibit II-1 (presented in Section II) indicates the amount and modal distribution of Section 3 capital grant approvals from February 1, 1965 to May 31, 1977. These grants total approximately $6.2 billion. Of this amount, nearly $1.7 billion, or 28 percent, has been approved to modernize existing rail systems. For the purposes of this evaluation, rail modernization excludes major extensions to existing facilities, and concentrates on the replacement and upgrading of existing facilities and equipment.

Although only public agencies are eligible for capital grants, private transportation companies may benefit from federal financial assistance through contractual arrangements with public agencies. Eligible projects under Section 3 include the acquisition, construction, reconstruction, or improvement of existing facilities and equipment. The External Operating Manual (UMTA) further describes eligible facilities and equipment as including land (but not public highways), buses and other rolling stock, and other real or personal property needed for an efficient and coordinated urban mass transportation system. This study separates rail modernization capital items under existing facilities and equipment into the following functional categories: rolling stock (new vehicles, modernization, rehabilitation, retrofit); way and structures (track, power, signals, structures); stations and terminals (rehabilitation, expansion, new, park and ride); yards and buildings (modernization, new); and operational improvements (maintenance equipment and facilities, fare collection, communications, surveillance, information, safety).

Federal funding of rail modernization projects was initially set at "two thirds of that part of the cost of the project which UMTA determines cannot reasonably b financed from revenues ('the net project cost')."[1] The Federal-Aid Highway Act of 1973 (Public Law 93-87) raised the federal grant limitations from a discretionary two-thirds of the net project cost to a mandatory 80 percent. Before federal funds may be approved for rail modernization products, however, UMTA must receive assurance that the local share of the net project cost will be available prior to the project's completion. This local share must be derived from nonfederal sources and should be in the form of cash, but may include "the direct contribution to the project labor,

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[1]Department of Transportation, UMTA, External Operating Manual, Program Information for Capital Grants and Technical Studies Grants, August 1972, Washington, D.C., p. IIB-2.

materials, land which has not previously been used for transit purposes, or other property of ascertainable value."[1]

Additional statutory requirements prior to the approval of federal funds include the following:

- evidence that the project is part of a program for a unified or officially coordinated urban mass transportation system;
- protection of private transportation companies to the maximum extent possible;
- review of area planning and protection of the environment;
- assurance that the applicant will maintain satisfactory continuing control over project facilities and equipment;
- protection of the interests of employees affected by federal grant assistance;
- provisions for an adequate relocation plan if project construction activity requires the displacement of persons from their homes or businesses;
- nondiscrimination in program benefits with regard to routing, scheduling, or quality of transportation service; and
- indications that reasonable efforts have been made to ensure that the elderly and handicapped will be able to effectively use the facilities.

RAPID RAIL OPERATIONS AND NATIONAL AGGREGATE IMPACTS

Presently, there are 10 rapid (heavy) rail operations in the United States, operating over approximately 1,064 route-miles (one way) with 9,714 rapid rail cars. The current rapid rail operations and the scope of these operations are shown in Exhibit A-1.

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[1]Department of Transportation, UMTA, External Operating Manual, Capital Grants and Technical Studies Grants, August 1972, Washington, D.C., p. IIB-12.

EXHIBIT A-1

RAPIL RAIL OPERATIONS AND OPERATING AND FINANCIAL STATISTICS AS OF DECEMBER 31, 1976[1]

Chicago Transit Authority	Chicago, IL
Greater Cleveland Regional Transit Authority	Cleveland, OH
Massachusetts Bay Transportation Authority	Boston, MA
New York City Transit Authority	Brooklyn, NY
Port Authority Trans-Hudson Corporation	New York, NY
Port Authority Transit Corporation of Pennsylvania and New Jersey	Camden, NJ
San Francisco Bay Area Rapid Transit District	Oakland, CA
Southeastern Pennsylvania Transportation Authority	Philadelphia, PA
Staten Island Rapid Transit Authority	New York, NY
Washington Metropolitan Area Transit Authority	Washington, DC

Rapid (Heavy) Rail Operations (December 31, 1976)	10
One-Way Miles of Line	559
One-Way Route Miles	1064
Rapid (Heavy) Rail Cars	9714
Total Passenger Rides (Millions)-1976	1632
Revenue Passenger Rides (Millions)-1976	1353
Operating Revenue (Millions)-1976	$631
Passenger Revenue (Millions)-1976	$616
Average Fare - 1976	$0.4556
Passenger Vehicle Miles Operated (Millions)-1976	407

[1] Source: American Public Transit Association, Transit Fact Book, Washington, D.C., June 1977, p. 41.

Measures of the operating and financial performance of the rapid rail industry are shown in Exhibit A-2. These include total passenger trips, revenue passenger trips, vehicle-miles operated, vehicles owned and leased, operating revenues, and passenger revenues.

EXHIBIT A-2

OPERATING AND FINANCIAL TRENDS IN THE RAPID RAIL INDUSTRY[1]
1965-1976(P)

YEAR	PASSENGER TRIPS (millions)	REVENUE PASSENGER TRIPS (millions)	VEHICLE MILES OPERATED (millions)	VEHICLES OWNED AND LEASED	OPERATING REVENUES (millions)	PASSENGER REVENUES (millions)
1965	1,858	1678.0	395.3	9115	310.1	279.0
1966	1,753	1584.0	378.9	9273	306.5	297.0
1967	1,938	1632.0	396.5	9257	352.0	340.4
1968	1,928	1627.0	406.8	9390	358.2	341.7
1969	1,980	1656.3	416.6	9343	380.4	362.5
1970	1,881	1573.5	407.1	9338	384.4	368.5
1971	1,778	1494.0	407.4	9325	379.4	363.8
1972	1,731	1445.7	386.2	9423	417.2	401.9
1973	1,714	1423.7	407.3	9387	461.0	437.6
1974	1,726	1435.1	431.9	9403	505.8	486.7
1975	1,673	1387.8	423.1	9608	517.1	504.3
1976(P)	1,632	1353.2	407.0	9714	630.7	616.5

(P) - Preliminary

[1] Source: American Public Transit Association, Transit Fact Book, Washington, D.C., June 1977.

COMMUTER RAIL OPERATIONS AND NATIONAL AGGREGATE IMPACTS

Eight metropolitan areas serve as operating locations for 14 commuter railroads in the United States. Exhibit A-3 presents the various commuter railroads and their respective operating locations. These commuter railroads transported approximately 265 million passengers in 1976, while operating on 2,873 route-miles (one way). Exhibit A-4 summarizes this information and indicates the number of self-propelled and locomotive-hauled commuter rail cars owned and leased.

Various measures of the operating and financial performance of commuter railroad operations (revenue passenger trips, revenue passenger miles, average journey per passenger, passenger revenue, and UMTA Section 3 commuter rail grant approvals per revenue passenger) are illustrated in Exhibit A-5. These data were developed by the Association of American Railroads based on quarterly reports on "commutation" operations received from Class I railroads in the United States.

Patronage of commuter rail operations increased 1 percent from 1965 to 1976. The trend of commuter rail patronage appears to indicate a varied performance during this period. For example, after increasing 8 percent from 1965 to 1969, revenue ridership decreased 10.7 percent between 1969 and 1973, and subsequently increased 4 percent from 1973 to 1976. Commuter rail grant approvals per revenue passenger have also fluctuated widely since 1965. Although approvals per revenue passenger increased 733 percent ($.03 to $.25) during this period, the yearly average was approximately $.28, with 1972 representing the high year of grants per revenue passenger ($.66) and 1969 representing the low year ($.01) of grants per revenue passenger. This wide fluctuation in commuter rail grant approvals per revenue passenger seems to indicate that a meaningful correlation between grants and patronage cannot be reasonably determined on an aggregate basis.

EXHIBIT A-3

COMMUTER RAIL OPERATIONS AS OF DECEMBER 31, 1976

COMMUTER RAILROADS	OPERATING LOCATIONS
The Baltimore and Ohio Railroad Company	Pittsburgh, PA
	Baltimore, MD/Washington, DC
Boston and Maine Corporation	Boston, MA
Burlington Northern	Chicago, IL
Chicago and North Western Transportation Company	Chicago, IL
Chicago, Milwaukee, St. Paul & Pacific Railroad Company	Chicago, IL
Chicago, Rock Island & Pacific Railroad Company	Chicago, IL
Chicago South Shore and South Bend Railroad	Chicago, IL
Consolidated Rail Corporation	
	Chicago, IL
	Hoboken, NJ
	Newark, NJ
	New York, NY
	Philadelphia, PA
	Washington, DC
Grand Trunk Western Railroad Company	Detroit, MI
Illinois Central Gulf Railroad Company	Chicago, IL
The Long Island RailRoad Company	New York, NY
Norfolk & Western Railway Company	Chicago, IL
The Pittsburgh & Lake Erie Railroad Company	Pittsburgh, PA
Southern Pacific Transportation Company	San Francisco, CA

EXHIBIT A-4

COMMUTER RAIL OPERATING STATISTICS[1] AS OF DECEMBER 31, 1976

Number of Commuter Railroads	15
One-Way Route Miles	2,873
Self-Propelled Commuter Rail Cars	2,583
Locomotive-Hauled Commuter Rail Cars	1,856
Total Passenger Rides (Millions)	265

[1] **Source: American Public Transit Association, Transit Fact Book, Washington, D.C., June 1977, p. 47.**

EXHIBIT A-5

OPERATING AND FINANCIAL TRENDS IN THE COMMUTER RAIL INDUSTRY[1] 1965-1976

YEAR	REVENUE PASSENGER TRIPS (millions)	REVENUE PASSENGER MILES (millions)	AVERAGE JOURNEY PER PASSENGER (miles)	PASSENGER REVENUE (millions)	GRANT APPROVALS PER REVENUE PASSENGER
1965	192.6	4,128	21.44	$136.4	$.03
1966	195.1	4,193	21.49	139.7	.03
1967	198.9	4,281	21.52	143.8	.48
1968	203.5	4,383	21.53	153.1	.13
1969	208.1	4,546	21.85	161.6	.01
1970	206.1	4,592	22.28	172.3	.55
1971	201.3	4,498	22.35	175.6	.07
1972	190.7	4,229	22.18	177.3	.66
1973	185.9	4,245	22.84	180.4	.15
1974	197.4	4,533	22.96	199.7	.65
1975	194.9	4,513	23.15	206.1	.36
1976	193.6	4,470	23.09	223.5	.25

[1] Source: Association of American Railroads, Statistics of Railroads of Class I, Washington, D.C., December 1977.

LIGHT RAIL OPERATIONS AND NATIONAL AGGREGATE IMPACTS

Exhibit A-6 indicates light rail operations in the United States as of December 31, 1976. Light rail transit operations account for approximately 112 million passenger rides, 301 route-miles (one way), and 963 light rail cars. The scope of operations in the light rail industry is also presented in Exhibit A-6.

Exhibit A-7 depicts measures of operating and financial trends (1965-1976) in the light rail industry, including total passenger trips, revenue passenger trips, vehicle-miles operated, vehicles owned and leased, operating revenues, and passenger revenues. These data are published by the American Public Transit Association (APTA) and represent the results of surveys voluntarily completed by APTA members. Not all light rail operations in the United States are members of APTA. In addition, not every member of APTA reports the various operating and financial data shown in Exhibit A-7. The potential for a refined and statistically significant analysis conducted with these data is therefore limited. However, as broad indicators of operating and financial trends in the light rail industry, the APTA data are the most comprehensive available.

EXHIBIT A-6

LIGHT RAIL OPERATIONS AND OPERATING AND FINANCIAL STATISTICS AS OF DECEMBER 31, 1976[1]

City of Detroit Department of Transportation[2]	Detroit, MI
Dillard's Department Store[2]	Fort Worth, TX
Greater Cleveland Regional Transportation Authority	Cleveland, OH
Massachusetts Bay Transportation Authority	Boston, MA
New Orleans Public Service, Inc.[2]	New Orleans, LA
Port Authority of Allegheny County	Pittsburgh, PA
San Francisco Municipal Railway	San Francisco, CA
Southeastern Pennsylvania Transportation Authority	Philadelphia, PA
Transport of New Jersey	Newark, NJ

Light Rail Operations (December 31, 1976)	9
One-Way Miles of Line	207
One-Way Route Miles	301
Light Rail Cars	963
Total Passenger Rides (Millions)-1976	112
Revenue Passenger Rides (Millions)-1976	86
Operating Revenue (Millions)-1976	27
Passenger Revenue (Millions)-1976	26
Average Fare - 1976	$0.2988
Passenger Vehicle Miles Operated (Millions)-1976	21

[1] Source: American Public Transit Association, Transit Fact Book, Washington, D.C., June 1977, p. 44.

[2] "Special service" operators.

EXHIBIT A-7

OPERATING AND FINANCIAL TRENDS IN THE LIGHT RAIL INDUSTRY[1] 1965-1976(P)

YEAR	TOTAL PASSENGER TRIPS (millions)	REVENUE PASSENGER TRIPS (millions)	VEHICLE MILES OPERATED (millions)	VEHICLES OWNED AND LEASED	OPERATING REVENUES (millions)	PASSENGER REVENUES (millions)
1965	276	204.0	41.6	1549	55.7	48.6
1966	282	211.0	42.9	1407	58.7	51.8
1967	263	196.0	37.8	1388	52.5	44.8
1968	253	187.3	37.5	1355	53.1	44.0
1969	249	183.4	36.0	1322	54.8	45.9
1970	235	172.4	33.7	1262	55.2	46.6
1971	222	155.1	32.7	1225	48.8	40.1
1972	211	147.3	31.6	1176	48.4	39.6
1973	207	143.5	31.2	1123	48.5	38.7
1974	150	113.7	26.9	1068	36.5	31.7
1975	124	94.0	23.8	1061	28.9	28.1
1976(P)	112	86.0	21.1	963	26.9	25.7

(P) - Preliminary

[1] **Source: American Public Transit Association, Transit Fact Book, Washington, D.C., June 1977.**

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