

Employment Requirements of Mass Transit



A Case Study
of the Massachusetts Bay Transportation Authority

U.S. Department of Labor
Bureau of Labor Statistics and
Employment and Training Administration
1978

BLS Bulletin 1989
ETA R&D Monograph 58

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August 1978

BLS Bulletin 1989
ETA R&D Mongraph 58

Library of Congress Cataloging in Publication Data

United States. Bureau of Labor Statistics.
Employment requirements of mass transit.

(R & D monograph ; 58) (Bulletin - Bureau of
Labor Statistics ; 1989)

1. United States--Public works--Case studies.
 2. Massachusetts Bay Transportation Authority.
 3. Manpower policy--United States--Case studies.
 4. Interindustry economics--Case studies.
- I. Binion, Marvin L. II. Fleming, Thomas F.
III. Rogers, Kenneth W. IV. Title. V. Series.
VI. Series: United States. Bureau of Labor
Statistics. Bulletin ; 1989.

HD3890.M4U52 1978 331.1'1 78-606064

Preface

The Bureau of Labor Statistics, as part of its research on the employment requirements of Federal programs, reviewed Federal aid for mass transit and selected the Massachusetts Bay Transportation Authority for a case study. The research was carried out with the financial assistance of the U.S. Department of Labor's Employment and Training Administration, Office of Research and Development, Howard Rosen, Director.

The mass transit study was a cooperative effort of two offices of the Bureau—the Office of Economic Growth and the Office of Employment Structure and Trends. Direction was provided by Ronald E. Kutscher, Assistant Commissioner, Office of Economic Growth, and Neal H. Rosenthal, Assistant Chief, Division of Occupational Outlook. Coordination of the project was provided by Thomas F. Fleming, Jr., of the Office of Economic Growth and Dixie A. Sommers of the Office of Employment Structure and Trends. Robert L. Ball of the Office of Productivity and Technology provided technical assistance on the capital improvements part of the study. Data were collected primarily by the Bureau's New England Regional Office, Wendell D. Macdonald, Regional Commissioner, under the direction of Paul V. Mulkern, Assistant Regional Commissioner. Leo Epstein supervised the field work for the study in the New England region. The report was written by Marvin L. Binion, Thomas F. Fleming, Jr., and Kenneth W. Rogers, of the Office of Economic Growth. Joseph B. Epstein was the project officer for the Office of Research and Development of the Employment and Training Administration.

The Bureau gratefully acknowledges the assistance of the officials of the Massachusetts Bay Transportation Authority who made the study possible as well as the cooperation of the many contractors who provided the data upon which this report is based.

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Introduction

Since Federal policies and expenditures can substantially affect the kinds and numbers of jobs required in the economy, it is important to have quantitative data on their overall impact to assist in program planning and evaluation. The Bureau of Labor Statistics (BLS) has undertaken a number of studies on the employment-generating effect of Federal expenditures. These studies initially dealt with broad sectors or categories of Federal expenditures, such as defense outlays or State and local governments; more recently, the studies have covered specific agencies or programs.¹

As a case study of employment arising from Federal assistance for mass transit systems, this study provides employment requirements, by industry and occupation, for the Massachusetts Bay Transportation Authority's current operations in 1974 and capital improvements projects from January 1972 through June 1974. The Federal role in underwriting mass transit, the selection of the Massachusetts Bay Transportation Authority (MBTA) for the study, and BLS research methods are discussed below. A more detailed discussion of research methods is contained in the appendixes.

Federal mass transit assistance

The need. Between 1950 and 1974, motor vehicle registrations in the United States more than doubled. The number of passengers carried by mass transit—light and heavy rail, trolleys, and buses—declined to 40 percent of the level nearly 25 years earlier. During the same period, the number of transit systems across the country fell from more than 1,400 to less than 1,000. Even more dramatic

¹Studies include *Manpower Impact of Federal Government Programs: Selected Grants-in-Aid to State and Local Governments*, Report 424 (1973); *Expenditures and Manpower Requirements for Selected Federal Programs*, Bulletin 1851 (1975); *Factbook for Estimating the Manpower Needs of Federal Programs*, Bulletin 1832 (1975); and *Impact of Federal Pollution Control and Abatement Expenditures on Manpower Requirements*, Bulletin 1836 (1975). In addition, the Bureau has published an extensive series of construction labor requirements studies. For example, see *Labor and Material Requirements for Private Multifamily Housing Construction*, BLS Bulletin 1892 (1976). Articles on other recent construction labor requirements studies include "Labor and Materials Requirements for Sewer Works Construction," Robert Ball and Joseph T. Finn, *Monthly Labor Review*, November 1976; and "Decline Noted in Hours Required to Erect Federal Office Buildings," John G. Olsen, *Monthly Labor Review*, October 1976.

was the shift in ownership. In 1950, less than 2 percent of these transit systems were publicly owned; by 1974, one-third of the existing systems were in public hands. Mass transit systems for the past quarter-century have lost passengers, raised fares, and incurred larger deficits as more and more people have come to rely upon the automobile.

Legislative history. From modest beginnings, the Federal Government has gradually devised a comprehensive and substantial program of assistance for mass transit.² In 1961, Congress enacted a \$25-million pilot program for demonstration grants and technical assistance to mass transit systems and provided a \$50-million borrowing authority for capital improvement programs. The Urban Mass Transportation Act of 1964 broadened the base for mass transit assistance, and congressional amendments in 1966 extended the Federal assistance available for mass transit to technical study grants, managerial training, and grants to educational institutions for graduate research and training programs. In 1968, responsibility for all urban mass transportation assistance at the Federal level was transferred to the Department of Transportation from the Department of Housing and Urban Development, and the Urban Mass Transportation Administration (UMTA) was established.

At the time of transfer, total grants-in-aid authorized amounted to only \$1.1 billion over the entire life of the act. Subsequently, the 1970 Urban Mass Transportation Assistance Act provided a higher level of funding, lengthened the period of assured funding to 12 years, and enlarged the roles of State governments and the private sector. The Federal-Aid Highway Act of 1973 further increased the availability of funds for mass transit capital improvements and increased the share of Federal participation in these projects. Most significantly, this legislation opened the use of highway funds for both rail and bus transit and also provided for use of highway funds for exclusive lanes, traffic control devices, bus shelters, and parking facilities. Interstate highway funds also were made available for these purposes under certain conditions.

²Legislative history based on information furnished by U.S. Department of Transportation, Urban Mass Transportation Administration.

The 1974 National Mass Transportation Assistance Act assured Federal funds for mass transit and established an \$11.8-billion, 6-year program to provide assistance for both capital improvements and current operating expenditures. Of the total amount provided by the 1974 legislation, \$7.8 billion was made available for mass transportation capital and planning projects administered by UMTA. The major new provision of the act was the apportionment of nearly \$4 billion to urbanized areas for use in either mass transportation capital projects or operating assistance projects.

Grants approved. At the time this study was planned, UMTA had approved approximately \$2.5 billion of capital grants (table 1). In the 10-year period, the total amount committed to mass transit assistance grew fivefold and the number of projects funded increased in almost every year to total 394. The largest commitments—two-thirds of the total—were to rail transportation, although in the earliest years UMTA's funding of rail projects was proportionally even higher. Almost 92 percent of the total funds went to 24 major metropolitan areas for 180 projects (table 2). The balance was shared by smaller communities for 214 projects, frequently the purchase of buses. Four of the metropolitan areas—San Francisco, Chicago, Boston, and the New York-New Jersey-Connecticut region—accounted for nearly 63 percent of the funding and 78 of the approved projects.

Selection of the MBTA for study

Improvement of the MBTA's capital plant has closely paralleled the expansion of Federal aid to urban mass transportation. The Authority received an initial \$16 million of Federal assistance in 1964 for the first phase of its systemwide modernization program. By early 1974, the time this study originated, the MBTA had received approval for more than \$267 million in Federal grants

Table 1. Capital grants by year and category, Urban Mass Transportation Administration, 1965-74

Year	Number of projects	Amount (millions)			
		Total	Rail	Bus	Boat and other
Total	394	\$2,526.2	\$1,669.9	\$732.0	\$124.2
1965	17	50.7	28.1	9.3	13.3
1966	27	106.1	64.4	39.5	2.2
1967	22	120.9	110.6	10.3	---
1968	26	121.8	104.8	17.0	---
1969	28	148.3	121.9	26.4	---
1970	28	133.4	83.2	49.8	4
1971	49	284.8	160.2	116.1	8.5
1972	66	510.0	280.4	166.3	63.2
1973	94	844.2	583.0	235.4	25.8
1974-first quarter	37	206.0	133.3	61.9	10.7

¹Most recent information available at the time the study was planned.

NOTE: Detail may not add to totals because of rounding.

SOURCE: Urban Mass Transportation Administration.

Table 2. Capital grants to metropolitan areas, Urban Mass Transportation Administration, 1965-74¹

Area	Number of projects	Amount (millions)
Total metropolitan areas	180	\$2,314.5
New York-New Jersey-Connecticut region	21	643.7
San Francisco (BART system)	22	405.4
Chicago (including northern Indiana)	17	270.4
Boston	18	267.4
Philadelphia (including southern New Jersey)	15	135.8
Atlanta	2	108.7
Pittsburgh	4	96.4
Washington, D.C.	4	71.0
Baltimore	3	47.3
Los Angeles	13	38.8
Minneapolis-St. Paul	5	30.6
Cleveland	3	22.2
Dallas	3	22.2
Seattle-Everett	5	20.4
Detroit	8	20.0
Kansas City	4	16.1
Rochester	3	14.3
New Orleans	4	14.2
Portland, Oregon	4	13.9
Cincinnati	3	12.7
San Juan, Puerto Rico	8	11.2
Anaheim-Santa Ana-Garden Grove	2	11.1
Miami	3	10.3
Honolulu	1	10.3

¹Projects of over \$10 million through Mar. 31, 1974.

NOTE: Detail may not add to totals because of rounding.

SOURCE: Urban Mass Transportation Administration.

and by 1976 had become eligible for a total of over \$625 million from UMTA. In fact, the Administrator of the Urban Mass Transportation Administration, Robert E. Patricelli, stated in October 1976 that "more than any other city, Boston has made effective use of Interstate and other Federal aid in improving all aspects of its public transportation system."²

The MBTA was selected for study because its broad capital projects program provided a variety of construction activities ranging from a new subway line to station modernization projects. In addition, the current operations of the Authority represented a wide range of expenditures for several modes of mass transit. Annually, the MBTA carries more than 144 million passengers, using a fleet of nearly 1,200 buses, 290 light rail vehicles, 353 heavy rail cars, and 52 trackless trolleys (trolley buses).³ In addition, the Authority subsidizes the operation of rail commuter service in the area.

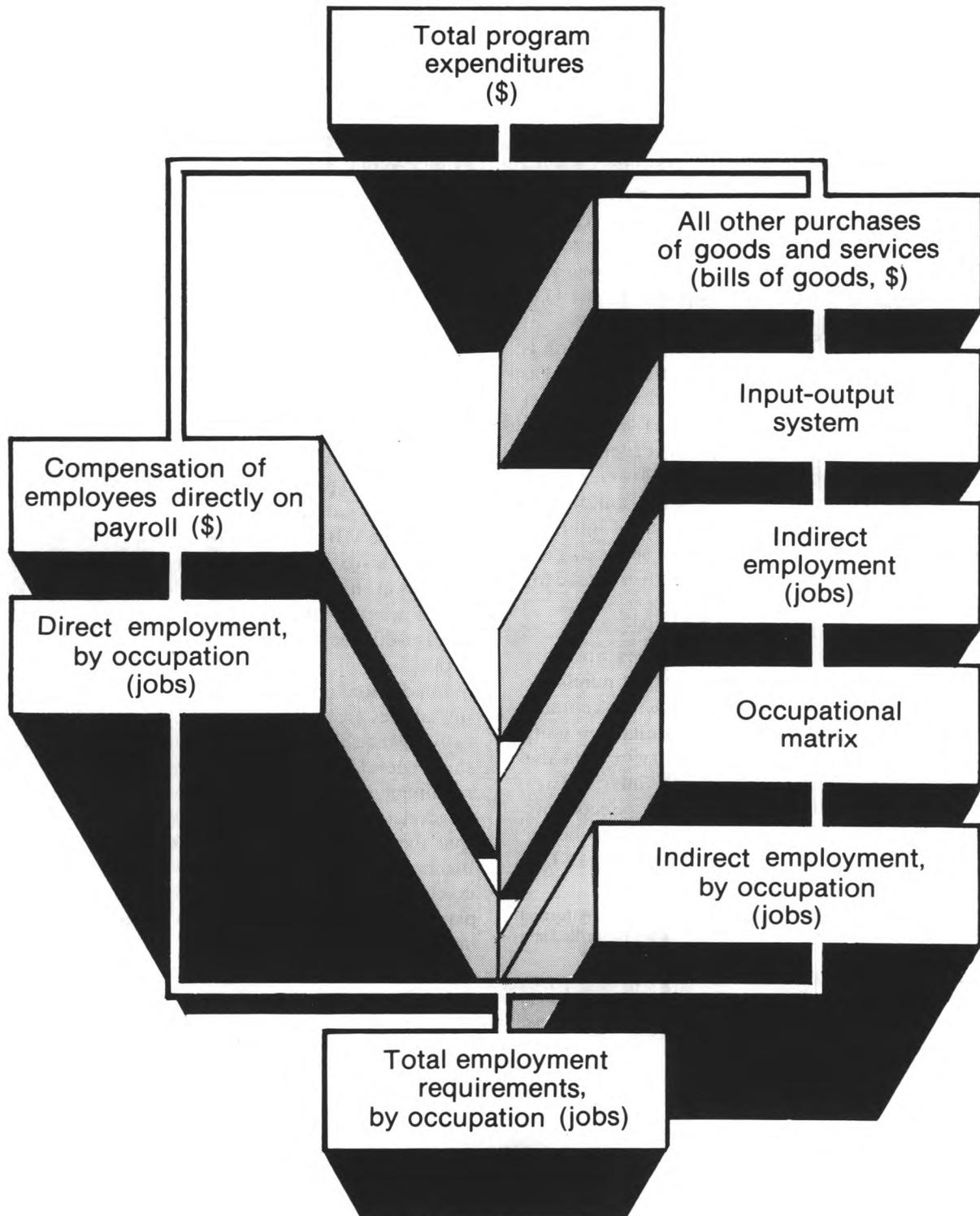
BLS research methods

In preparing employment requirements studies, after initial research indicates the feasibility of such a study, the usual pattern is to define the characteristics of the universe and, where necessary, to select a sample. In the MBTA study, the information furnished by the Authority permitted selection of contracts for the 30-

²UMTA press release 101, Oct. 6, 1976.

³Based on data for 1974 supplied by the Massachusetts Bay Transportation Authority.

Chart 1. Relationship of expenditures, employment, and occupational requirements



month period January 1972 through June 1974. The study period was chosen to allow a mix of capital projects; due to the long construction time of many of these projects, it was felt that a single year would be insufficient to reflect a representative mix. June 1974 was chosen as the cutoff date, since data through that period were the latest available at the planning stages of the study.⁵

Employment definitions. In this study employment is classified as direct or indirect. Direct employment is defined as jobs identified specifically from the payrolls of the MBTA, construction contractors, or architectural and engineering firms. In contrast, indirect employment results from the expenditures of the MBTA or its contractors for all goods and services other than for the direct compensation of their own employees. Included are both the primary or first tier of jobs—those required initially in the industry providing the product or service bought—and the second tier, or all the remaining jobs which are required in supporting industries (chart 1).

Sources of data. The direct employment information is derived from primary sources either at the government agency or through survey work and field visits. Direct employment requirements for programs are usually developed either from the records of Federal funds recipients (e.g. the MBTA) or directly from payroll records of contractors. The indirect employment estimates are developed by obtaining detailed information on specific costs of materials and services. (See appendixes A and B for further detail and forms used for data collection.)

The interindustry model. The expenditures are then grouped by industry sector to provide lists of purchases (called “bills of goods”) required as input for the interindustry model which translates these dollar amounts into the resultant employment by industry at both the primary and secondary levels. Briefly, the interindustry model traces the intricate linkages through the economy and measures both the primary and secondary requirements of the output of each of the industries.⁶ The

⁵Since the survey was not actually taken until mid-1975, in retrospect the survey period probably should have been extended forward into 1975.

⁶Appendix C describes the model in more detail. A complete description of the input-output system can be found in *The Structure of the U.S. Economy in 1980 and 1985*, Bulletin 1831 (Bureau of Labor Statistics, 1975). More information on the occupational matrix is avail-

able in *Occupational Employment Statistics, 1960-70, 1738* (Bureau of Labor Statistics, 1972).

production links are translated into employment requirements by use of employment-output ratios for each sector.

The occupational matrix. After industry employment requirements are developed, they become inputs to the industry-occupational matrix. This matrix distributes total national employment into 400 occupations and cross-classifies them by 200 industries.

Manpower factors. To aid in program planning and to simplify comparisons of employment generated by Federal expenditures, the Bureau of Labor Statistics frequency provides “manpower factors” representing the estimated number of jobs per million or billion dollars of expenditures rather than just the number of jobs generated by actual dollars expended for the program. A complete description of this process is contained in chapter 2 of *Factbook for Estimating the Manpower Needs of Federal Programs.*⁷ Requests for additional information may be addressed to the Assistant Commissioner, Office of Economic Growth, Bureau of Labor Statistics, Washington, D.C. 20212.

Limitations. This study of the MBTA was a single case study to measure the number of jobs, by occupation, resulting from projects capable of being federally funded. Despite the variety of projects and extensive expenditures of the MBTA, this study in no way can be defined as representative of other federally funded mass transit projects at this time. Only additional survey work could reveal whether the estimates of employment requirements would be roughly comparable in other mass transit projects.

In addition, these employment estimates are qualified in that they are average requirements and are not specifically the additional or incremental requirements due to the Federal program. Furthermore, the employment requirements presented here do not include the multiplier or accelerator effects of the dollars expended. This means that the further employment and occupational requirements generated as jobholders spend their earnings on consumer goods and services and as businesses invest in plant and equipment to meet increased demand are not included in the estimates.

⁷Bulletin 1832 (1975).

Overview of Results

Employment requirements arising from the MBTA's 1974 current operations budget of \$193.2 million were estimated to total about 8,400 jobs. Nearly 6,400 of these were directly on the Authority's own payroll. The remaining 2,000 jobs were generated by its purchases of goods and services to run the system. Employment required to operate its mass transit routes ranked the MBTA among the top 20 nongovernment employers in the Commonwealth of Massachusetts that year.

Capital improvements contracts of the MBTA, totaling \$63.2 million for the 30-month period, provided a total of nearly 3,900 jobs. Construction contracts for a new subway line, yards and shops, station modernization projects, and other improvements to the MBTA system provided over 90 percent of these jobs. The remainder resulted from architectural and engineering contracts of the MBTA.

Table 3. Percent distribution of indirect employment requirements for current operations and capital improvements by industry sector, Massachusetts Bay Transportation Authority

Industry sector	Current operations, 1974	Capital improvements 1972-74	
		Construction contracts	Architectural and engineering contracts
Total	100.0	100.0	100.0
Agriculture, forestry, and fisheries .....	.7	.9	.8
Mining	2.6	3.8	.6
Construction	4.3	3.8	1.7
Manufacturing	18.9	48.9	13.2
Transportation, communications, and public utilities	27.1	9.7	14.3
Wholesale and retail trade	10.5	10.7	8.0
Finance, insurance, and real estate	21.0	4.9	16.4
Services	12.3	15.7	41.2
Government enterprises	2.6	1.5	3.7

Data are for the 30-month period January 1972-June 1974.

NOTE: Detail may not add to totals because of rounding.

SOURCE: Bureau of Labor Statistics.

Comparison of direct and indirect employment

In analyzing the employment requirements of mass transit—and the MBTA in particular—it may be useful to compare the direct and indirect employment generated to estimate the number of job opportunities most likely to be created locally. Direct employment is usually in the local area; jobs generated through the purchase of goods and services may be widespread geographically. Chart 2 shows the proportions of direct and indirect employment for the various categories of MBTA expenditures.

The current operations of the MBTA had proportionately the greatest direct employment, followed closely by the architectural and engineering firms working on the MBTA capital improvements programs. Since the construction contracts themselves were less labor intensive and required substantial purchases of materials, direct employment requirements were less than half of the total employment requirements arising from construction.

Table 4. Percent distribution of employment requirements for current operations and capital improvements by occupational group, Massachusetts Bay Transportation Authority

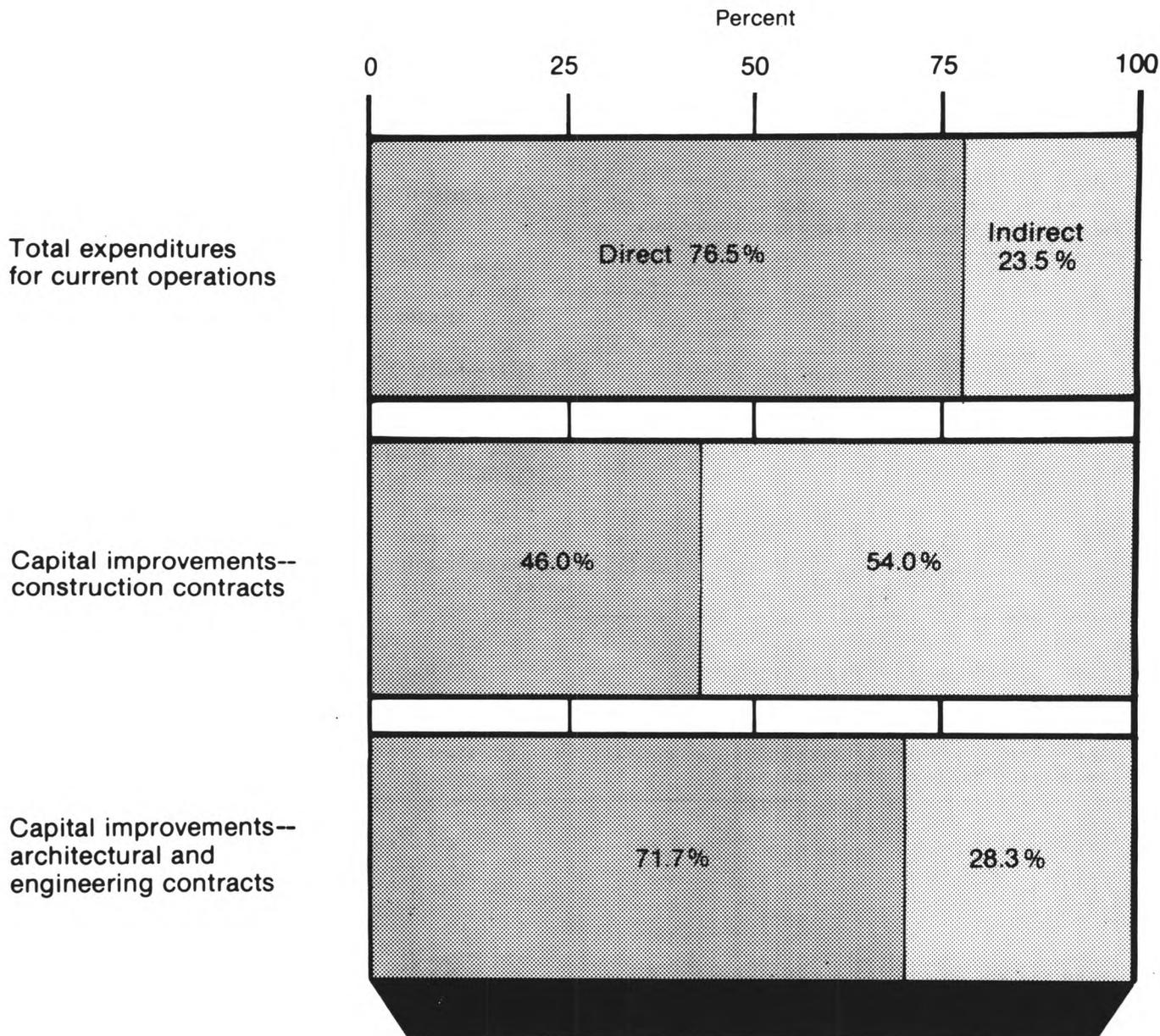
Occupational group	Current operations, 1974		Capital improvements, 1972-74			
	Direct	Indirect	Construction contracts		Architectural and engineering contracts	
			Direct	Indirect	Direct	Indirect
Total	100.0	100.0	100.0	100.0	100.0	100.0
Professional and technical workers	3.6	8.9	11.5	9.4	72.0	16.2
Managers and administrators	3.0	11.7	3.9	9.6	4.6	10.4
Sales workers	0	8.1	0	4.0	0	7.1
Clerical workers	12.2	23.6	7.7	16.8	17.6	26.2
Craft workers	27.0	16.5	46.4	19.2	4.6	10.6
Operatives	37.8	18.6	5.3	27.7	.4	13.9
Service workers	8.6	6.0	0	6.7	---	12.3
Laborers, farm workers	7.9	6.6	25.3	6.4	8	3.2

Data are for the 30-month period January 1972-June 1974

SOURCE: Bureau of Labor Statistics

NOTE: Detail may not add to totals because of rounding

Chart 2. Comparison of direct and indirect employment requirements for current operations and capital improvements



Industry and occupational patterns

Purchases of goods and services generated different employment requirements for current operations than for capital improvements projects. Almost half the indirect jobs required by current operations were found in either the transportation, communications, and public utilities industries or in finance, insurance, and real estate (table 3). Manufacturing jobs accounted for another one-fifth of the indirect jobs generated by current operations. For construction contracts, however, manufacturing jobs represented about half of all the indirect jobs required.

Another 16 percent of the jobs were found in services. The largest portion of the indirect jobs generated by architectural and engineering contracts was in the services sector.

Occupational patterns varied (table 4). For direct employment, over three-quarters of the jobs arising from current operations were classified in the operative, craft worker, and clerical worker occupational groups—ranked in that order. Almost half the direct jobs on construction projects were in the crafts; another one-quarter were laborer jobs. Direct jobs on architectural and engineering contracts were heavily concentrated in the professional and technical group.

Part I. Current Operations

The Massachusetts Bay Transportation Authority had its origins in the West End Railway company, founded in 1887. In 1918, after a succession of private efforts in providing horse-drawn and, later, electric street railway transportation to Boston, the State assumed its first role in public transit by furnishing a subsidy to the operators. In 1947, the Commonwealth of Massachusetts assumed complete control through purchase of the system and reorganized the transit service as the Metropolitan Transit Authority (MTA) to operate in Boston and 13 adjoining cities and towns.

However, as suburban growth spread farther out from the City of Boston in the postwar period, ridership fell sharply. Revenue miles decreased from nearly 55 million in 1948 to approximately 36 million in 1963. In 1964, in recognition of the regional nature of transportation needs in the Boston metropolitan area, the State chartered the Massachusetts Bay Transportation Authority to encompass the 14 cities in the MTA jurisdiction as well as the other 64 cities and towns which made up the Boston Standard Metropolitan Statistical Area (SMSA). One additional town outside the SMSA elected to join the Authority, providing a total of 79 cities and towns to support mass transportation in the Boston metropolitan region.

The MBTA system

The MBTA transportation system consists of five streetcar and three rapid transit routes which form a spiderlike rail network 73 miles long connecting the Boston central business district with other major commercial and residential centers in Boston and surrounding communities (table 5).⁸ For the most part, these transit routes are underground in the most densely developed areas and at the surface or on elevated tracks in the less intensely developed areas. In many instances, these lines have remained unchanged since their original construction in the early 1890's. With its inception in 1964, the MBTA began an extensive capital improvements program to upgrade or replace entirely the oldest rapid transit and streetcar lines and their associated stations. This ongoing capital improvements program is expected to continue into the 1980's, requiring a large amount of local and Federal funding.

Light rail (streetcar) lines are distinguished from heavy rail lines primarily in the construction of the vehicles operating on them. Light rail vehicles are much lighter in weight and do not require as extensive a roadbed foundation as heavy rail vehicles. Also, heavy rail routes have platforms located at the same level as the floor of the transit vehicle and the stations are at fixed points along the route. Light rail vehicles, in contrast, require passengers to step up or down to enter or leave the vehicle, much like a bus, but have the advantage of being able to pick up and discharge passengers at almost any point along a surface route without requiring special stations. Both types of vehicles are powered by electricity.

Operating in coordination with the rapid transit and streetcar routes is a system of 218 bus routes in areas not directly serviced by rail. In many cases, these bus routes funnel a large portion of the commuter traffic directly to rapid transit stations. In 1974, this combined service accounted for 71 percent of all passengers; strictly bus users accounted for 21 percent and exclusively rapid transit users only 8 percent.

Table 5. Current operations statistics,¹ Massachusetts Bay Transportation Authority, 1974

Item	Number
Population of 79 communities in district (1970 U.S. Census)	2,763,410
Daily passenger load (approx.)	475,000
Annual passenger load (approx.)	144,287,000
Routes:	
Buses	218
Streetcars	5
Rapid transit	3
Trackless trolleys	4
Equipment miles:	
Buses	722.4
Single-track streetcars	86.7
Single-track rapid transit	77.3
Trackless trolleys	15.7
Equipment units:	
Buses	1,197
Streetcars	290
Rapid transit cars	353
Rapid transit stations	51
Trackless trolleys	52
Total annual revenue miles operated	40,750,384
Buses	23,212,289
Streetcars	6,313,820
Rapid transit	10,325,344
Trackless trolleys	898,931

¹Excluding subsidized commuter rail operations.

SOURCE: Massachusetts Bay Transportation Authority, *Tenth Annual Report*, p. 9.

⁸Based on information provided by the MBTA.

The third major segment of the MBTA system is the commuter railroad service. In 1974, the MBTA paid more than \$12 million to the Penn Central and Boston and Maine railroads to operate their existing commuter rail services to many outlying communities. Involvement in the commuter rail operation was further expanded in 1975 when the MBTA agreed to purchase the Boston and Maine commuter rights of way and equipment, thus incorporating the commuter rail service directly into the operating system. By the end of 1975, the extent of commuter operations was such that the MBTA was providing transportation to over 30,000 persons daily on routes totaling 244 miles.

Revenues

The total costs of operation of the MBTA were funded in roughly equal shares by farebox and miscellaneous revenue sources, State financial assistance, and local community financial assistance. The MBTA has the implicit authority to tax directly each community within the MBTA district. This is accomplished through a unique mechanism whereby the State pays the entire cost of the MBTA deficit. In turn, the State apportions the local community share of the deficit to each of the 79 cities and towns by a formula based on the total number of commuters living in each jurisdiction and the number of riders boarding express service buses or rapid transit vehicles in each community. The local community is obligated to furnish the funds—either from its own sources or by obtaining funding from Federal sources—or forego the services normally covered by the State aid.

Beginning in 1974, Federal grants to cover the costs of operating local public transportation systems became available and the MBTA received approximately \$11 million in operating assistance from the U.S. Department of Transportation.

Federal aid payments allowed by the National Mass Transportation Assistance Act of 1974 are scheduled to grow from \$11 million in 1975 to nearly \$20 million in 1979. In addition, since 1973, the Commonwealth of Massachusetts has increased its level of aid to the MBTA to cover approximately one-half the annual deficit incurred by transit operations. The combined effect of these two actions has been to reduce the local tax burden imposed by the deficit.

Expenditures

The total cost of operating the MBTA in 1974 was \$193,244,765. This amount included the costs of operating and maintaining the bus, streetcar, and rapid transit fleet; general management and administrative costs; and the subsidy allocated to commuter rail operations.⁹

⁹The total costs and revenues from commuter rail operations are not included since these operations were actually performed and accounted for by the two railway companies involved.

Table 6. Current operations expenditures, Massachusetts Bay Transportation Authority, 1974-75

Expenditure category	Amount (millions)		Percent distribution	
	1974	1975	1974	1975
Total	\$193.2	\$212.4	100.0	100.0
Wages and salaries	97.3	105.3	50.4	49.6
Other employee-related expenses ..	25.9	27.4	13.4	12.9
Fuel	11.1	11.6	5.7	5.4
Other materials, supplies, and services	13.7	14.6	7.1	6.9
Industrial and transit-related accident claims	3.2	3.9	1.7	1.8
Current operations interest	3.8	4.5	2.0	2.1
Railroad and mass transit subsidies ..	12.0	14.9	6.0	7.0
Fixed interest and principal	25.3	29.3	13.1	13.8
Other fixed costs .....	.1	.1	(¹)	(¹)
Other current costs .....	.7	.8	.4	.4

¹Less than 0.05 percent.

NOTE: Detail may not add to totals because of rounding.

SOURCE: Based on information provided by the Massachusetts Bay Transportation Authority.

Wages and fringe benefits for its approximately 6,400 employees constitute the major current operations expenditures of the MBTA.¹⁰ Compensation has been the predominant expenditure category in all years, amounting to 63.8 percent and 62.5 percent of current operating expenses in 1974 and 1975, respectively. In contrast, expenditures for fuel, materials, and supplies accounted for only 12.8 percent of expenditures in 1974 and 12.3 percent in 1975. Prior to its reorganization as the MBTA in 1964, fixed costs of the transit system were fairly constant, ranging from \$4 million to \$7 million annually, reflecting primarily the low level of capital investment during those years. Beginning in 1964, MBTA fixed costs rose dramatically to nearly \$30 million in 1975, due primarily to the extensive capital improvements undertaken to update and expand transit operations. Table 6 details the major expenditure categories for 1974 and 1975.

In 1974, total purchases of goods and services in constant 1972 dollars totaled \$23.3 million, excluding the rail subsidy. Of this amount, over 65 percent represented purchases from five industries, as shown in the tabulation below:

Industry	Percent of total purchases
Insurance	29.5
Petroleum products	15.9
Electric utilities	8.4
Wholesale trade	8.1
Motor vehicles and parts	3.4

The largest single industry affected by MBTA purchases was the insurance industry. These purchases were predominantly for health and medical insurance

¹⁰Current operating expenses in this context are defined as those variable costs incurred in transit operation not including operating costs of a fixed nature such as interest and principal payments on bonds used to finance capital construction or acquisition projects.

provided employees as a fringe benefit. Other forms of insurance purchased were group life and accident policies. The total does not include the cost of liability insurance. Rather, the MBTA has chosen to be a self-insurer for transit-related accidents and for industrial accidents up to a certain level. Therefore, liability insurance purchased covers only claims exceeding these amounts, with claims for smaller amounts paid directly out of current operating costs.¹¹

Ranked second in expenditures, petroleum products totaled 16 percent of all purchases. These products were primarily gasoline and diesel fuel used in the bus operations and fuel oil used to power boilers. The period 1972-74 witnessed a dramatic rise in the portion of operating costs attributable to fuel. While some of this rise was caused by an increase in the quantity of fuel purchased, most of the increase reflected higher prices. MBTA annual purchases of diesel fuel exceed 7 million gallons, which, according to MBTA data, cost approximately 12 cents per gallon in 1972 but by 2 years later had nearly tripled, to 35 cents per gallon. Prices for other petroleum products rose at similar rates. Altogether, the MBTA paid \$4.5 million in 1972 for total fuel costs, including power purchased from independent electric utilities. In 1974, this figure had increased to \$11.1 million.

Other major purchases were made predominantly from the manufacturing and service sectors. Most purchases from manufacturing industries were for tools, repair and replacement parts, and equipment used to maintain the transit rolling stock and associated buildings and structures such as electrical substations. Purchases from the services sector were primarily from establishments providing business and professional services and medical facilities.

Employment requirements

MBTA operations provided nearly 8,400 full- and part-time jobs in 1974 either directly on the payroll of the MBTA or indirectly through the purchase of goods and services.

Direct employment. Direct employees of the MBTA accounted for nearly 6,400 jobs during 1974. The MBTA makes a significant contribution to the employment rolls in the New England region. Excluding employees of Federal, State, and local government, the MBTA is the 19th largest employer in the Commonwealth of Massachusetts and the 15th largest employer in the Boston metropolitan area. Except for the top 150 managers and officials, MBTA employees are represented by 28 separate collective bargaining units. These units range from office and professional employee

¹¹These costs, as discussed in appendix A, have been excluded from this study.

Table 7. Indirect employment requirements of purchases for current operations, major sectors and selected industries, Massachusetts Bay Transportation Authority, 1974

Sector and industry	Number of jobs	Percent distribution
Total	1,967	100.0
Agriculture, forestry, and fisheries	14	.7
Mining	51	2.6
Construction	85	4.3
Maintenance	74	3.8
Manufacturing	372	18.9
Transportation, communications, and public utilities	534	27.1
Railroad transportation	386	19.6
Electric utilities	43	4.4
Wholesale and retail trade	207	10.5
Finance, insurance, and real estate	413	21.0
Insurance	338	17.2
Services	241	12.3
Government enterprises	51	2.6

NOTE: Detail may not add to totals because of rounding.

SOURCE: Bureau of Labor Statistics.

unions to a variety of construction trade employee associations and vary in size from fewer than 10 employees to thousands.

Indirect employment. Jobs generated indirectly through purchases numbered nearly 2,000, with the impact spread over a large number of different industries (table 7). The major sectors most significantly affected were transportation, communications, and public utilities; and the finance, insurance, and real estate sector—which together accounted for approximately 950 jobs. This pattern is consistent with the pattern of direct purchases, where the railroad subsidy and purchases of insurance were the two largest categories of employment-generating expenditures. The railroad subsidy itself accounted for over 600 jobs—nearly 400 in the railroad industry and the remainder in industries providing materials and services directly to the railroads.

Business and professional services and wholesale and retail trade were also substantially affected. This is explained by the high labor content relative to the amount of purchases in these industries. Employment requirements in the manufacturing sector as a whole ranked high, but because of the wide variety of manufactured goods purchased, no one industry (with the exception of petroleum products) was affected to a large extent. The petroleum industry is unique in that, while purchases of petroleum ranked second, employment resulting from these purchases was relatively small—in employment, the industry ranked only 11th among all industries supplying the MBTA. However, the job requirements in the crude petroleum industry, which is a major input into the petroleum products industry, were significantly higher; the crude petroleum industry ranked seventh in terms of the number of jobs required. This is an excellent example of a situation where the largest indirect employment impact is not in the primary producing industry but rather in a

secondary industry supplying major inputs into the primary industry's production process.

Occupational patterns

Among MBTA employees, transportation and equipment operatives made up the largest single group of workers, totaling nearly 40 percent of all employees (table 8). The majority of these workers were bus drivers and rapid transit vehicle operators; the remainder were operatives of various types of machinery and equipment. Skilled crafts and kindred occupations formed the second largest group of employees. These workers were primarily employed as mechanics and other skilled repairers involved in the extensive maintenance program required to keep the transit fleet and related facilities functioning.

Clerical personnel consisting mostly of secretaries, bookkeepers, and miscellaneous clerks made up the third largest group. These employees worked primarily in general administrative positions such as accounting and purchasing departments. Nearly one-third of the clerical personnel were classified as dispatchers and vehicle starters responsible for maintaining an orderly flow of transit vehicles throughout the working day.

The remaining 1,500 jobs directly on MBTA payrolls were divided equally between service workers, laborers, and professional, technical, and managerial personnel. Cleaning personnel and guards made up the majority of the service group; the laborer group consisted mostly of personnel engaged in track maintenance and repair and helpers and assistants aiding skilled workers in most maintenance and repair facilities. Engineers of various specialties and unspecified managers made up the remaining group.

Major occupations required by MBTA purchases were in the clerical, skilled craft, and production worker fields. These occupations accounted for nearly 60 percent of all indirect jobs generated. Clerical workers employed in the insurance industry accounted for 191 of the 464 clerical jobs required and the railroad industry employed nearly 200 of the 690 craft and operative workers. One-fifth of all the positions required were in professional and managerial occupations; accountants, engineers, engineering technicians, and miscellaneous office managers and supervisors were the most common job classifications. Service workers and laborers combined accounted for only 12 percent of the indirect jobs required.

Table 8. Direct and indirect employment requirements for current operations by occupational group, Massachusetts Bay Transportation Authority, 1974

Occupational group	Total		Direct		Indirect	
	Number of jobs	Percent distribution	Number of jobs	Percent distribution	Number of jobs	Percent distribution
Total	8,359	100.0	6,392	100.0	1,967	100.0
Professional and technical workers	402	4.8	227	3.6	175	8.9
Engineers	128	1.5	97	1.5	31	1.6
Others	274	3.3	130	2.0	144	7.3
Managers and administrators	422	5.0	191	3.0	231	11.7
Sales workers	159	1.9	---	---	159	8.1
Clerical workers	1,245	14.9	781	12.2	464	23.6
Craft workers	2,050	24.5	1,725	27.0	325	16.5
Operatives	2,783	33.3	2,418	37.8	365	18.6
Bus drivers	(¹)	(¹)	2,025	31.7	(¹)	(¹)
Rapid transit operators	(¹)	(¹)	207	3.2	(¹)	(¹)
Other	(¹)	(¹)	186	2.9	(¹)	(¹)
Service workers	665	8.0	547	8.6	118	6.0
Laborers, farm workers	633	7.6	503	7.9	130	6.6

¹Detail not available.

SOURCE: Bureau of Labor Statistics.

NOTE: Detail may not add to totals because of rounding.

Part II. Capital Improvements

Since its receipt of an initial Federal grant of \$16 million in February 1965—just 7 months after the enactment of the Urban Mass Transportation Act of 1964—the MBTA has won approval of more than \$700 million in Federal assistance to improve its system. The 30 months of capital improvements projects studied—January 1972 to June 1974—represented \$63 million, or 9 percent, of these dollars. As can be seen from chart 3, although the trend of Federal assistance has been strongly upward, there has been considerable year-to-year variation, especially in earlier years of UMTA funding.

Expenditures

The bulk of the expenditures for capital improvements projects studied went for construction.¹² Almost two-thirds of the \$56.7 million of construction was done by prime contractors with the MBTA. Direct payroll costs were a much larger proportion of architectural and engineering contracts—approximately 57 percent—than for construction contracts, where they accounted for roughly 25 percent of the total. Expenditures on materials, services, and equipment accounted for over half of the dollar value of construction contracts, but dropped to about 3 percent for architectural and engineering contracts (table 9).

Three manufacturing industries received over 40 percent of the total expenditures for manufacturing goods—\$4 million for basic steel products, \$2 million for fabricated metals, and over \$1 million for electric transmission equipment. Another sector receiving a substantial share of the purchases for the construction of capital projects was services, which accounted for 11 percent of the purchases.

Almost 90 percent of the purchases of the architectural and engineering firms with MBTA contracts were centered in three industry sectors. The services sector received the largest amount—40 percent—of the purchases from architectural and engineering contractors, with miscellaneous business services and professional services accounting for nearly all of these purchases. Finance, insurance, and real estate—primarily insurance—accounted for about 30 percent of the purchases.

¹²The scope of the case study was confined to construction and architectural and engineering contracts for capital improvements. Training grants and equipment purchases of light rail vehicles, for example, were excluded from the study.

The transportation, communications, and public utilities sector accounted for about 20 percent of the purchases; highway transport and communications industries accounted for the majority of the purchases within the sector.

Employment requirements

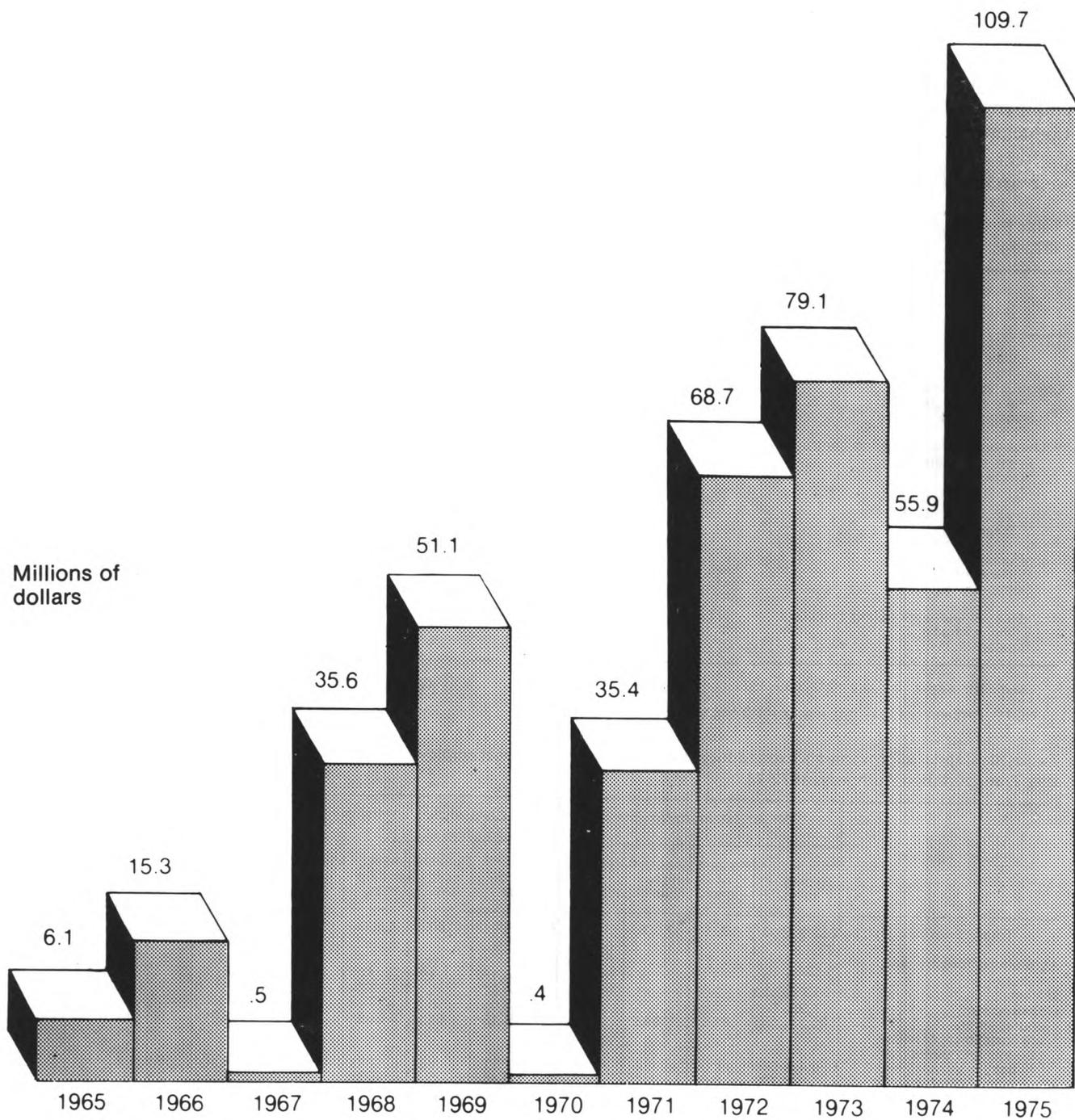
The MBTA contractors spent \$33 million on goods and services from the private sector, which generated about 2,000 jobs in addition to those directly on their own payrolls. The majority of these jobs were concentrated in manufacturing and services, which together accounted for about two-thirds of the indirect employment (table 10). Blast furnaces, basic steel products, and fabricated metals accounted for 10 percent of the construction indirect employment, while none of the other industries in the manufacturing sector accounted for more than 4 percent of the indirect employment.

More than 40 percent of the indirect employment generated by purchases by the architectural and engineering firms was in services. Miscellaneous business services accounted for 25 percent of the indirect employment within the service sector. The wholesale and retail trade sector accounted for 10 percent of all indirect employment from capital products but only 5 percent of the total dollars expended. This disparity arises because services and trade are more labor intensive than the other major sectors. Transportation, communications, and public utilities accounted for 10 percent of the indirect employment, evenly distributed throughout the sector.

Occupational patterns

The employment requirements of the MBTA projects for the 30 months totaled a little less than 4,000 jobs, of which 1,882 represented jobs directly on the payrolls of construction contractors or architectural and engineering firms (table 11). For employees of construction contractors, the largest single occupational group was craft and kindred workers, which accounted for 46 percent of all direct construction jobs. The next largest occupational group was that of laborers, with 25 percent of direct construction jobs. Professional, technical, and administrative workers represented 12 percent of the total direct employment on construction contracts, while clerical workers made up 8 percent. Operatives accounted for 5 percent of these direct jobs;

Chart 3. Federal grants to Massachusetts Bay Transportation Authority, 1965-75



Total, 1965-75

\$457.7 million

the small remaining balance consisted of managers, officials, and proprietors.

The occupational pattern was considerably different for employment generated by architectural and engineering contracts. Nearly three-quarters of all the direct employment on these contracts was classified as professional and technical. Clerical workers represented the next largest group, with 18 percent. No other occupational group accounted for as much as 5 percent of the total direct employment. Within the broad groups, civil engineers were the single most predominant occupation, representing 30 percent of the direct employment on architectural and engineering contracts. Eighteen percent of the balance of the employees were drafters, 10 percent were clerical workers, and 5 percent were architects.

Among the nine major occupational categories, the largest group, operatives, accounted for 27 percent of the indirect employment generated by the purchases of MBTA contractors, while farm workers—the smallest group—accounted for less than 1 percent of the indirect employment. The largest subgroup for operatives was “operatives, except transport,” which contained over 70 percent of the operatives. Transport equipment operatives constituted 47 percent of the operatives, with these jobs equally distributed among assemblers and miscellaneous operatives.

Clerical and craft workers each represented 18 percent of the total indirect employment. The largest subgroups within these categories were “other clerical workers”—70 percent of all clerical workers—and mechanics, repairers,

Table 9. Capital improvements expenditures by type of contract and expenditure, Massachusetts Bay Transportation Authority, 1972-74¹

Type of contract	Total expenditures	Payroll	Materials and services	Equipment	Overhead	
					Payroll	Other
Total.....	\$63,138,947	\$17,650,321	\$27,848,036	\$3,844,611	\$6,154,022	\$7,641,957
Construction contracts.....	56,731,342	14,017,434	27,683,666	3,813,783	5,216,911	5,999,548
Prime contracts.....	36,261,654	8,855,836	17,151,387	2,815,002	3,386,587	4,052,842
Subcontracts.....	20,469,688	5,161,598	10,532,279	998,781	1,830,324	1,946,706
Architectural and engineering contracts.....	6,407,605	3,632,887	164,370	30,828	937,111	1,642,409
Prime contracts.....	5,905,231	3,441,352	134,463	9,963	821,370	1,498,083
Subcontracts.....	502,374	191,535	29,907	20,865	115,741	144,326
Percent distribution						
Total.....	100.0	28.0	44.1	6.1	9.8	12.1
Construction contracts.....	100.0	24.7	48.8	6.7	9.2	10.6
Prime contracts.....	100.0	24.4	47.3	7.8	9.3	11.2
Subcontracts.....	100.0	25.2	51.4	4.9	8.9	9.5
Architectural and engineering contracts.....	100.0	56.7	2.6	.5	14.6	25.6
Prime contracts.....	100.0	58.3	2.3	.2	13.9	25.4
Subcontracts.....	100.0	38.1	6.0	4.2	23.0	28.7

¹30-month period, January 1972-June 1974

SOURCE: Bureau of Labor Statistics.

NOTE: Percentages may not add to 100.0 because of rounding.

Table 10. Capital improvements expenditures (1972 dollars) and indirect employment requirements by industry sector, Massachusetts Bay Transportation Authority, 1972-74¹

Industry sector	All capital improvements				Construction contracts				Architectural and engineering contracts			
	Expenditures	Percent of total	Indirect employment	Percent of total	Expenditures	Percent of total	Indirect employment	Percent of total	Expenditures	Percent of total	Indirect employment	Percent of total
Total.....	\$32,962,037	100.0	2,005	100.0	\$31,355,915	100.0	1,900	100.0	\$1,606,745	100.0	104	100.0
Agriculture, forestry, and fisheries.....	6,199	(²)	18	1.0	6,187	(²)	17	.9	12	(²)	1	.8
Mining.....	939,879	2.9	73	3.6	939,879	3.0	72	3.8	0	0	0	.6
Construction.....	1,953,051	5.9	75	3.7	1,953,051	6.2	73	3.8	0	0	0	1.7
Manufacturing.....	20,277,065	61.5	943	47.0	20,124,154	64.2	929	48.8	152,911	9.5	14	13.2
Transportation, communications, and public utilities.....	2,475,065	7.5	199	9.9	2,167,224	6.9	184	9.7	308,464	19.2	15	14.3
Wholesale and retail trade.....	1,644,762	5.0	211	10.5	1,605,460	5.1	203	10.7	39,302	2.4	8	8.0
Finance, insurance, and real estate.....	1,595,198	4.8	110	5.5	1,128,436	3.6	93	4.9	466,762	29.1	17	16.4
Services.....	4,064,074	12.3	342	17.1	3,425,912	10.9	299	15.7	638,162	39.8	43	41.2
Government enterprises.....	6,744	(²)	34	1.7	5,612	(²)	30	1.5	1,132	(²)	4	3.7

¹30-month period January 1972-June 1974.

NOTE: Detail may not add to totals because of rounding.

²Less than 0.05 percent.

SOURCE: Bureau of Labor Statistics.

Table 11. Direct and indirect employment requirements of capital improvements projects by occupational group, Massachusetts Bay Transportation Authority, 1972-74¹

Occupational group	All capital improvements		Construction contracts		Architectural and engineering contracts	
	Direct	Indirect	Direct	Indirect	Direct	Indirect
Total	1,882	2,005	1,618	1,901	264	104
Professional and technical workers ..	374	197	185	180	189	17
Managers and administrators	74	194	62	183	12	11
Sales workers	0	83	0	76	0	7
Clerical workers	170	348	124	321	46	27
Craft workers	760	374	748	363	12	11
Operatives	87	541	86	527	1	14
Service workers	0	140	0	127	0	13
Laborers	409	114	407	111	2	3
Farm workers	0	12	0	11	0	1
Percent distribution						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Professional and technical workers ..	20.0	9.8	11.5	9.4	72.0	16.2
Managers and administrators	3.9	9.7	3.9	9.6	4.6	10.4
Sales workers	0	4.1	0	4.0	0	7.1
Clerical workers	9.1	17.4	7.7	16.8	17.6	26.2
Craft workers	40.6	18.7	46.4	19.2	4.6	10.6
Operatives	4.6	27.0	5.3	27.7	4	13.9
Service workers	0	7.0	0	6.7	0	12.3
Laborers	21.8	5.7	25.3	5.9	.8	2.5
Farm workers	0	.6	0	.6	0	.8

¹30-month period January 1972-June 1974.

NOTE: Detail may not add to totals because of rounding

SOURCE: Bureau of Labor Statistics.

and installers—20 percent of all craft workers. Another 20 percent of craft workers were construction craft workers. Each of three occupational groups represented about 9 percent of the indirect employment—professional and technical workers; managers and officials; and service workers. Cleaning service workers and food service workers each accounted for 30 percent of the indirect employment for service workers.

Occupations by project type. A study of construction contracts by project type revealed significant differences in the occupational mix. The project types studied are shown in table 12—a major rail extension (Haymarket-North), yards and shops, station modernization and repair projects, and all other capital improvement projects. While laborers contributed the largest proportion of workers in each group, their importance ranged from 21 percent on the major rail project to 50 percent on the station modernization and repair projects. A significant proportion in each group—ranging from 8.5 percent up to 16 percent—were classified as blue-collar worker supervisors. Structural metal craft workers as well as electricians were important to the modernization and repair projects. Carpenters and electricians each accounted for roughly 10 percent of the work-hours on the rail project.

Table 12. Percent distribution of hours worked by occupation and project type, Massachusetts Bay Transportation Authority, 1972-74¹

Occupation	Haymarket-North, new rail extension	Yards and shops	Station modernization and repair	All other projects
Total	100.0	100.0	100.0	100.0
Laborers	21.3	31.4	50.0	44.0
Blue-collar worker supervisors	13.9	15.4	8.5	16.0
Carpenters	10.8	7.6	.8	7.7
Electricians	9.1	8.2	8.1	0
Excavation equipment operators	4.4	2.3	0	4.6
Structural metal craft workers	3.9	4.6	12.7	2.2
Truck drivers	3.3	3.0	7.7	0
Managers	2.4	0	1.8	4.3
Plumbers	2.1	3.7	1.3	0
Stationary engineers	0	3.8	1.9	0
All other occupations	28.8	20.0	7.2	18.2

¹30-month period January 1972-June 1974.

SOURCE: Bureau of Labor Statistics.

Appendix A. Data Collection and Methods of Adjustment

Current operations

For the current operations part of the study, data were required to identify all the goods and services purchased by the MBTA and the occupation and number of hours worked by each employee. For the most part, data on expenses were provided by the MBTA in the form of an accounts payable ledger detailing all expenses incurred in operating the transit system in 1974. Each of the approximately 46,000 items in this account was evaluated to determine if the item was supplied by an industry which could be classified into the Standard Industrial Classification (SIC). A majority of the expense items were purchases of goods and services and, as such, could be identified with a producing industry. In the remaining cases, each expense was classified in one of two ways.

The first classification constituted expenditures to other general ledger accounts such as payroll, payroll deductions, retirement funds, or social security. For the most part, these items could not be classified as purchases of goods and services and, with the exception of the payroll ledger, were not included in this study. The payroll account was treated separately and compared with data provided directly from the payroll department detailing the occupation and hours of each worker employed by the MBTA.

The second classification consisted of transfer payments from the MBTA to governments and individuals, and reserves held aside by the MBTA as investments. The transfer payments to governments were primarily for taxes levied by various State and local governmental units whereas transfer payments to individuals were primarily made in compensation for liability claims against the MBTA arising from injuries and damages suffered in work-related or transit-related accidents. These payments made up most of the \$3.2 million spent in 1974 for injuries and damage claims by private individuals and workers' compensation claims by MBTA employees. The remaining portions of these funds were identified as payments made directly to physicians, medical facilities, and attorneys involved in settlement of claims. This category of items was reclassified as a purchase of services and included in the total for purchases of goods and services.

Adjustment was made to the data to reflect changes in inventory. Given the diverse nature of the MBTA transit system, a large inventory of repair and replacement parts

must be maintained to accommodate repair needs. The identified expenditures for parts for various transit vehicles and related facilities do not reflect actual usage but rather replenishment of stocks or addition to inventory reserves. This study required that the actual usage of these items be reflected in expenditures. Therefore, a second ledger file detailing actual inventory usage was obtained from the MBTA and expenditure data were adjusted to reflect annual usage. In cases where inventories were drawn down, more expenditures for a given class of items are noted to reflect a usage greater than actual expenditures in that class. The opposite holds true in those cases where inventories were built up—actual expenditures were adjusted downwards.

Following the classification, all data were grouped, with those items identified as having labor input in one group and those items which had no effect or an indeterminate effect on labor in a second group. This latter group was excluded from further study, yielding a modified MBTA budget (table A-1).

With the exception of wage data, all expenditure data included in this portion of the study were classified into one of 134 input-output producing industries of the BLS interindustry model discussed in appendix B. The sum of all industry purchases forms a bill of goods specifying the

Table A-1. Direct operations budget, Massachusetts Bay Transportation Authority, 1974

Item	Amount
Total	\$193,244,785
Total: Items included in study	143,986,502
Wages and salaries	97,346,037
Accident and sickness insurance	504,392
Group life insurance	729,795
Blue Cross-Blue Shield	7,706,728
Materials, supplies, and services	14,507,221
Fuel	11,110,575
Railroad and rapid transit subsidies	12,040,187
Bank service charges	41,567
Total: Items excluded	49,258,283
MBTA pensions	11,839,299
Social security taxes	4,753,356
Workers' compensation	1,158,825
Unemployment insurance	115,000
Injuries and damages	1,515,448
Taxes	678,534
Interest and principal payments	29,179,045
Miscellaneous fixed costs	18,776

¹Adjusted total after removing identified services.

SOURCE: Based on information provided by Massachusetts Bay Transportation Authority

total purchases of goods and services by the MBTA in 1974. One final adjustment was made to convert the data in 1972 constant dollars for the purposes of comparability with the construction portion of this study and the BLS model. With these data, the model developed estimates of the indirect jobs created by MBTA purchases of goods and services.

Capital improvements

Direct employment information on MBTA capital improvements was collected from the contractors, who in most instances are required by the Davis-Bacon Act to keep detailed weekly records for on-site workers consisting of the names, occupations, and hours worked. This is required for all contractors and subcontractors working on buildings or works financed in whole or in part by loans or grants from the Federal Government. Under provisions of the act, contractors are required to submit weekly payroll statements to the agency contracting for or financing the work. The Davis-Bacon Act does not cover employees in white-collar occupations or immediate supervisors of blue-collar employees. The act applies only to actual construction contracts, and does not apply to architectural and engineering design contracts.

The MBTA supplied a listing of the 97 prime contractors who had worked on the MBTA capital projects during the 2 1/2-year period, January 1972-June 1974. These prime contractors provided the names of

Table A-2. Number of contracts for capital improvements within scope of survey and number studied, Massachusetts Bay Transportation Authority

Item	Total	Construction contracts	Architectural and engineering contracts
Total contracts in sample . . .	340	274	66
Less: Firms out of business	15	14	1
Refusals	15	15	0
Equals: Contracts studied	310	245	65
Prime contracts	97	55	42
Subcontracts	213	190	23

SOURCE: Bureau of Labor Statistics.

subcontractors who had worked on each of their projects. The final list contained 514 names, later reduced to 340 because many of the original number were found to have done no work during the period selected for study (table A-2). It was decided that only 66 of the architectural and engineering contracts, or about 50 percent, would be included in the survey. These contracts were arranged in rank order according to the amount of money spent during the survey period. All architectural and engineering contracts greater than \$30,000 were included in the sample, while only a portion of those less than \$30,000 were used although they were weighted to compensate for the partial sample.

For the 340 contracts forming the final sample, refusals totalled 15 or 4.4 percent of the total. A like number of firms were found to be out of business by the time of the survey in mid-1975. The overall response rate, then, was greater than 91 percent for the whole project. Architectural and engineering contracts had a 98.5-percent response rate, while the rate for construction contracts was slightly below 90 percent, reflecting both refusals and a greater number of firms having gone out of business.

The direct employment was determined by dividing the number of hours worked by the hours equivalent to 1 work-year for the occupations in the MBTA direct employment sector. The estimates were based on two sources:

- Estimates of average annual hours for selected construction crafts in three cities published in BLS Bulletin 1612, *Seasonality and Manpower in Construction*. Data for these occupations were also used for related or similar occupations where no data were available.
- Assumption of 2,080-hour standard work-year for all other occupations.

This approach provided employee-hour estimates roughly comparable to those used by BLS' Office of Productivity and Technology (in construction labor requirements studies) of 1,800 hours per employee for onsite construction; 2,000 for offsite construction; 2,053 for manufacturing; 1,803 for wholesale trade, transportation, and services; and 2,074 for mining and other industries.

Appendix B. Forms Used for Data Collection

BLS-3061
June 1975

U.S. DEPARTMENT OF LABOR
Bureau of Labor Statistics

Office of Management and
Budget No. 44-S75014
Approval Expires 12/31/75

INTERVIEW GUIDE
Employment Impact of Mass Transit
System Construction

Schedule A

Interview conducted at _____ Contract No. _____
(company)

(address)

with _____ Telephone _____
(name of respondent)

Date _____ Name of Interviewer _____

A. Introduction

This interview is being conducted as part of a study by the Bureau of Labor Statistics of the U. S. Department of Labor, with the permission and cooperation of the Massachusetts Bay Transportation Authority (MBTA). The study is intended to measure the number of jobs, by occupation, resulting from the construction of a mass transit system, and will provide information to manpower planners in areas where large expenditures are planned for mass transit construction.

A list of design and construction contracts and information on contract amounts and type of work involved has been furnished by the MBTA. For most construction contracts, data on employment of on-site blue-collar workers has been compiled from weekly payroll statements filed by the contractor as required under the Davis-Bacon Act. In this interview the respondent will be asked to verify the information and to furnish additional data on employment, and on purchases and other non-payroll costs associated with the contract. Cost information will be used to estimate the number of jobs created in industries producing the goods and services purchased.

All data and information obtained in this interview will be held in strict confidence by the Bureau of Labor Statistics, and any published information will not allow identification of individual contractors.

B. Site Information

1. What is the major activity of the respondent's establishment? Include the type of construction, good, or service produced, such as tunnel construction, landscape architecture.

SIC	1
-----	---

2. Contract Identification. All remaining questions pertain to work performed by the respondent under MBTA contract number _____.

- a. Was the respondent

	2
--	---

Code

- 1 - A prime contractor?
- 2 - A subcontractor? List name and address of prime contractor.

- 3 - A sub-subcontractor? List name and address of subcontractor.

- b. What type of work was performed by the respondent?

	3
--	---

Code

- 1 - Architectural and engineering services
- 2 - Construction
- 3 - Other (specify)

B. Site information, cont.

c. What was the duration of the contract?

Starting date (for prime contracts, the date of notice to proceed from MBTA).....

/	/	4
---	---	---

Completion date (for prime contractors, the date of acceptance by MBTA). For active contracts list the scheduled completion date.....

/	/	5
---	---	---

Duration of the contract in weeks.....

	6
--	---

d. What was the dollar amount of the contract?

For the total contract..... \$

	7
--	---

For work performed between January 1, 1972 and June 30, 1974?..... \$

	8
--	---

e. For construction contracts only

Was this work primarily

	9
--	---

Code

- 1 - New construction?
- 2 - Renovation, maintenance or repair?

Was the structure or facility constructed or renovated primarily for

	10
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Code

- 1 - Heavy rail system?
- 2 - Light rail system?
- 3 - Bus sytem?

Were the structures or facilities constructed or renovated primarily

	11
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Code

- 1 - Yards and shops?
- 2 - Stations?
- 3 - Surface rail lines ?
- 4 - Underground rail lines ?
- 5 - Elevated rail lines?
- 6 - Other? (describe)

B. Site Information, cont.

3. For prime contracts and sub-contracts only. Was any of the work subcontracted?

a. What was the total amount of all subcontracts?..... \$

12

b. List the names and addresses of the subcontractors, the dollar amounts of the subcontracts, and the type of work performed.

NOTE: Do not include contracts that involved only a purchase of goods or services. These should be included under item D.

Subcontract Number	Name and address of subcontractor	Type of work performed	Dollar amount of subcontract
01			\$
02			\$
03			\$
04			\$
05			\$
06			\$
07			\$
08			\$
09			\$
10			\$
TOTAL			\$

Continue on additional sheets if necessary.

Appendix C. Interindustry Employment Model and Industry-Occupational Matrix

This appendix describes the interindustry model and the national industry-occupational matrix. Specific methodologies used in the current operations and capital improvements parts of the study are covered in appendix A. The purpose of this appendix is to furnish the overall analytical framework for the studies.

Interindustry employment model

The interindustry employment model used contains 134 industry sectors. Each sector represents a group of industries classified by Standard Industrial Classification (SIC) codes as shown in table C-1. An interindustry model, in its most basic form, distributes the transaction value of the sales that each industry sector makes to itself, to each of the other industry sectors, and to final purchasers.

In an interindustry model, intermediate goods are sold to other industries where further fabrication occurs before a finished good is produced. Finished products are sold to the final demand or product sectors of the national income accounts—personal consumption expenditures, gross private domestic investment, net exports of goods and services, Federal Government purchases, and State and local government purchases. Intermediate sales provide the basic structure of an interindustry model while final sales, or final demand, represent the usual input to a model of this type.

Each of the 134 rows in the interindustry model shows the *sales* made by an industry to itself, to other industries, and to the final demand sectors. Each of the 134 columns shows an industry's *purchases* from each industry, including itself, which were required to produce its own output. The sum of all purchases in a column plus that industry's value added¹ is equal to the total value of production for that industry. When the purchases in a column are divided individually by the total production of that industry, they form ratios that define the amount of input required from each industry in order to produce a unit of output (usually stated in dollar terms) of the purchasing industry. For example, these ratios, or coefficients, would show how much the automobile

industry would have to buy from such industries as rubber, textiles, steel, aluminum, advertising business services, plastics, transportation, and trade in order to produce a unit value of output.

These purchases represent the requirements from the immediate or first tier of supplying industries. Each of these supplying industries would also require inputs in order to manufacture its product. The steel industry would need coal and iron ore to make steel. The coal and iron ore industries, in turn, would need fuel and other products and services to produce their outputs. Each final purchase would require a chain of purchases back through the more basic supplying industries. An interindustry model provides a way of solving simultaneously all of the interrelated requirements created in the economy by purchases of the various final demand sectors or programs.

The elements of this model can be transformed from production requirements to employment requirements by applying employment-output ratios to each industry's total output. The interindustry employment table which results from this process shows the total employment attributable to deliveries to final demand. Total employment generated by a given type of final demand using an interindustry model consists of the employment in the industry producing the final product or service and also the employment in all the supporting industries.

The interindustry table used here is expressed in terms of 1972 prices. Moreover, the transactions in 1972 dollars are in terms of producers' value and not purchasers' values. Producers' values are purchasers' values minus trade and transportation costs—put another way, producers' values are values stated at the site of production. The trade margins and transportation costs associated with all of the transactions appear as direct purchases from the trade and transportation industries. Use of this table, therefore, requires the conversion of purchases to 1972 producers' prices.

National industry-occupational matrix

The employment generated in each industry is disaggregated into occupations using the national industry-occupational employment matrix. This matrix is a table which presents for total U.S. employment the

¹The value added of a sector includes compensation of employees, depreciation, profits, and other payments to the factors of production.

percent distribution of 422 occupations in each of 201 industries. By applying an industry's occupational pattern to total employment in that industry, estimates are developed of the industry's employment by occupation. To arrive at total national requirements for each occupation, the estimates for all the industries are summed across each row in the table or matrix.

The current industry-occupational matrix is based primarily on data from the 1970 Census of Population, supplemented by data from other sources. These supplemental data include annual averages from the Current Population Survey (CPS) and:

- Employment estimates for teachers and librarians based on data collected by the Office of Education;
- Occupational employment data collected by regulatory agencies for regulated sectors such as railroads, airlines, and telephone and telegraph communications;
- Employment data collected by professional societies, especially for medical and health occupations;
- Federal Civil Service Commission statistics on employment by occupation in Federal Government agencies;
- Occupational employment information compiled by the Postal Service on its employees.

The 1970 matrix was used to prepare the 1972-74 occupational employment estimates since each industry's occupational structure changes slowly and is relatively stable over the short run.

A number of adjustments had to be made to the occupational matrix in order to use it in conjunction with the interindustry model system for the studies presented in this report, since the industry classifications differ in the two systems. The restructuring of the 201 industries in the occupational matrix to conform to the 134 indus-

tries in the interindustry model was accomplished by comparing the industries in terms of Standard Industrial Classification (SIC) codes and making necessary adjustments. While many of the industries in both models matched exactly by SIC code, there were various differences that had to be reconciled.

In some areas, there was greater industry detail in the occupational matrix than in the interindustry model. In these cases, the matrix industries were aggregated. Where the industry-occupational matrix industries were less detailed than those in the interindustry model, the employment of the matrix industry was distributed according to the proportion of its SIC content. Thus, if a matrix industry was composed of two SIC industries, the total employment of each SIC industry as found in *Employment and Earnings* (Bureau of Labor Statistics) was added together, then divided by the total to calculate a percent distribution for the matrix industry in terms of its SIC content. This distribution was used to adjust each cell of the matrix industry, and these adjusted cells were used to form the interindustry model sector or were added to corresponding adjusted cells from other matrix industries to form the input-output sector. For example, if an SIC industry was found to represent 30 percent of the total employment of a matrix industry, each cell of the matrix industry was multiplied by 30 percent to form the corresponding cell for the interindustry model sector or was added to similarly adjusted cells from other matrix industries to form the interindustry model sector's cell. These operations were performed on private wage and salary, self-employed, and unpaid family worker occupational cells for each industry. Government workers were placed in three input-output cells based on independent information.

Table C-1. Interindustry model sectoring plan

Sector number	Sector name	1963 Input-output number	SIC code ¹	Sector number	Sector name	1963 Input-output number	SIC code ¹
Agriculture, forestry, and fisheries:				Manufacturing — Continued			
1	Livestock and livestock products	1.01-1.03	01	32	Paperboard	25	265
2	Crops and other agricultural products	2.01-2.07	01	33	Publishing	26.01-26.04	271, 272, 273, and 274
3	Forestry and fisheries	3	0.74, 08, and 091	34	Printing	26.05-26.08	275, 276, 277, 278, and 279
4	Agriculture, forestry, and fishery services	4	071, 0723, pt. 0729, 073, 085, and 098	35	Chemical products	27.01 and 27.04	281, 286, and 289 (except 28195)
Mining:				36	Agricultural chemicals	27.02-27.03	287
5	Iron ore mining	5	101, 106	37	Plastic materials and synthetic rubber	28.01-28.02	2821, 2822
6	Copper ore mining	6.01	102	38	Synthetic fibers	28.03-28.04	2823, 2824
7	Other nonferrous metal ore mining	6.02	103-109, except 106	39	Drugs	29.01	283
8	Coal mining	7	11, 12	40	Cleaning and toilet preparations	29.02-29.03	284
9	Crude petroleum	8	1311, 1321, 138	41	Paint	30	285
10	Stone and clay mining and quarrying	9	141-145, 148, and 149	42	Petroleum products	31.01-31.03	29
11	Chemical and fertilizer mining	10	147	43	Rubber products	32.01-32.03	30 except 307
Construction:				44	Plastic products	32.04	307
12	New residential building construction (excludes equipment and land development costs)	11.01	} 15, 16, and 17	45	Leather, footwear, and leather products	33 and 34.01 34.03	31
13	New nonresidential building construction	11.02		46	Glass	35.01-35.02	321, 322, and 323
14	New public utilities construction	11.03		47	Cement, clay, and concrete products	36.01-36.05 and 36.10-36.14	324, 325, and 327
15	New highway construction	11.04		48	Miscellaneous stone and clay products	36.06-36.09 and 36.15-36.22	326, 328, and 329
16	All other new construction	11.05		49	Blast furnaces and basic steel products	37.01	331
17	Maintenance and repair construction	12.01-12.02	50	Iron and steel foundries, and forgings	37.02-37.04	332, 3391, and 3399	
Manufacturing:				51	Primary copper metals	38.01	3331
18	Guided missiles and space vehicles	13.01	1925	52	Primary aluminum	38.04	3334 and 28195
19	Other ordnance	13.02-13.07	19 except 1925	53	Other primary and secondary nonferrous metal	38.02-38.03, 38.05, and 38.06	3332, 3333, 3339, and 334
20	Food products	14.01-14.32	20	54	Copper rolling and drawing	38.07	3351
21	Tobacco manufacturing	15.01-15.02	21	55	Aluminum rolling and drawing	38.08	3352
22	Fabric, yarn, and thread mills	16.01-16.04	221, 222, 223, 224, 226 and 228	56	Other nonferrous rolling and drawing	38.09-38.10	3356 and 3357
23	Miscellaneous textiles and floor coverings	17.01-17.10	227 and 229	57	Miscellaneous nonferrous metal products	38.11-38.14	336 and 3392
24	Hosiery and knit goods	18.01-18.03	225	58	Metal containers	39.01-39.02	341 and 3491
25	Apparel	18.04	23 (except 239), 3992	59	Heating apparatus and plumbing fixtures	40.01-40.03	343
26	Miscellaneous fabricated textile products	19.01-19.03	239	60	Fabricated structural metal	40.04-40.09	344
27	Logging, sawmills, and planing mills	20.01-20.04	241 and 242	61	Screw machine products	41.04-41.02	345 and 346
28	Millwork, plywood, and other wood products	20.05-20.09 and 21	243, 244, and 249	62	Other fabricated metal products	42.01-42.11	342, 347, 348 and 349 except 3491
29	Household furniture	22.01-22.04	251	63	Engines, turbines, and generators	43.01-43.02	351
30	Other furniture	23.01-23.07	25 except 251	64	Farm machinery	44	352
31	Paper products	24.01-24.07	26 except 265				

See footnotes at end of table.

Table C-1. Interindustry model sectoring plan—Continued

Sector number	Sector name	1963 Input-output number	SIC code ¹	Sector number	Sector name	1963 Input-output number	SIC code ¹
Manufacturing—Continued				Transportation, communication and public utilities—Continued			
65	Construction, mining, and oilfield machinery	45.01-45.03	3531, 3532, and 3533	103	Water and sanitary services	68.03	494, 495, 496, 497, and part 493
66	Material handling equipment	46.01-46.04	3534, 3535, 3536, and 3537	Wholesale and retail trade:			
67	Metalworking machinery	47.01-47.04	354	104	Wholesale trade	69.01	50
68	Special industry machinery	48.01-48.06	355	105	Retail trade	69.02	52, 53, 54, 55, 56, 57, 58, and 59
69	General industrial machinery	49.01-49.07	356	Finance, insurance and real estate:			
70	Machine shop products	50	359	106	Finance	70.01-70.03	60, 61, 62, and 67
71	Computers and peripheral equipment	51.01	3573, 3574	107	Insurance	70.04-70.05	63 and 64
72	Typewriters and other office machines	51.02-51.04	357, except 3573 and 3574	108	Owner-occupied dwellings	70.01	(2)
73	Service industry machines	52.01-52.05	358	109	Other real estate	71.02	65 and 66
74	Electric transmission equipment	53.01-53.03	361	Services:			
75	Electrical industrial apparatus	53.04-53.08	362	110	Hotels and lodging places	72.01	70
76	Household appliances	54.01-54.07	363	111	Other personal services	72.02-72.03	72 and 76
77	Electric lighting and wiring	55.01-55.03	364	112	Miscellaneous business services	73.01	73 except 731
78	Radio and television sets	56.01-56.02	365	113	Advertising	73.02	731
79	Telephone and telegraph apparatus	56.03	3661	114	Miscellaneous professional services	73.03 and 74	81 and 89 except 892, nonprofit research
80	Other electronic communication equipment	56.04	3662	115	Automobile repair	75	75
81	Electronic components	57.01-57.03	367	116	Motion pictures	76.01	78
82	Other electrical machinery	58.01-58.05	369	117	Other amusements	76.02	79
83	Motor vehicles	59.01-59.03	371	118	Health services except hospitals	77.01 and 77.03	80 (except 806), 0722
84	Aircraft	60.01-60.04	372	119	Hospitals	77.02	806
85	Ship and boat building and repair	61.01-61.02	373	120	Educational services	77.04	82
86	Railroad and other transportation equipment	61.03-61.05	374 and 375	121	Nonprofit organizations	77.05	84, 86, and 892
87	Transportation equipment	61.06-61.07	379	Government enterprises:			
88	Scientific and controlling instruments	62.01-62.03 and 62.07	381, 382, and 387	122	Post Office	78.01	(2)
89	Medical and dental instruments	62.04-62.06	384	123	Commodity Credit Corporation	78.03	(2)
90	Optical and ophthalmic equipment	63.01-63.02	383 and 385	124	Other Federal enterprises	78.02 and 78.04	(2)
91	Photographic and equipment and supplies	63.03	386	125	State and local government enterprises	79.01-79.03	(2)
92	Miscellaneous manufactured products	64.01-64.12	39 (except 3992)	Imports:			
Transportation, communication, and public utilities:				126	Directly allocated imports	80.01	(2)
93	Railroad transportation	65.01	40 and 474	127	Transferred imports	80.02	(2)
94	Local transit and intercity bus	65.02	41	Dummy industries:			
95	Truck transportation	65.03	42 and 473	128	Business travel, entertainment, and gifts	81	(2)
96	Water transportation	65.04	44	129	Office supplies	82	(2)
97	Air transportation	65.05	45	130	Scrap, used and secondhand goods	83	(2)
98	Other transportation	65.06-65.07	46, 47 (except 473 and 474)	Special industries:			
99	Communications, except radio and TV	66	48 except 483	131	Government industry	84	(2)
100	Radio and TV broadcasting	67	483	132	Rest of the world industry	85	(2)
101	Electric utilities	68.01	491 and part 493	133	Households	86	(2)
102	Gas utilities	68.02	492 and part 493	134	Inventory valuation adjustment	87	(2)

¹ Standard Industrial Classification Manual, 1967 edition, Bureau of the Budget (now Office of Management and Budget).

² No comparable industry.

Appendix D. Detailed Tables

Table D-1. Current operations: Purchases of goods and services and indirect employment by industry, Massachusetts Bay Transportation Authority, 1974

Industry	Purchases					Indirect employment ¹				
	Transit services	Main-tenance	General overhead	Total, with rail subsidy	Total, without rail subsidy	Transit services	Main-tenance	General over-head	Total, with rail subsidy	Total, without rail subsidy
Total	\$6,286,942	\$6,121,486	\$20,685,248	\$33,093,600	\$22,448,080	53.51	62.56	205.84	321.90	228.14
Livestock and livestock products	0	0	0	0	0	.14	.14	.25	.53	.43
Crops and other agricultural products	0	0	15	15	15	.27	.27	.41	.95	.80
Forestry and fisheries	0	0	0	0	0	.02	.10	.05	.17	.14
Agriculture, forestry, and fishery services	0	12,249	0	12,249	12,249	.12	.33	.11	.56	.51
Iron ore mining	0	0	0	0	0	.01	.08	.03	.12	.10
Copper ore mining	0	0	0	0	0	.02	.14	.03	.19	.17
Other nonferrous metal ore mining	0	0	0	0	0	.01	.06	.02	.09	.08
Coal mining	0	0	0	0	0	.65	.23	.47	1.34	1.20
Crude petroleum	0	0	0	0	0	5.04	.54	.89	6.47	5.93
Stone and clay mining and quarrying	0	14,599	0	14,599	14,599	.14	.19	.13	.46	.36
Chemical and fertilizer mining	0	41,885	0	41,885	41,885	.01	.12	.01	.14	.14
New residential buildings	0	0	0	0	0	0	0	0	0	0
New nonresidential buildings	0	244,167	1,612	245,779	245,779	0	1.19	.01	1.20	1.20
New public utilities	0	0	0	0	0	0	0	0	0	0
New streets and highways	0	0	0	0	0	0	0	0	0	0
All other new construction	0	0	0	0	0	0	0	0	0	0
Maintenance and repair	0	0	0	0	0	2.14	.74	9.27	12.14	4.06
Guided missiles and space vehicles	0	0	0	0	0	.01	.01	.01	.02	.02
Other ordnance	0	0	0	0	0	0	.02	.01	.03	.03
Food products	0	58	20	78	78	.14	.12	.27	.53	.43
Tobacco manufacturing	0	0	0	0	0	0	0	0	.01	0
Fabric, yarn, and thread mills	0	0	256	256	256	.38	.17	.14	.70	.67
Miscellaneous textiles and floor coverings	0	486	0	486	486	.03	.07	.06	.16	.14
Hosiery, knit goods	0	0	161	161	161	.15	.02	.01	.18	.18
Apparel	167,025	427	182	167,634	167,634	1.39	.09	.07	1.54	1.51
Miscellaneous fabricated textile products	74	257	39	371	371	.03	.10	.03	.16	.15
Logging, sawmills, and planing mills	0	140,818	201	141,019	141,019	.15	1.01	.43	1.59	1.33
Millwork, plywood, and other wood products	0	3,929	0	3,929	3,929	.10	.29	.21	.59	.46
Household furniture	0	0	0	0	0	.01	.03	.01	.05	.04
Other furniture	0	10,056	2,722	12,777	12,777	.01	.10	.04	.15	.14
Paper products	3,235	1,644	13,255	18,134	18,134	.32	.26	.82	1.39	1.24
Paperboard	0	0	1,019	1,019	1,019	.12	.16	.15	.43	.38
Publishing	46	1,697	8,085	9,828	9,828	.39	.30	1.41	2.10	1.90
Printing	31,519	1,368	89,387	122,273	122,273	.78	.42	3.19	4.40	3.91
Chemical products	0	30,692	5,700	36,392	36,392	.55	.51	.48	1.54	1.33
Agricultural chemicals	0	0	0	0	0	.02	.01	.02	.05	.04
Plastic materials and synthetic rubber	0	7,221	0	7,221	7,221	.05	.18	.15	.38	.33
Synthetic fibers	0	0	0	0	0	.04	.03	.03	.10	.10
Drugs	0	9	4,166	4,175	4,175	.01	.01	.05	.07	.07
Cleaning and toilet preparations	1,677	26,623	1,078	29,378	29,378	.03	.06	.02	.11	.10
Paint	0	32,666	223	32,889	32,889	.05	.16	.36	.36	.24
Petroleum products	3,348,118	260,608	91,393	3,700,120	3,700,120	3.55	.36	.56	4.47	4.10
Rubber products	40	21,374	147,446	168,859	168,859	.08	.35	.89	1.33	1.23
Plastic products	3,087	38	0	3,126	3,126	.11	.41	.30	.82	.68
Leather, footwear, and leather products	0	103	0	103	103	.03	.05	.05	.12	.10
Glass	0	85,782	0	85,782	85,782	.03	.60	.10	.74	.67
Cement, clay, and concrete products	0	63,263	70	63,333	63,333	.14	.51	.16	.80	.69
Miscellaneous stone and clay products	1,014	3,270	318	4,630	4,630	.13	.24	.16	.53	.43
Blast furnaces and basic steel products	0	182,903	18	182,920	182,920	.19	1.98	.59	2.76	2.29
Iron and steel foundries and forgings	0	114,197	4	114,201	114,201	.06	1.25	1.04	2.34	1.35
Primary copper metals	0	0	0	0	0	.01	.07	.01	.09	.08
Primary aluminum	0	0	0	0	0	.01	.09	.02	.13	.11
Other primary and secondary nonferrous metal products	0	0	0	0	0	.02	.15	.04	.21	.18

See footnote at end of table.

Table D-1. Current operations: Purchases of goods and services and indirect employment by industry, Massachusetts Bay Transportation Authority, 1974—Continued

Industry	Purchases					Indirect employment ¹				
	Transit services	Maintenance	General overhead	Total, with rail subsidy	Total, without rail subsidy	Transit services	Maintenance	General overhead	Total, with rail subsidy	Total, without rail subsidy
Copper rolling and drawing	0	\$3,426	\$ 2	\$ 3,429	\$ 3,429	0.01	0.14	0.03	0.18	0.16
Aluminum rolling and drawing	0	0	0	0	0	.02	.20	.04	.27	.24
Other nonferrous rolling and drawing	0	197,416	71	197,487	197,487	.05	.70	.07	.82	.77
Miscellaneous non-ferrous metal products	\$ 312	19,261	166	19,739	19,739	.02	.2	.09	.39	.32
Metal containers	0	23	0	23	23	.11	.04	.05	.20	.17
Heating apparatus and plumbing fixtures	0	10,066	6	10,072	10,072	.02	.09	.06	.16	.11
Fabricated structural metal	0	353,935	48	353,982	353,982	.14	2.36	.21	2.71	2.55
Screw machine products	0	16,271	188	16,459	16,459	.06	.70	.21	.98	.85
Other fabricated metal products	3,944	185,579	1,647	191,169	191,169	.15	1.52	.66	2.32	1.79
Engines, turbines, and generators	0	14,888	199	15,087	15,087	.04	.20	.21	.45	.27
Farm machinery	0	0	0	0	0	0	.02	.01	.03	.03
Construction, mining and oil field machinery	0	24,933	0	24,933	24,933	.06	.23	.07	.36	.31
Material handling equipment	0	216,609	0	216,609	216,609	.02	1.01	.04	1.07	1.04
Metalworking machinery	0	39,439	24	39,463	39,463	.04	.68	.29	1.02	.77
Special industry machinery	0	834	252	1,086	1,086	.03	.09	.06	.19	.16
General industrial machinery	0	83,581	5,632	89,213	89,213	.08	.90	.23	1.20	1.04
Machine shop products	0	21,413	56	21,469	21,469	.08	1.00	.32	1.39	1.17
Computers and peripheral equipment	204	33	94,439	94,676	94,676	.02	.03	.58	.64	.62
Typewriters and other office machines	1,897	3,268	47,431	52,596	52,596	.02	.04	.23	.28	.27
Service industry machines	284	3,324	153	3,760	3,760	.02	.14	.07	.23	.18
Electric transmission equipment	0	171,845	0	171,845	171,845	.05	1.65	.21	1.91	1.76
Electrical industrial apparatus	0	315,090	19,780	334,869	334,869	.15	2.53	.41	3.08	2.88
Household appliances	771	29,900	376	31,046	31,046	.01	.17	.03	.21	.20
Electric lighting and wiring	0	99,049	299	99,348	99,348	.07	.76	.22	1.04	.89
Radio and television sets	43	5	25	73	73	0	.03	.02	.05	.04
Telephone and telegraph apparatus	0	390	0	390	390	.02	.05	.11	.18	.16
Other electronic communication equipment	21,337	30,662	6,597	58,596	58,596	.11	.22	.07	.40	.38
Electronic components	0	715	3,444	4,159	4,159	.09	.40	.30	.79	.68
Other electrical machinery	983	253,572	1,186	255,741	255,741	.03	1.26	.19	1.48	1.34
Motor vehicles	1,240	804,164	621	806,025	806,025	.01	2.14	.03	2.17	2.16
Aircraft	100	0	0	100	100	.05	.13	.12	.30	.24
Ship and boat building and repair	0	0	0	0	0	.07	.12	.04	.23	.20
Railroad and other transportation equipment	0	351,770	711	352,481	352,481	.01	1.55	.22	1.78	1.57
Miscellaneous transportation equipment	0	0	0	0	0	0	.01	0	.01	.01
Scientific and controlling instruments	0	8,791	1,822	10,612	10,612	.03	.29	.09	.42	.37
Medical and dental instruments	349	1,673	4,964	6,986	6,986	.01	.03	.08	.12	.11
Optical and ophthalmic equipment	12	22	1	35	35	0	.02	.01	.04	.04
Photographic equipment and supplies	445	72	4,186	4,703	4,703	.04	.05	.18	.27	.24
Miscellaneous manufactured products	274	10,080	1,808	12,162	12,162	.10	.19	.31	.61	.52
Railroad transportation	45,160	58,504	10,649,008	10,752,671	107,055	.73	.80	61.41	62.94	1.87
Local transit and intercity bus	0	0	193	193	193	.08	.09	.62	.80	.37
Truck transportation	48,204	70,001	215,936	334,140	334,140	1.19	1.47	2.75	5.41	4.69

See footnote at end of table.

Table D-1. Current operations: Purchases of goods and services and indirect employment by industry, Massachusetts Bay Transportation Authority, 1974—Continued

Industry	Purchases					Indirect employment ¹				
	Transit services	Main-tenance	General overhead	Total, with rail subsidy	Total, without rail subsidy	Transit services	Main-tenance	General over-head	Total, with rail subsidy	Total, without rail subsidy
Water transportation ..	\$65,731	\$9,066	\$ 1,875	\$ 76,673	\$ 76,673	0.45	0.09	0.11	0.66	0.58
Air transportation	88	1,941	627	2,655	2,655	.16	.20	.79	1.14	.74
Other transportation ..	38,199	8,387	8,782	55,369	55,369	1.05	.17	.94	2.16	1.36
Communications, except radio and TV.	155	6,173	341,508	347,835	347,835	.39	.44	3.98	4.81	4.07
Radio and TV broadcasting	0	0	0	0	0	.12	.09	.41	.63	.57
Electric utilities	1,414,757	119	545,668	1,960,544	1,960,544	4.61	.30	2.38	7.29	7.06
Gas utilities	0	0	33,982	33,982	33,982	.37	.13	.38	.89	.79
Water and sanitary services	3,292	99,406	54,392	157,090	157,090	.05	.23	.29	.58	.46
Wholesale trade	879,216	441,051	80,806	1,401,073	1,401,073	9.37	5.78	3.99	19.13	17.31
Retail trade	184,485	169,429	83,103	437,016	437,016	5.08	4.42	5.24	14.74	13.29
Finance	0	3,487	45,655	49,142	49,142	1.42	.84	4.68	6.94	5.51
Insurance	0	0	6,864,111	6,864,111	6,864,111	.64	.48	54.65	55.78	55.27
Owner-occupied dwellings	0	0	0	0	0	0	0	0	0	0
Other real estate	0	108,839	0	108,839	108,839	1.18	.62	1.86	3.66	2.92
Hotels and lodging places	0	0	3,389	3,389	3,389	.25	.24	.74	1.23	1.05
Other personal services	9,120	118,368	65,433	192,921	192,921	.29	2.55	1.69	4.52	4.34
Miscellaneous business services	3,045	96,222	128,013	227,280	227,280	2.32	2.59	7.84	2.75	10.43
Advertising	0	0	189,610	189,610	189,610	.13	.09	.42	.64	.58
Miscellaneous professional services ...	251	227,196	301,504	528,951	528,951	.83	2.27	5.53	8.63	7.46
Automobile repair	0	109,617	164,804	274,421	274,421	.26	.73	1.22	2.21	2.00
Motion pictures	0	0	0	0	0	.09	.07	.29	.45	.40
Other amusements	0	0	0	0	0	.08	.06	.21	.35	.30
Health services except hospitals ...	0	0	44,953	44,953	44,953	.07	.05	3.49	3.62	3.56
Hospitals	0	0	206,639	206,639	206,639	.02	.01	3.33	3.36	3.35
Educational services ..	833	4,572	8,376	13,781	13,781	.04	.09	.30	.43	.38
Nonprofit organizations	597	6,469	29,817	36,883	36,883	.15	.24	2.09	2.48	1.96
Post Office	0	0	22,044	22,044	22,044	.46	.39	2.21	3.06	2.53
Commodity Credit Corporation	0	0	0	0	0	0	0	0	0	0
Other Federal enterprises	4	0	171	176	176	.42	.06	.39	.87	.70
State and local government enterprises ...	27	2,382	11,086	13,495	13,495	1.68	.70	2.04	4.41	3.84
Directly allocated imports	0	0	0	0	0	0	0	0	0	0
Transferred imports ..	0	0	0	0	0	0	0	0	0	0
Business travel, entertainment, and gifts	0	0	0	0	0	0	0	0	0	0
Office supplies	5,721	5,769	20,410	31,900	31,900	0	0	0	0	0

¹Employment numbers are not rounded to preserve detail at industry level. SOURCE: Bureau of Labor Statistics.

Table D-2. Capital improvements: Purchases of goods and services by industry, Massachusetts Bay Transportation Authority, 1972-74

Industry	1972 ¹		1973 ¹		1974 ²	
	Construction contracts	Architectural and engineering contracts	Construction contracts	Architectural and engineering contracts	Construction contracts	Architectural and engineering contracts
Total	\$6,776,004	\$525,617	\$14,293,323	\$735,495	\$10,286,588	\$345,633
Livestock and livestock products	0	0	0	0	0	0
Crops and other agricultural products	0	0	3,112	0	3,075	12
Forestry and fisheries	0	0	0	0	0	0
Agriculture, forestry, and fishery services	0	0	0	0	0	0
Iron ore mining	0	0	0	0	0	0
Copper ore mining	0	0	0	0	0	0
Other nonferrous metal ore mining	0	0	0	0	0	0
Coal mining	0	0	0	0	0	0
Crude petroleum	0	0	0	0	0	0
Stone and clay mining and quarrying	191,950	0	537,886	0	210,043	0
Chemical and fertilizer mining	0	0	0	0	0	0
New residential buildings	0	0	0	0	0	0
New nonresidential buildings	586,522	0	765,692	0	600,837	0
New public utilities	0	0	0	0	0	0
New streets and highways	0	0	0	0	0	0
All other new construction	0	0	0	0	0	0
Maintenance and repair	0	0	0	0	0	0
Guided missiles and space vehicles	0	0	0	0	0	0
Other ordnance	0	0	0	0	0	0
Food products	372	0	92	0	0	0
Tobacco manufacturing	0	0	0	0	0	0
Fabric, yarn, and thread mills	482	0	3,744	0	231	0
Miscellaneous textiles and floor coverings	506	0	482	0	13,549	0
Hosiery, knit goods	0	0	0	0	0	0
Apparel	0	24	0	65	62	0
Miscellaneous fabricated textile products	29	18	160	50	1,566	0
Logging, sawmills, and planing mills	115,340	0	280,547	0	339,365	0
Millwork, plywood, and other wood products	144,821	42	157,991	96	89,364	0
Household furniture	0	0	0	0	0	0
Other furniture	320	0	11,540	172	5,095	133
Paper products	1,477	8,188	6,312	11,253	1,400	3,781
Paperboard	6	0	19	0	0	0
Publishing	0	16	0	23	0	0
Printing	19	1,817	0	4,262	0	155
Chemical products	29,418	32	28,235	383	4,335	0
Agricultural chemicals	0	0	3,331	0	2,571	0
Plastic materials and synthetic rubber	0	0	1,182	0	412	0
Synthetic fibers	178	0	102	0	0	0
Drugs	0	0	2,689	0	0	0
Cleaning and toilet preparations	43	0	517	0	729	0
Paint	5,370	36	22,103	97	14,509	0
Petroleum products	73,960	12	80,097	27	19,650	0
Rubber products	1,307	0	31,453	0	28,081	0
Plastic products	51,395	0	67,167	0	9,402	0
Leather, footwear, and leather products	0	21	422	55	207	0
Glass	3,478	44	9,069	83	4,306	0
Cement, clay, and concrete products	624,145	0	1,146,943	0	412,603	0
Miscellaneous stone and clay products	52,732	408	244,780	455	688,646	0
Blast furnaces and basic steel products	921,591	803	1,888,199	0	1,859,139	0
Iron and steel foundries and forgings	48,058	0	75,372	0	19,476	0
Primary copper metals	0	0	0	0	0	0
Primary aluminum	0	0	0	0	0	0
Other primary and secondary nonferrous metal products	8	0	6	0	2	0
Copper rolling and drawing	5,530	0	27,917	0	34,768	0
Aluminum rolling and drawing	97	0	1,555	0	609	0
Other nonferrous rolling and drawing	21,446	0	590,845	0	468,301	0
Miscellaneous nonferrous metal products	0	0	0	0	0	0
Metal containers	0	0	0	0	0	0
Heating apparatus and plumbing fixtures	44,634	0	174,240	0	122,200	0
Fabricated structural metal	640,362	2,967	917,850	8,217	395,022	0

See footnotes at end of table.

Table D-2. Capital improvements: Purchases of goods and services by industry, Massachusetts Bay Transportation Authority, 1972-74—Continued

Industry	1972 ¹		1973 ¹		1974 ²	
	Construction contracts	Architectural and engineering contracts	Construction contracts	Architectural and engineering contracts	Construction contracts	Architectural and engineering contracts
Screw machine products	\$ 6,809	0	\$ 38,750	\$ 107	\$ 23,419	0
Other fabricated metal products	218,326	71	288,734	85	177,479	0
Engines, turbines, and generators	0	0	94	0	0	0
Farm machinery	259	0	3,472	0	5,452	0
Construction, mining, and oil field machinery	221,408	\$3,680	462,305	915	295,989	0
Material handling equipment	8,216	0	68,444	0	144,599	0
Metalworking machinery	24,696	12	57,787	32	51,692	0
Special industry machinery	16,320	12	11,702	31	0	0
General industrial machinery	20,855	613	161,484	0	99,136	0
Machine shop products	0	0	0	680	0	\$1,001
Computers and peripheral equipment	486	84	675	3,299	1,277	643
Typewriters and other office machines	22,398	2,600	46,254	3,601	29,855	796
Service industry machines	4,137	0	22,306	0	8,681	0
Electric transmission equipment	490,305	2,165	604,790	1,079	320,011	1,703
Electrical industrial apparatus	35,703	462	90,491	1,227	64,923	25
Household appliances	385	0	5,312	0	1,119	0
Electric lighting and wiring	20,316	387	355,823	181	392,265	35
Radio and television set	0	0	77,711	0	9,490	0
Telephone and telegraph apparatus	0	0	103,059	0	78,030	0
Other electronic communication equipment	99,292	0	653,471	122	430,935	175
Electronic components	27	0	26	1,616	12	2,423
Other electrical machinery	34,975	1	64,667	2	7,830	0
Motor vehicles	61,426	2,251	125,361	1,833	73,064	0
Aircraft	0	0	0	0	0	0
Ship and boat building repair	0	0	0	0	0	0
Railroad and other transportation equipment	4,587	0	8,105	0	3,720	0
Miscellaneous transportation equipment	501	0	1,166	0	336	0
Scientific and controlling instruments	5,245	377	7,776	522	4,148	688
Medical and dental instruments	0	0	0	0	0	0
Optical and ophthalmic equipment	0	0	0	0	25	0
Photographic equipment and supplies	0	19	0	106	0	247
Miscellaneous manufactured products	51,098	24,750	115,148	33,959	80,359	14,559
Railroad transportation	106,268	614	240,464	802	170,819	262
Local transit and intercity bus	45,379	28,129	97,203	42,951	88,874	25,548
Truck transportation	172,152	807	451,146	1,280	286,987	554
Water transportation	9,613	12	20,654	17	10,582	4
Air transportation	7,504	43,617	5,203	52,459	2,856	18,581
Other transportation	39,872	850	75,746	1,475	52,251	618
Communications, except radio and TV	55,957	22,641	115,577	33,312	86,501	15,888
Radio and TV broadcasting	0	0	0	0	0	0
Electric utilities	5,121	4,901	11,463	6,459	5,984	2,356
Gas utilities	105	0	127	134	81	32
Water and sanitary services	60	1,669	412	1,673	2,263	819
Wholesale trade	263,879	5,752	572,450	8,157	418,369	2,997
Retail trade	72,728	7,732	157,026	10,265	121,008	4,399
Finance	301	132	0	1,374	13	1,488
Insurance	177,823	66,259	351,110	103,467	247,317	47,475
Owner-occupied dwellings	0	0	0	0	0	0
Other real estate	84,336	74,387	157,246	115,341	110,290	56,839
Hotels and lodging places	1,789	1,174	1,145	959	600	720
Other personal services	53	75	2,517	127	2,807	52
Miscellaneous business services	380,710	114,058	903,102	154,987	698,252	76,620
Advertising	864	223	2,015	371	5,492	138
Miscellaneous professional services	51,190	95,472	90,453	117,686	65,362	60,023
Automobile repair	325,269	1,779	452,195	1,814	165,294	728
Motion pictures	0	0	0	0	0	0
Other amusements	0	0	0	0	0	0
Health services except hospitals	0	0	0	0	0	0
Hospitals	0	0	0	0	0	0
Educational services	0	6	11	6	116	2
Nonprofit organizations	61,202	3,005	127,679	5,131	87,795	3,006
Post Office	0	411	634	613	2,640	108
Commodity Credit Corporation	0	0	0	0	0	0
Other Federal enterprises	376	0	0	0	0	0
State and local government enterprises	87	0	1,241	0	634	0
Directly allocated imports	0	0	0	0	0	0
Transferred imports	0	0	0	0	0	0
Business travel, entertainment, and gifts	0	0	0	0	0	0
Office supplies	0	0	0	0	0	0

¹All contracts for calendar year.

SOURCE: Bureau of Labor Statistics.

²All contracts for 6 months, January 1 to June 30.

Table D-3. Capital improvements: Direct employment by occupation, Massachusetts Bay Transportation Authority, 1972-74

Occupation	Construction contracts				Architectural and engineering contracts			
	Total ¹	1972 ²	1973 ³	1974 ³	Total ¹	1972 ²	1973 ²	1974 ³
Total	1,618.28	350.52	767.45	506.31	264.03	82.24	120.56	61.24
Accountants	13.11	3.00	5.79	4.32	1.98	.62	.99	.46
Architects	3.75	.71	1.72	1.32	13.53	4.65	6.02	2.86
Computer systems analysts	---	---	---	---	12	.05	.05	.02
Engineers, civil	36.68	8.25	17.73	10.70	76.94	23.21	33.33	20.40
Engineers, electrical	62.43	11.29	28.75	22.39	10.67	2.94	5.01	2.72
Engineers, industrial	---	---	---	---	2.63	1.27	1.02	.34
Engineers, mechanical .....	.16	.01	.10	.05	.91	.01	.47	.44
Sales engineers .....	.01	0	.01	0	---	---	---	---
Engineers, other	9.52	2.90	3.99	2.63	3.45	.90	1.69	.86
Lawyers .....	.12	0	.06	.06	.09	.04	.05	0
Statisticians	---	---	---	---	.22	.10	.11	.01
Geologists .....	.11	.06	.04	0	.47	.07	.24	.16
Life, physical scientists	---	---	---	---	.14	.14	0	0
Personnel, labor relations .....	.05	.03	.02	0	1.02	.31	.47	.24
Economists	---	---	---	---	.15	0	0	.15
Urban and regional planners	---	---	---	---	5.49	1.99	3.37	.13
Drafters	49.07	8.07	22.27	18.73	47.51	16.34	20.03	11.12
Electrical, electronics technicians .....	.71	.02	.31	.38	.26	.09	.06	.11
Industrial engineering technicians	---	---	---	---	.07	0	.07	0
Mechanical engineering technicians .....	.39	.39	0	0	.09	0	.04	.06
Surveyors	7.24	1.65	3.58	2.01	.90	.12	.50	.28
Engineering, science technicians	1.91	.79	.93	.20	11.78	3.56	5.28	2.94
Designers .....	.42	.01	.04	.38	8.95	1.08	4.68	3.18
Painters and sculptors	---	---	---	---	.01	0	0	.01
Public relations workers and writers	---	---	---	---	.29	.14	.14	.01
Research workers	---	---	---	---	.59	.19	.39	.01
Purchasing agents, buyers .....	.35	0	.17	.18	11.98	3.54	6.13	2.31
Railroad conductors .....	.01	0	0	0	---	---	---	---
Other managers, administrators	61.65	15.00	26.55	20.10	---	---	---	---
Sales personnel .....	.35	.02	.27	.06	.11	.02	.06	.04
Billing clerks .....	.06	0	0	.06	---	---	---	---
Bookkeepers	1.80	.81	.81	.18	6.41	2.52	2.85	1.04
Clerical supervisors .....	.44	0	.09	.36	.42	0	.42	0
Enumerators and interviewers	---	---	---	---	---	---	---	---
Estimators, investigators	5.17	.87	2.58	1.72	3.28	1.01	1.50	.78
Expeditors, production controllers .....	.03	.03	0	0	---	---	---	---
Bookkeeping, billing operators	6.05	1.84	2.54	1.68	0	0	0	0
Computer, peripheral equipment operators	2.97	.54	1.28	1.15	.13	.05	.05	.03
Duplicating machine operators	0	0	0	0	---	---	---	---
Other office machine operators	3.37	.74	1.49	1.14	.01	.01	0	0
Payroll, timekeeping clerks	59.76	11.50	26.58	21.69	.18	.08	.11	0
Legal secretaries	---	---	---	---	.05	.05	0	0
Secretaries, other	27.34	5.09	13.15	9.10	11.34	4.13	5.13	2.09
Statistical clerks	---	---	---	---	.48	0	.48	0
Stenographers	1.68	1.05	.57	.06	.30	.11	.12	.07
Stock clerks, storekeepers .....	.02	.01	.01	0	---	---	---	---
Telephone operators .....	.03	0	.02	0	---	---	---	---
Typists	0	0	0	0	.02	.01	.01	0
Miscellaneous clerical workers	7.18	2.08	3.41	1.70	10.80	3.16	5.12	2.52
Clerical, not specified	8.58	3.22	3.37	1.99	15.30	4.22	7.48	3.60
Brickmasons and stonemasons	13.73	3.15	5.99	4.58	---	---	---	---
Brick and stonemason apprentices .....	.29	.08	.08	.13	---	---	---	---
Bulldozer operators	8.14	2.86	4.00	1.28	---	---	---	---

See footnotes at end of table.

Table D-3. Capital improvements: Direct employment by occupation, Massachusetts Bay Transportation Authority, 1972-74—Continued

Occupation	Construction contracts				Architectural and engineering contracts			
	Total ¹	1972 ²	1973 ²	1974 ³	Total ¹	1972 ²	1973 ²	1974 ³
Carpenters	124.45	25.64	58.92	39.89	----	----	----	----
Carpenters' apprentices	3.71	0.70	2.10	0.90	----	----	----	----
Cement and concrete finishers	10.40	2.08	6.01	2.31	----	----	----	----
Crane, derrick, hoist operators	13.89	3.19	6.00	4.70	----	----	----	----
Electricians	125.14	18.50	68.82	37.82	----	----	----	----
Electrical apprentices	21.15	3.25	13.54	4.36	----	----	----	----
Electric power line installers and repairers	10.99	.05	5.80	5.14	----	----	----	----
Excavating, grading machine operators	46.37	16.81	19.94	9.61	----	----	----	----
Floor layers, except tile setters	3.16	1.11	1.36	.69	----	----	----	----
Blue-collar worker supervisors	178.16	35.58	85.79	56.79	0.22	0.03	0.19	0.01
Glaziers	2.05	.13	1.33	.59	----	----	----	----
Inspectors, other	.28	.26	.01	.01	1.56	0	.78	.78
Locomotive engineers	.01	0	0	0	----	----	----	----
Air conditioning, heating, and refrigeration mechanics	.09	0	0	0	----	----	----	----
Automobile mechanics and apprentices	.09	.06	.03	0	----	----	----	----
Heavy equipment mechanics including diesel	10.43	3.02	4.09	3.33	----	----	----	----
Household appliance mechanics	2.49	2.03	.46	0	----	----	----	----
Rail carshop mechanics	1.19	.48	.48	.24	----	----	----	----
Mechanical apprentices	.02	.01	.01	0	----	----	----	----
Other mechanics and repairers	.47	.01	.17	.29	9.60	3.88	4.26	1.47
Mechanics not specified	.18	.07	.07	.04	----	----	----	----
Millwrights	.50	.05	.29	.16	----	----	----	----
Painters, construction and maintenance	10.34	1.13	6.00	3.22	----	----	----	----
Painters' apprentices	.46	0	.31	.15	----	----	----	----
Plasterers	.17	.07	.10	0	----	----	----	----
Plumbers and pipefitters	30.23	4.53	14.86	10.85	----	----	----	----
Plumbers' apprentices	5.67	.69	3.59	2.39	----	----	----	----
Roofers and slaters	5.35	.91	2.59	1.85	----	----	----	----
Sheetmetal workers, tinsmiths	4.88	1.00	2.26	1.62	----	----	----	----
Sheetmetal apprentices	.53	.48	.01	.04	----	----	----	----
Sign painters and letterers	.14	.13	.01	0	----	----	----	----
Stationary engineers	29.77	6.14	14.20	9.43	----	----	----	----
Structural metal workers	78.63	13.76	40.12	24.74	----	----	----	----
Telephone installers, repairers	.25	.25	0	0	----	----	----	----
Telephone installers, spicers	.04	.01	.01	.01	----	----	----	----
Tilesetters	.32	0	.25	.07	----	----	----	----
Craft apprentices	8.42	.51	4.76	3.14	----	----	----	----
Craft and kindred workers	.07	.04	.03	0	----	----	----	----
Asbestos, insulation workers	3.43	0	2.96	.47	----	----	----	----
Assemblers	.28	.01	.18	.09	----	----	----	----
Blasters	.20	.08	.09	.04	----	----	----	----
Surveyors' helpers	7.44	2.95	3.01	1.48	----	----	----	----
Checkers, examiners	----	----	----	----	1.00	.26	.71	.02
Cutting operatives	0	0	0	0	----	----	----	----
Drillers, earth	.89	.89	0	0	.27	.27	0	0
Drywall installers	.05	.04	.01	0	----	----	----	----
Oilers, greasers, except auto	15.56	4.64	7.19	3.74	----	----	----	----
Packers, wrappers, except meat	.04	0	.03	.01	----	----	----	----
Painters, manufactured articles	0	0	0	0	----	----	----	----
Punch stamping press operators	.03	0	.02	.01	----	----	----	----
Sawyers	.03	0	.02	.01	----	----	----	----
Stationary firefighters	.58	.25	.29	.03	----	----	----	----
Welders and flame cutters	6.59	2.99	2.50	1.10	.12	.08	.04	0
Miscellaneous machine operators	11.63	2.87	5.77	2.99	----	----	----	----
Operatives	.24	.11	.11	.01	----	----	----	----
Busdrivers	.01	0	.01	0	----	----	----	----
Delivery and route workers	.02	0	.02	0	----	----	----	----
Forklift, tow motor operators	.93	.26	.48	.19	----	----	----	----
Railroad brake operators and couplers	7.97	3.19	3.19	1.60	----	----	----	----
Rail switch operators	.99	.39	.39	.20	----	----	----	----
Truck drivers	29.05	8.57	13.82	6.65	----	----	----	----
Carpenters' helpers	1.96	.32	1.60	.04	----	----	----	----
Construction laborers, except carpenters' helpers	366.93	81.43	166.17	119.33	.85	.63	.22	0
Freight material handlers	1.52	.09	.92	.51	----	----	----	----
Teamsters	.64	.07	.31	.26	----	----	----	----
Other laborers	35.22	12.43	16.20	6.59	1.34	.36	.98	0
Janitors and sextons	0	0	0	0	----	----	----	----
Guards	.97	.18	.52	.27	----	----	----	----

¹Data are for the 30-month period January 1972-June 1974.

²All contracts for calendar year.

³All contracts for 6 months, January 1 to June 30.

⁴Employment numbers are not rounded to preserve detail at the occupational level.

SOURCE: Bureau of Labor Statistics.

Table D-4. Capital improvements: Indirect employment by industry, Massachusetts Bay Transportation Authority, 1972-74

Industry	1972 ¹		1973 ¹		1974 ²	
	Construction contracts	Architectural and engineering contracts	Construction contracts	Architectural and engineering contracts	Construction contracts	Architectural and engineering contracts
Total.....	420.46	33.95	851.53	47.26	628.81	22.63
Livestock and livestock products .....	.69	.07	1.45	.10	1.21	.05
Crops and other agricultural products	1.56	.16	3.07	.21	2.73	.11
Forestry and fisheries .....	.72	.01	1.40	.01	1.51	.01
Agriculture, forestry, and fishery services .....	.57	.03	1.20	.05	1.04	.02
Iron ore mining	1.33	.01	2.44	.01	1.87	0
Copper ore mining .....	.63	.01	2.45	.01	1.72	0
Other nonferrous metal ore mining .....	.37	.01	.83	.01	.58	0
Coal mining	2.58	.05	5.14	.07	4.16	.03
Crude petroleum	1.68	.10	3.08	.15	2.04	.07
Stone and clay mining and quarrying	9.20	.02	21.71	.02	10.07	.01
Chemical and fertilizer mining .....	.10	0	.21	0	.20	0
New residential buildings	0	0	0	0	0	0
New nonresidential buildings	14.33	0	19.60	0	17.92	0
New public utilities	0	0	0	0	0	0
New streets and highways	0	0	0	0	0	0
All other new construction	0	0	0	0	0	0
Maintenance and repair	4.58	.56	9.62	.84	6.85	.41
Guided missiles and space vehicles .....	.06	0	.28	0	.21	0
Other ordnance .....	.16	0	.31	0	.18	0
Food products .....	.70	.07	1.43	.10	1.00	.04
Tobacco manufacturing .....	.01	0	.02	.07	.01	0
Fabric, yarn, and thread mills .....	.63	.05	1.65	.07	1.47	.03
Miscellaneous textiles and floor coverings .....	.28	.01	.65	.02	.75	.01
Hosiery, knit goods .....	.09	0	.18	.01	.73	.01
Apparel .....	.45	.02	.92	.03	.13	0
Miscellaneous fabricated textile products .....	.19	.01	.39	.01	.45	0
Logging, sawmills, and planing mills	6.93	.09	13.65	.13	14.93	.06
Millwork, plywood, and other wood products	6.28	.05	9.40	.08	6.58	.04
Household furniture .....	.15	.01	.52	.01	.25	0
Other furniture .....	.18	0	.76	.01	.48	.01
Paper products	1.83	.32	3.70	.43	2.64	.17
Paperboard .....	.91	.05	1.95	.07	1.40	.03
Publishing	1.52	.18	3.21	.25	2.51	.12
Printing	2.14	.37	4.66	.61	4.00	.25
Chemical products	2.65	.10	4.90	.13	4.26	.06
Agricultural chemicals .....	.08	.01	.21	.01	.18	0
Plastic materials and synthetic rubber .....	.76	.03	1.82	.05	1.68	.03
Synthetic fibers .....	.16	.01	.33	.01	.30	0
Drugs .....	.05	0	.15	0	.06	0
Cleaning and toilet preparations .....	.12	.01	.23	.01	.15	.01
Paint .....	.65	.02	1.25	.03	.77	.01
Petroleum products	1.10	.07	1.98	.10	1.16	.04
Rubber products	1.31	.05	3.54	.06	2.57	.03
Plastic products	3.10	.09	6.20	.14	3.89	.07
Leather, footwear, and leather products .....	.17	.02	.42	.03	.35	.02
Glass .....	.94	.02	2.16	.03	1.38	.01
Cement, clay, and concrete products	22.79	.02	41.25	.03	18.44	.01
Miscellaneous stone and clay products	3.73	.04	12.01	.05	30.14	.02
Blast furnaces and basic steel products	30.71	.14	52.30	.16	45.72	.05
Iron and steel foundries and forgings	4.94	.05	8.64	.05	5.06	.02
Primary copper metals .....	.24	0	.99	0	.81	0
Primary aluminum .....	.49	.01	.92	.01	.74	0
Other primary and secondary nonferrous metal products .....	.56	.01	1.56	.01	1.58	.01
Copper rolling and drawing .....	.60	.01	2.19	.01	1.78	.01
Aluminum rolling and drawing	1.56	.02	2.76	.02	1.73	.01
Other nonferrous rolling and drawing	1.25	.02	11.01	.02	9.00	.01
Miscellaneous nonferrous metal products .....	.84	.02	.80	.02	1.18	.01
Metal containers .....	.19	.01	.36	.01	.25	.01
Heating apparatus and plumbing fixtures	1.68	.01	5.01	.01	3.20	0
Fabricated structural metal	25.87	.14	36.41	.33	19.21	.02

See footnotes at end of table.

Table D-4. Capital improvements: Indirect employment by industry, Massachusetts Bay Transportation Authority, 1972-74—Continued

Industry	1972 ¹		1973 ¹		1974 ²	
	Construction contracts	Architectural and engineering contracts	Construction contracts	Architectural and engineering contracts	Construction contracts	Architectural and engineering contracts
Screw machine products	3.07	.06	7.77	.08	5.25	.03
Other fabricated metal products	10.38	.08	16.13	.11	11.08	.04
Engines, turbines, and generators	.72	.03	1.46	.04	.92	.02
Farm machinery	.13	.01	.33	.01	.30	.01
Construction, mining, and oil field machinery	6.13	.10	12.33	.04	8.53	.01
Material handling equipment	.86	.01	2.91	.01	4.55	0
Metalworking machinery	2.67	.04	5.83	.05	4.56	.02
Special industry machinery	.82	.02	1.09	.02	.60	.01
General industrial machinery	2.59	.05	8.51	.04	5.76	.02
Machine shop products	2.01	.05	4.57	.10	3.76	.11
Computers and peripheral equipment	.33	.06	.75	.19	.60	.06
Typewriters and other office machines	.70	.09	1.38	.11	.95	.03
Service industry machines	.67	.03	1.59	.04	1.02	.02
Electric transmission equipment	20.78	.10	27.56	.09	17.25	.09
Electrical industrial apparatus	4.33	.08	8.58	.13	6.53	.05
Household appliances	.38	.01	.76	.01	.42	0
Electric lighting and wiring	2.00	.04	14.31	.04	15.55	.02
Radio and television sets	.13	0	1.88	.01	.36	0
Telephone and telegraph apparatus	.48	.04	5.99	.06	3.27	.02
Other electronic communication equipment	2.88	.01	15.81	.02	11.80	.01
Electronic components	2.58	.05	8.38	.14	5.41	.13
Other electrical machinery	1.55	.03	3.33	.03	1.36	.02
Motor vehicles	1.16	.04	2.27	.04	1.41	0
Aircraft	.61	.10	1.48	.13	1.15	.06
Ship and boat building and repair	.96	.01	1.88	.02	1.28	0
Railroad and other transportation equipment	.23	.01	.43	.01	.31	.01
Miscellaneous transportation equipment	.05	0	.09	0	.04	0
Scientific and controlling instruments	1.35	.04	2.56	.05	1.66	.04
Medical and dental instruments	.12	0	.26	.01	.19	0
Optical and ophthalmic equipment	.08	0	.18	0	.11	0
Photographic equipment and supplies	.35	.06	.79	.09	.56	.05
Miscellaneous manufactured products	2.68	1.06	6.00	1.48	4.82	.71
Railroad transportation	8.03	.14	15.54	.17	11.63	.08
Local transit and intercity bus	3.09	1.64	6.63	2.50	5.68	1.43
Truck transportation	16.31	.25	36.04	.33	23.52	.15
Water transportation	.87	.02	1.33	.02	.90	.01
Air transportation	1.54	1.33	2.89	1.61	1.91	.56
Other transportation	2.07	.13	3.71	.17	2.47	.07
Communications, except radio and TV	4.93	1.05	10.26	1.53	6.97	.68
Radio and TV broadcasting	.52	.05	1.14	.07	.77	.03
Electric utilities	2.22	.21	4.40	.27	3.55	.13
Gas utilities	.90	.04	1.91	.06	1.50	.03
Water and sanitary services	.19	.03	.42	.04	.36	.02
Wholesale trade	26.48	.91	56.30	1.31	41.63	.58
Retail trade	17.49	1.84	34.80	2.50	26.39	1.20
Finance	4.63	.46	11.14	.89	8.07	.49
Insurance	12.24	3.53	23.79	5.33	16.87	2.48
Owner-occupied dwellings	0	0	0	0	0	0
Other real estate	3.91	1.23	7.46	1.81	4.96	.85
Hotels and lodging places	1.78	.37	3.38	.44	2.33	.24
Other personal services	.84	.08	1.91	.11	1.39	.05
Miscellaneous business services	36.83	8.53	82.89	11.54	60.52	5.50
Advertising	.57	.05	1.14	.07	.78	.03
Miscellaneous professional services	7.70	4.32	14.43	5.42	10.63	2.83
Automobile repair	10.39	.18	14.92	.22	6.65	.11
Motion pictures	.41	.05	.83	.07	.58	.03
Other amusements	.42	.06	.84	.08	.57	.03
Health services except hospitals	.72	.20	1.50	.33	1.09	.16
Hospitals	.06	.02	.12	.03	.09	.01
Educational services	.50	.04	1.05	.07	.76	.04
Nonprofit organizations	7.17	.44	13.99	.67	9.50	.36
Post Office	3.43	.62	7.15	.82	5.58	.40
Commodity Credit Corporation	0	0	0	0	0	0
Other Federal enterprises	.41	.04	.78	.06	.53	.0
State and local government enterprises	2.61	.59	5.33	.83	4.03	.45
Directly allocated imports	0	0	0	0	0	0
Transferred imports	0	0	0	0	0	0
Business travel, entertainment, and gifts	0	0	0	0	0	0
Office supplies	0	0	0	0	0	0

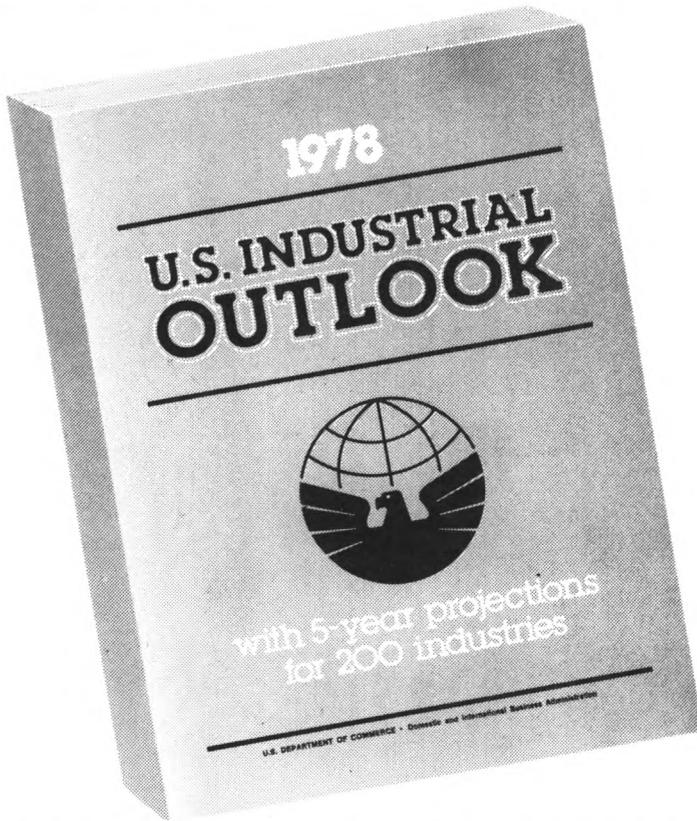
¹All contracts for calendar year.

²All contracts for 6 months, January 1 to June 30.

NOTE: Employment numbers are not rounded to preserve detail at the industry level.

SOURCE: Bureau of Labor Statistics.

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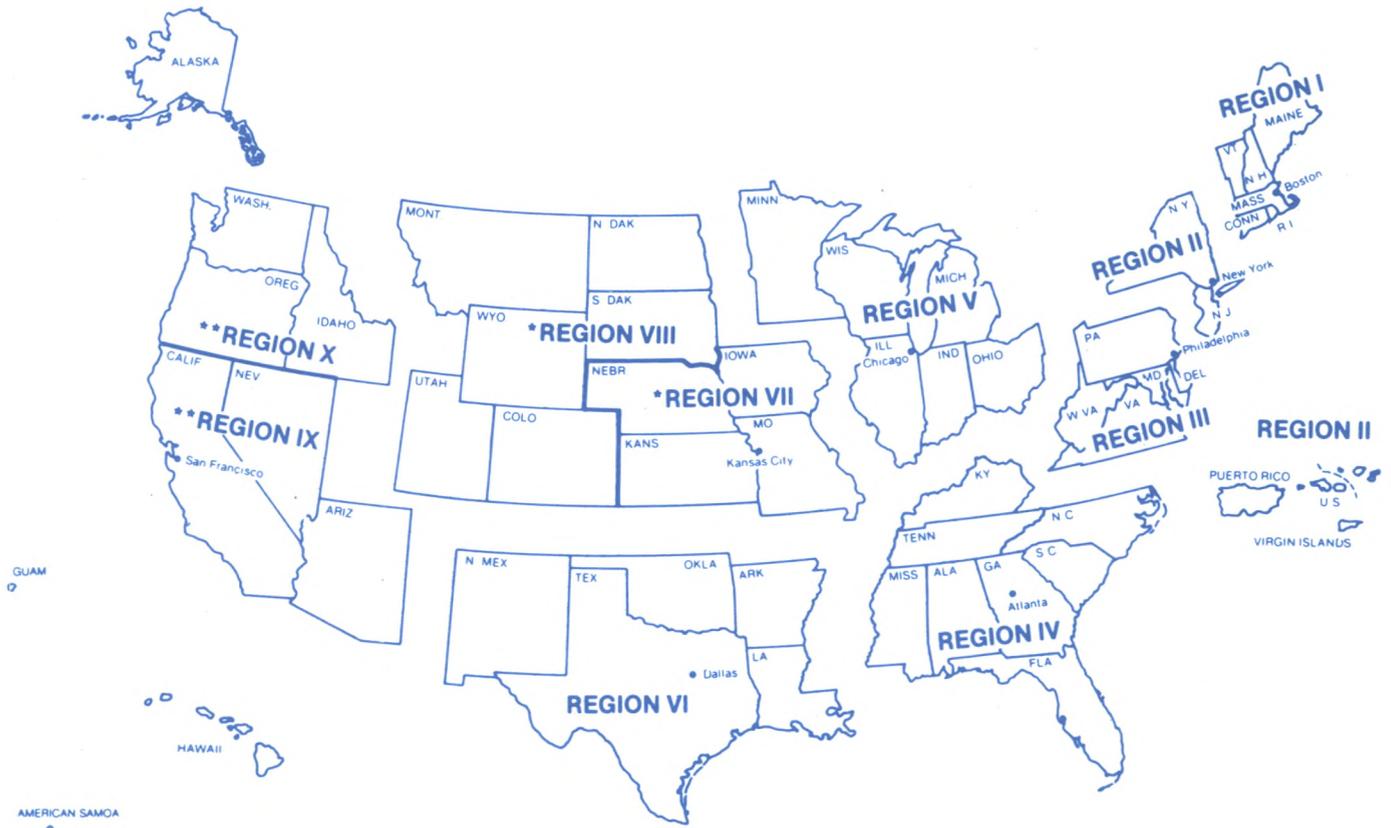
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