Labor and Material Requirements for Private Multifamily Housing Construction

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U.S. Department of Labor
W. J. Usery, Jr., Secretary
Bureau of Labor Statistics
Julius Shiskin, Commissioner
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Preface

This bulletin is the first study of private multifamily housing which the Bureau of Labor Statistics has conducted. It provides detailed data on employee-hour requirements by occupation and contractor as well as information on the amount and type of materials and supplies required. Other studies in the series include highways, general hospitals, elementary and secondary schools, private single-family housing, public housing, Federal office buildings, civil works, college housing, and sewer works. Such information enables policymakers to determine the number of jobs, by occupation, generated from a given amount of expenditures for construction.

Joseph T. Finn and Frank L. Wood of the Office of Productivity and Technology prepared this bulletin under the supervision of Robert Ball. Larry G. Ludwig wrote the "Nature of industry" section in the Introduction.

A summary of the results of this study was published in the January 1975 issue of the *Monthly Labor Review*. ("Labor and Material Requirements for Apartment Construction," by Robert Ball, pp. 70–73.) This bulletin elaborates on that summary and presents the survey findings in greater detail.

The Bureau wishes to acknowledge the generous cooperation of the Federal Housing Administration of the Department of Housing and Urban Development. The Bureau also wishes to thank the nearly 3,000 general and special trade contractors who provided data for the survey.

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Chapter I. Introduction

The current program of construction labor requirements studies was started in 1959 when Congress recognized the need for information on the possible employment generating effects of various types of construction. Since then, the Bureau of Labor Statistics (BLS) has conducted a series of studies presenting data on the total amount of employment and employee-hours, both onsite and offsite, per $1,000 of construction expenditures and, for some studies, per 100 square feet of space.

These studies provide data by occupation which are important in planning for training requirements as well as in determining skill shortages or bottlenecks for various types of construction. Resurveys of a given type of construction over time can contribute information about cost indexes and about estimates of productivity changes for onsite construction labor. Market research analysts and companies manufacturing equipment and supplies are interested especially in lists of materials used for construction.

Private multifamily (apartment) building is a major component of construction and a prime source of employment. Jobs are created not only at the site of construction but also in many manufacturing, trade, transportation, mining, and other industries which furnish the materials and services for construction. The multiplier effect of jobs created by the respending of wages and salaries of workers and profits of contractors is not included in the present study.

The study shows (1) the amount of labor time required to complete an average apartment; (2) detailed characteristics by type of apartment, contractor, and occupation; (3) ratios per $1,000 of cost and per 100 square feet of space; (4) materials used by type; (5) distribution of costs; and (6) total labor requirements generated by the manufacture, sale, and delivery of these materials.

Scope of survey

The current survey was designed to measure employee-hours and the value of materials required for each $1,000 of new private multi-family housing construction in 1971. It was based on a sample of 89 projects of five units or more each in 22 Standard Metropolitan Statistical Areas (SMSA's) in the continental United States, stratified by geographic location and estimated cost of projects. These projects were selected from Federal Housing Administration reports, but the sample was designed to represent all new private, multifamily housing in structures of five units or more in metropolitan areas, where permits were issued during 1969 for 500 dwelling units or more of this type in metropolitan areas. BLS obtained data on onsite employee-hours, materials, occupations, contractor operations, and other characteristics from nearly 3,000 general and special trade contractors who worked on sample projects. Included were commercial facilities in apartment buildings and enclosed parking areas. Land costs, condominiums, completely prefabricated projects, and structures having fewer than five units were excluded.

Survey methods

Labor requirements in the construction industry (onsite) were developed from payroll data supplied by contractors. Labor requirements other than for onsite construction were developed by translating the requirements for materials, equipment, and supplies produced in the various industries of the economy (offsite) into the labor expended to mine, process, transport, and distribute them. Estimates were derived by first classifying and aggregating material values by type and then deflating by an appropriate wholesale price index to match the base year of the input-output tables. These deflated values were matched with appropriate industry sectors in the input-output tables to generate estimates of final demand. Sector productivity factors then were applied to derive employee-hours by industry group. Further details on survey methods are given in appendix A.

Nature of industry

The industry is divided into two major segments, multifamily and single-family housing. These two types of housing, particularly apartment buildings with over three to five stories, often employ different construction materials and techniques. Also, an apartment project requires larger outlays of labor and capital than single-family housing, and the time between project inception and completion can be as great as 29-30 months.[1] Construction time for multifamily projects in the survey averaged 57 weeks compared with 21 weeks for projects of the single-family type.[2]

From 1930 to 1960, multifamily housing averaged only 15 percent of all private housing starts[3] whereas from 1956

[1] *Apartment Construction News,* November 1966, p. 9.

[2] *Labor and Material Requirements for Construction of Private Single-Family Houses,* Bull. 1755 (Bureau of Labor Statistics, 1972), p. 5.

[3] Based on Bureau of the Census and National Association of Home Builders data appearing in *Journal of Homebuilding,* November 1970, p. 13.

to 1966 it ranged from 9.1 to 33.1 percent, or an average annual rate of change of 13.8 percent,[4] according to the Bureau of the Census and the National Association of Home Builders. The steady upward trend, which continued through 1973, increased at an average annual rate of change of 4.3 percent from 1966 to 1973 to reach 44.7 percent of all U.S. private housing starts in 1973 (chart 1). However, the trend was reversed sharply in 1974 when multifamily housing constituted only 33.6 percent of total private housing starts. This downward trend continued into the first quarter of 1975, when multifamily housing provided only 25 percent of the total on a seasonally adjusted basis.

Data on housing starts are very closely correlated with data on value put in place, as shown in the tabulation below, which contains statistics abstracted from Bureau of the Census reports.[5]

	Multifamily housing as percent of—	
	Total private housing starts	*Total value put in place for private housekeeping residential housing*
1960	20.6	15.2
1965	34.6	27.7
1970	43.3	39.2
1971	43.9	36.7
1972	44.4	38.4
1973	44.7	40.7
1974	33.6	35.8
First quarter 1975 (seasonally adjusted annual rate)	25.0	26.2

Value put in place went from 15.2 percent of new private housekeeping residential construction in 1960 to 36.7 percent in 1971; the level continued to climb to 40.7 percent in 1973. Both statistical series showed a sharp drop in apartment construction during 1974 which extended into the first quarter in 1975.

The BLS survey sample for this study covers multifamily structures containing five dwelling units or more in accordance with the BLS definition of that universe, which differs in some respects from the definition of the Bureau of the Census in the data shown above. However, the differences do not significantly affect the analysis.[6]

Structures containing five units or more clearly dominate the private multifamily housing industry, as shown in the following tabulation:

	Private housing units started—		
		In structures of 5 units or more	
	In all multifamily structures (thousands)	*Number (thousands)*	*Percent of all multifamily units*
1965	509.1	422.5	83.0
1970	620.7	535.9	86.3
1974	449.6	381.6	84.9
First quarter 1975 (seasonally adjusted annual rate)	248.0	203.0	81.9

Generally, five-or-more-unit dwellings are divided into two basic construction groupings: Low rise buildings of three stories or less, often built with wood frames and no elevators; and high rise buildings of four stories or more containing elevators and usually constructed of reinforced concrete or structural steel. The majority of five-or-more-unit dwellings are built in low rise buildings. In 1965, for example, 95 percent of new multifamily structures had three floors or less and contained approximately 78 percent of all multifamily dwelling units. The remaining 5 percent were high rise buildings containing 22 percent of the multifamily units.[7] In 1971, 94 percent of five-or-more-unit buildings in the BLS survey were low rise buildings. In the North-east region, the only significant variation from the national average, only 48 percent were low rise buildings. The rest of the five-or-more-unit apartment buildings were high rise buildings, confirming the 1965 data that high rises in the Northeast contained approximately 40 percent of the dwelling units.

The average dwelling unit in all multifamily structures, which contained 861 square feet in 1960, increased to 1,100 square feet by December 1971.[8] This upward trend is evident in the present study which shows an average dwelling unit of 979 square feet in 1971. Also, in 1965, about 92 percent of multifamily housing was constructed in metropolitan areas (SMSA's),[9] in contrast to the 69 percent of all private housing (including single-family) started in metropolitan areas in 1965. In 1971, 1973, and 1974, the figures for all private housing were 73, 73, and 69 percent,[10] respectively.

The steady growth in demand for multifamily dwellings during the last decade resulted from several concurrent social, technological, and economic factors, including the following:

1. A national trend toward fewer children per family and more families without children decreased the necessity for the larger living space of single-family houses;
2. New households were formed at an increasing rate as World War II "baby boom" children grew up;

[4] Ibid. Average annual rates of change are calculated by compound interest.

[5] Based on data in Bureau of the Census, *Construction Reports*, Series C20, and C30, up through the June 1975 issue.

[6] The Bureau of the Census includes in its definition structures containing over 10 percent of available footage as townhouses, newly built condominiums or cooperatives, modular units, or rowhouses; BLS does not. The units excluded by BLS, however, are only a small percentage of total 5-or-more-unit construction. Also, the dwelling units in this BLS study are located entirely in metropolitan areas (SMSA's), while some units in the census data are located in rural areas. Since most multifamily housing is constructed in metropolitan areas, this difference is insignificant.

[7] *Apartment Construction News*, July 1966, p. 33.

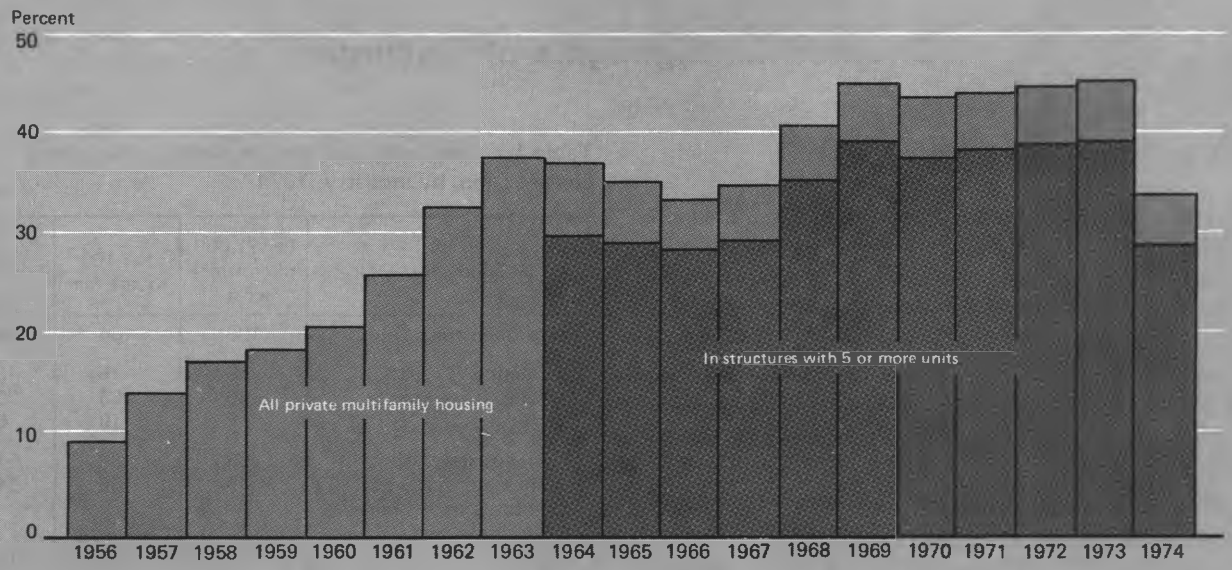
[8] *Apartment Construction News*, December 1971, p. 4.

[9] *Apartment Construction News*, July 1966, p. 33.

[10] *Housing Starts*, Series C20 (Bureau of the Census, April 1975), p. 4.

Chart 1.

Multifamily Housing as a Percent of All Private Housing Starts, 1956-74



Note: Data for structures with 5 or more units not available separately before 1964.

Source: Bureau of the Census.

3. Land scarcity and rising taxation encouraged more efficient land use;
4. A rise in construction costs of about 10 percent a year[11] emphasized the need for the economies of material and labor that multifamily housing could effect;
5. The relaxation of antiquated zoning laws enabled progressive developments such as the "Planned Unit Development" (PUD) to be built;
6. The advent of total community planning, especially PUD, made possible the incorporation of both single and multifamily dwellings in one community;
7. Increased geographical and job mobility made apartment living, with its ease of moving, more desirable;
8. More women worked and had less time to spend on home management and upkeep;
9. Apartment living as a life style gained greater social acceptance.

The multifamily housing industry during the past decade generally has followed traditional construction practices: Wood frame for low rise buildings, and reinforced concrete or structural steel for high rise. Modular unit construction techniques made some headway between 1969 and 1973, but they have tapered off since that time. More successful has been the modification of industrialized system construction where component parts such as wall panels, bathroom modules, and floor slabs are prefabricated and then erected at the construction site. The development of new products for the apartment construction industry has been slow, but the steadily spiraling cost of lumber has resulted in greater use of concrete and metals such as steel and aluminum for framing in low rise structures.

The construction industry as a whole is composed of a multiplicity of small firms. The same is true of the housing construction segment of the industry as well. In 1972, 86,749 establishments employed 460,155 workers and had receipts of more than $21.3 million.[12] Of these firms, 7,965 were primarily engaged in building multifamily dwellings; they had receipts of over $6.3 million and employed over 112,000 workers.

Multifamily housing construction is expected to expand in the foreseeable future and should continue to be studied for a better understanding of its growing role in the economy.

[11] *Apartment Construction News*, May 1974, p. 5.

[12] *1972 Census of Construction Industries*, Preliminary Reports CC72(P)–1 and CC72(P)–2 (Bureau of the Census, January and March 1974), pp. 1–4.

Chapter II. Highlights of Findings

General findings

Private multifamily housing construction required 50 employee-hours of onsite labor for each $1,000 expended in 1971, according to the survey. This compares with estimates from other studies of 49 employee-hours for single-family housing and 65 for public housing.[13] Thus, multifamily housing construction requires about the same number of employee-hours for a given amount of expenditure as single-family housing; public housing calls for the greatest number of employee-hours.

A total of 126 employee-hours of labor was generated in all sectors of the economy for each $1,000 of construction cost for multifamily housing in 1971, as shown in table 1. (Also see charts 2 and 3.) Of this amount, 50 employee-hours were expended at the construction site and another 8 employee-hours of offsite labor were expended in contractors' warehouses and offices,[14] for a total of 58 direct construction employee-hours.

In addition to he 58 employee-hours of direct labor requirements generated in the construction industry, 68 employee-hours per $1,000 of construction cost were created in industries which produce, transport, and sell materials, equipment, and supplies used in multifamily housing construction. Thus, for every hour of onsite construction work, an additional 0.2 hour of labor was spent in contractors' warehouses and offices, and 1.4 hours in industries other than construction.

Apartment construction in 1971 provided an estimated 414,000 full-time jobs for construction workers and an additional 57,000 jobs for contractors' offsite personnel.[15]

[13] *Labor and Material Requirements for Public Housing Construction,* Bull. 1821 (Bureau of Labor Statistics, 1974); *Labor and Material Requirements for Construction of Private Single-family Houses,* Bull. 1755 (Bureau of Labor Statistics, 1972); adjusted to reflect 1971 prices and productivity.

[14] Offsite construction employee-hours were estimated from the ratio of nonconstruction workers to total workers for the special trade construction industry (SIC 17), as shown in the BLS periodical *Employment and Earnings,* March 1971. The resulting hours were adjusted to remove that portion of administrative and clerical hours already counted as onsite.

[15] These estimates are stated as full-time job equivalents since, in actual practice, more workers could be employed than indicated because of the seasonal nature of construction employment. Jobs created by the respending of wages and salaries of workers and profits of contractors (the rippling or multiplier effect) are beyond the scope of the present work.

Table 1. Employee-hour requirements in apartment construction, by industry, 1971

Industry	Per $1,000 of contract cost	Per 100 square feet	Percent distribution[1]
All industries	126	164	100.0
Construction	58	75	46.0
Onsite	50	65	39.7
Offsite	8	10	6.3
Other industries	68	89	54.0
Manufacturing	43	56	34.1
Wholesale trade, transportation, and services	15	20	11.9
Mining and all other	10	13	7.9

[1] Distribution is the same for both columns.

NOTE: Detail may not add to totals due to rounding.

Also, 437,000 jobs were generated in industries which provided materials used to construct multifamily units. Thus, for every onsite construction job, an additional 0.1 job was spent in contractors' warehouses and offices and 1.1 jobs in industries other than construction.[16]

On average, a multifamily project took 57 weeks to complete. Actual construction of the sample projects took place in 1970 through 1972, but most were completed in 1971. Each project in the study contained an average of 157 dwelling units. These apartments averaged 979 square feet in size, cost $12,686 (excluding land) to build, and had two bedrooms. These averages generally varied according to geographic region.

Requirements by occupation and type of contractor

Carpenters, laborers, and helpers, the largest components of onsite labor requirements for multifamily housing, each made up over 25 percent of onsite requirements. The occupational distribution was similar to that found in public housing but quite different from that in single-family housing construction, since relatively less wood is used in multifamily than in single-family housing construction, proportionately fewer carpenters were employed; since much larger amounts of heavier materials must be moved onto

[16] Due to differing assumptions for the number of employee-hours per employee-year in construction and other industries, employee-hour ratios do not apply to employee-year estimates. To calculate employment, 1,800 hours a year were used for construction and 2,000 for all other industries.

Chart 2.

Employee-Hour Requirements per $1,000 of Contract Cost in Apartment Construction, by Industry, 1971

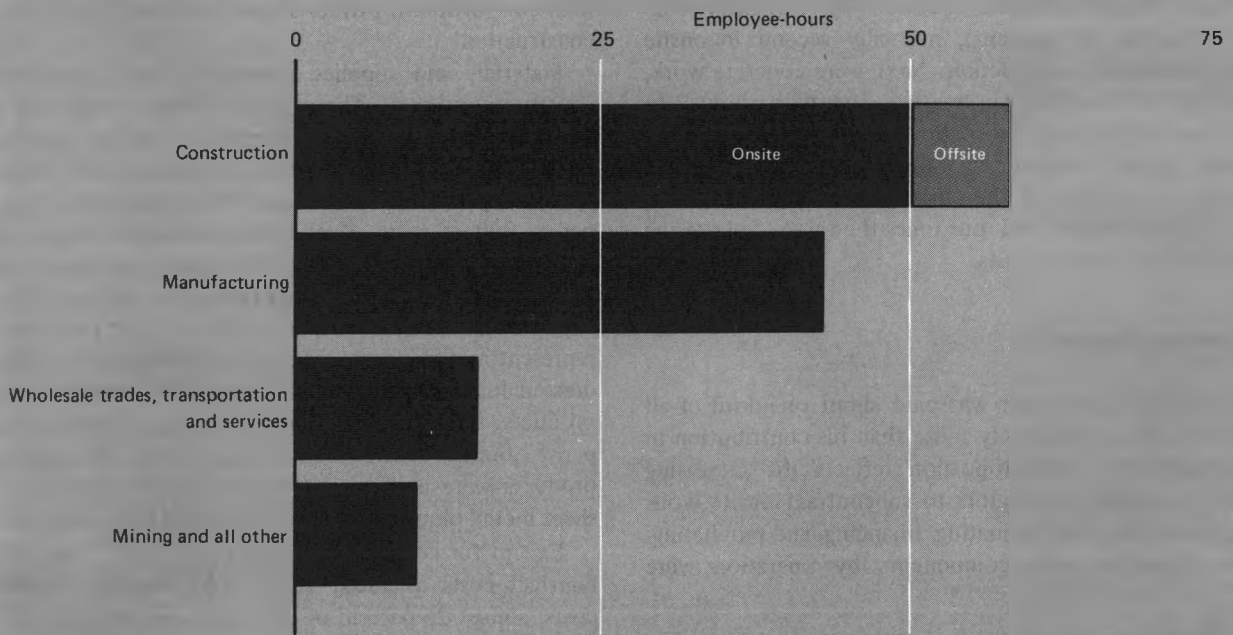
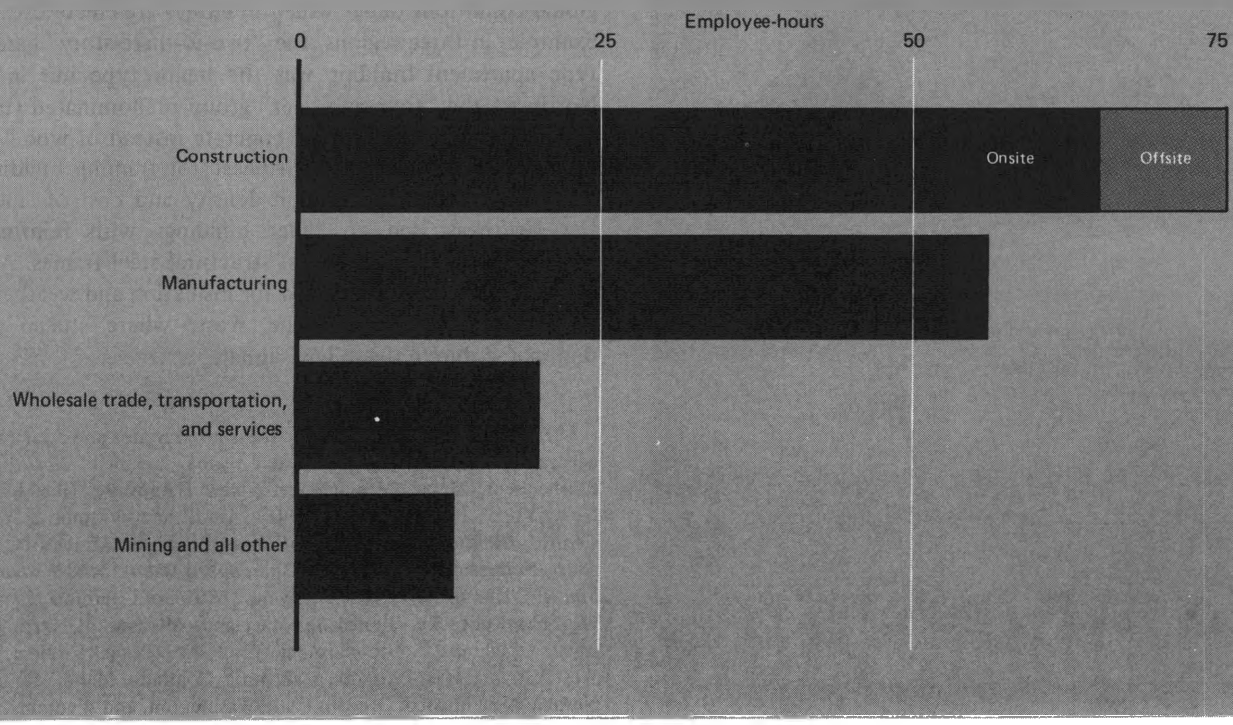


Chart 3.

Employee-Hour Requirements Per 100 Square Feet of Apartment Construction, by Industry, 1971



and within the site, relatively more laborers were required. In descending order, other important occupations for multifamily housing construction were plumbers, electricians, superintendents and blue-collar supervisors, bricklayers, painters, cement finishers and operating engineers.

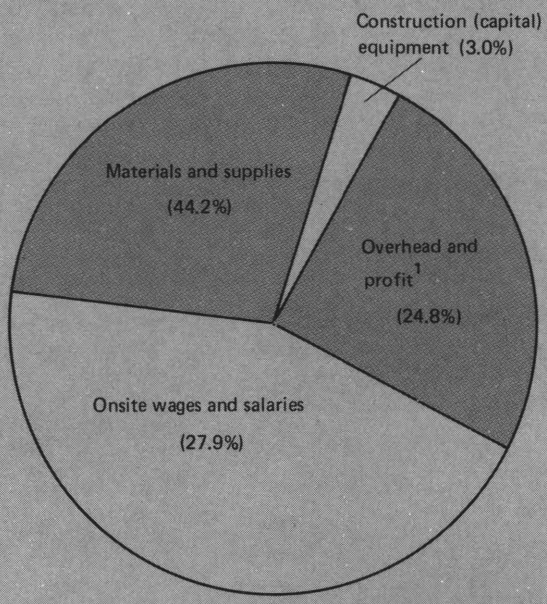
The general contractor provided a little over 20 percent of onsite employee-hours, followed by carpentry contractors (about 13 percent), normally second in onsite hours in building construction. Next were concrete work, plumbing, and masonry contractors, each with about 9 to 10 percent of the onsite work. Since wallboard virtually has replaced plaster for interior walls, wallboard contractors had about 8 percent of the onsite work compared with 2 percent for plasterers, and four times the value of plastering contractors in contract costs.

Distribution of costs

The general contractor was paid about one-third of all contract costs, considerably more than his contribution in employee-hours. This proportion reflects the increasing trend for general contractors to subcontract onsite work and concentrate on coordinating, financing, and purchasing. Other important cost components by operation were carpentry; plumbing; concrete; heating, ventilating, and air-conditioning; electrical; wallboard; and masonry. Of overall costs, onsite wages and salaries constituted almost 30 percent, with carpenters and laborers representing nearly one-half of this amount (chart 4). Skilled trades made up about two-thirds of total onsite direct labor costs, similar to their proportion in private single-family and public housing construction.

Chart 4.

Distribution of Apartment Construction Contract Costs, 1971



[1] Includes profit, salaries for offsite workers, supplemental benefits, interest expense, other overhead, and miscellaneous expenses.

Materials and supplies constituted over two-fifths of construction costs. Three major groups made up over one-half of the cost of all materials used in multifamily housing construction. Stone, clay, glass, and concrete products represented over one-fifth of these costs, or $105 per $1,000 of costs. Most important within this grouping were ready-mix concrete, and wallboard. Lumber and wood products, except furniture and fixtures, were the next most expensive materials—$89 per $1,000 of costs. The materials representing the largest costs in this group were rough and dressed lumber, millwork, and plywood. Fabricated metal products, the third most important group, constituted $74 per $1,000 of costs. Within this group, the important products were metal doors and windows, reinforcing bars, sheet metal, plumbing products, and heating equipment.

Except for construction equipment (about 3 percent of contract costs or about $31 per $1,000), the remaining costs, almost 25 percent of the total, were not collected for the survey but consisted of items such as supplementary wage benefits paid by contractors, construction financing costs, offsite work in offices and warehouses, other overhead expenses, and profit.

Regional differences

Differences in construction characteristics reflect regional conditions under which buildings are erected.[17] For example, in three regions, the "two-to-three-story" garden-type apartment building was the major type but in the Northeast the "four and over" group predominated (table 2). Furthermore, reinforced concrete instead of wood was used most often in the Northeast for framing buildings. Probably the high population density and cost of land in the Northeast led to taller buildings with reinforced concrete and, in some cases, structural steel frames. Also, brick exterior siding was used for insulation and weathering in every region except the West, where stucco predominated due to the milder climate.

[17] The study provided data for the United States and four broad geographic regions. States in each region included: *Northeast*—Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *North Central*—Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*—Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*—Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Table 2. Summary of apartment project characteristics, by region, 1971

Characteristic	United States	Northeast	South	North Central	West
Most common number of stories	2 to 3	4 and over	2 to 3	2 to 3	2 to 3
Average number of dwelling units per project	157	240	149	163	135
Average square feet of space per dwelling unit	979	935	946	1,039	992
Average cost per dwelling unit	$12,686	$17,438	$11,252	$13,169	$11,484
Average cost per square foot	$12.96	$18.64	$11.89	$12.67	$11.57
Most common framing material used	Wood	Reinforced concrete	Wood	Wood	Wood
Most common exterior wall material used	Brick	Brick	Brick	Brick	Stucco
Average hourly earnings	$5.60	$6.27	$4.57	$6.32	$6.22
Wages as a percent of contract costs	27.9	30.8	27.3	28.5	25.2

The Northeast led in cost per dwelling unit and per square foot. These higher costs were the result of several factors. The buildings in this region tended to have more stories and generally contained elevators. Also, most of them had frames made of reinforced concrete as opposed to wood framing, used in the other regions. In addition, average hourly earnings of onsite workers were higher than in all the other regions except the North Central, and the proportion of contract costs allocated to wages was the highest. However, when measured by square footage, apartments in the Northeast were the smallest.

Average hourly earnings also varied according to region. The U.S. average of $5.60 reflected the range from $4.57 in the South to $6.32 in the North Central region. Wages as a percent of contract costs varied from about 25 percent in the West to almost 31 percent in the Northeast. Lower wage rates in the South kept total wage costs low on projects in this area, i.e., about 27 percent of contract costs. On the other hand, in the West, as shown in table 2, only about 25 percent of contract costs went for wages, despite the fact that average hourly earnings ($6.22) were significantly higher than in the South ($4.57). A similar divergence was found in the Northeast. Although average hourly rates in the Northeast were lower than those in the North Central region, total wage costs as a percent of contract costs were higher. This anomaly in these regions could be due to differing rates of productivity, differences in relative costs of materials, and other factors.

Chapter III. Labor Requirements and Characteristics

Onsite

Employee-hours by occupation. Data for the United States as a whole indicate that, of onsite employee-hours in apartment construction, 66 percent were worked by skilled tradesworkers, 28 percent by semiskilled and unskilled workers, and 6 percent by nonproduction employees such as supervisors, engineers, and clerks (table 3).

For skilled trades and semiskilled and unskilled workers, the proportion of employee-hours was essentially the same as that found in other types of residential construction, i.e., single-family housing, public housing, and college housing. However, a significantly higher proportion of onsite employee-hours in private multifamily construction was contributed by workers in nonproduction occupations, as shown by the following tabulation:

	Nonproduction employee-hours as percent of all onsite employee-hours
Private multifamily housing	6.0
Single-family housing	2.8
College housing	3.4
Public housing	3.6

Table 3. Onsite employee-hour requirements per $1,000 of contract cost in apartment construction by occupation and region, 1971

Occupation	United States		Northeast		South		North Central		West	
	Hours per $1,000	Percent	Hours per $1,000	Percent	Hours per $1,000	Percent	Hours per $1,000	Percent	Hours per $1,000	Percent
All occupations	50.0	100.0	48.9	100.0	59.8	100.0	45.0	100.0	41.7	100.0
Professional, technical, and kindred workers	2.9	5.8	2.7	5.6	3.4	5.7	2.4	5.3	2.9	7.1
Professional/technical	.2	.4	.6	1.1	.2	.3	.0	.1	.1	.3
Superintendent/supervisor	2.6	5.2	1.9	3.9	3.1	5.2	2.3	5.1	2.8	6.7
Clerical workers	.1	.2	.2	.5	.1	.2	.1	.1	.1	.2
Skilled trades	33.1	66.1	33.3	68.2	34.6	57.9	32.8	72.7	30.7	73.8
Bricklayers	2.5	5.0	3.2	6.5	3.5	5.8	2.3	5.1	.4	.9
Carpenters	12.7	25.4	10.4	21.2	13.1	22.0	13.1	29.1	13.8	33.2
Cement finishers	1.7	3.4	2.4	4.9	1.6	2.8	1.3	3.0	1.5	3.6
Electricians	2.9	5.9	3.2	6.5	2.7	4.5	3.2	7.2	2.7	6.4
Elevator constructors	.2	.3	.4	.8	.1	.2	.1	.2	.0	.1
Glaziers	.1	.1	.1	.2	.0	.0	.1	.1	.0	.1
Insulation workers	.2	.4	.2	.4	.2	.4	.1	.3	.2	.4
Iron workers-ornamental	.3	.5	.3	.6	.2	.4	.3	.7	.2	.4
Iron workers-reinforced	.3	.6	.4	.8	.4	.6	.2	.5	.3	.6
Iron workers-structural	.6	1.2	1.9	3.9	.3	.5	.3	.8	.1	.2
Lathers	.3	.6	.6	1.1	.1	.2	.0	.1	.6	1.4
Operating engineers	1.5	2.9	.9	1.9	1.7	2.9	1.6	3.6	1.4	3.3
Painters	2.0	4.0	1.7	3.5	2.9	4.8	1.3	3.0	1.8	4.3
Plasterers	.5	1.1	.7	1.5	.5	.8	.2	.4	.9	2.2
Plumbers and pipefitters	4.7	9.4	5.8	11.7	4.4	7.3	4.9	10.9	4.1	9.7
Roofers	.4	.7	.2	.5	.4	.7	.3	.7	.5	1.3
Sheet-metal workers	1.0	2.1	.2	.5	1.0	1.8	1.6	3.4	1.1	2.7
Soft-floor layers	.2	.5	.2	.4	.4	.7	.1	.1	.3	.7
Tile setters	.4	.7	.3	.6	.5	.8	.4	1.0	.2	.5
Other skilled trades	.6	1.3	.3	.6	.4	.8	1.1	2.5	.7	1.9
Laborers and other	14.0	28.0	12.8	26.2	21.8	36.4	9.9	22.0	8.0	19.1
Laborers, helpers, and tenders	12.9	25.8	11.9	24.3	20.3	34.0	8.9	19.7	7.1	17.1
Truckdrivers	.4	.9	.4	.8	.6	1.0	.4	.9	.3	.8
Custodial workers	.2	.5	.1	.2	.4	.6	.3	.6	.1	.3
Other semiskilled and unskilled workers	.4	.9	.5	1.0	.5	.9	.3	.7	.4	.9

NOTE: Detail may not add to totals due to rounding.

This increase in employee-hours allotted to administrative and supervisory personnel may be due partially to the larger size of the average project in this survey compared to other types of residential construction.

Carpenters, the major skilled craft, accounted for 38 percent of the employee-hours of all skilled workers. They were followed, in descending order, by plumbers, electricians, bricklayers, and painters.

The ranking of skilled trades varied within the four broad geographical regions. Carpenters and plumbers ranked first and second respectively in all regions. However, the relative importance of the other trades changed from region to region. Bricklayers were in third position in the Northeast and South, fourth in the North Central region, and below the first five in the West. Cement finishers were fourth in the Northeast and fifth in the West; they ranked below fifth in the South and North Central regions. Electricians ranked third in all regions except the South where they were fifth. Painters occupied fourth place in the South and West but were below the top five in the other regions.

In square footage, 64.8 employee-hours were required for each 100 square feet of space constructed (table 4). Employee-hours per 100 square feet ranged from about 48 in the West to about 91 in the Northeast. Employee-hour requirements by occupation were the same, proportionately, for 100 square feet as for $1,000 of construction.

Apprentices made up about 8 percent of all skilled workers, as shown in the tabulation below. This figure ranged from about 5 percent in the South to nearly 12 percent in the West. The occupations which had the largest relative numbers of apprentices were plumbers and pipefitters, electricians, machinists, and soft-floor layers.

Occupation	*Apprentices as percent of skilled workers*
All apprentices	7.8
Bricklayers	3.4
Carpenters	7.6
Cement finishers	2.9
Electricians	15.1
Elevator constructors	6.0
Insulation workers	4.8

Table 4. Onsite employee-hour requirements per 100 square feet in apartment construction, by occupation and region, 1971

Occupation	United States		Northeast		South		North Central		West	
	Hours per 100 square feet	Percent	Hours per 100 square feet	Percent	Hours per 100 square feet	Percent	Hours per 100 square feet	Percent	Hours per 100 square feet	Percent
All occupations	64.8	100.0	91.1	100.0	71.1	100.0	57.1	100.0	48.2	100.0
Professional, technical, and kindred workers	3.8	5.8	5.1	5.6	4.1	5.7	3.0	5.3	3.4	7.1
Professional/technical	.3	.4	1.0	1.1	.2	.3	.1	.1	.1	.3
Superintendent/supervisors	3.4	5.2	3.6	3.9	3.7	5.2	2.9	5.1	3.2	6.7
Clerical workers	.2	.2	.4	.5	.2	.2	.1	.1	.1	.2
Skilled trades	42.9	66.1	62.2	68.2	41.1	57.9	41.5	72.7	35.6	73.8
Bricklayers	3.2	5.0	6.0	6.5	4.1	5.8	2.9	5.1	.4	.9
Carpenters	16.5	25.4	19.3	21.2	15.6	22.0	16.6	29.1	16.0	33.2
Cement finishers	2.2	3.4	4.4	4.9	2.0	2.8	1.7	3.0	1.7	3.6
Electricians	3.8	5.9	5.9	6.5	3.2	4.5	4.1	7.2	3.1	6.4
Elevator constructors	.2	.3	.8	.8	.2	.2	.1	.2	.0	.1
Glaziers	.1	.1	.2	.2	.0	.0	.1	.1	.0	.1
Insulation workers	.2	.4	.4	.4	.3	.4	.2	.3	.2	.4
Iron workers-ornamental	.3	.5	.6	.6	.3	.4	.4	.7	.2	.4
Iron workers-reinforced	.4	.6	.7	.8	.4	.6	.3	.5	.3	.6
Iron workers-structural	.7	1.2	3.5	3.9	.3	.5	.4	.8	.1	.2
Lathers	.4	.6	1.0	1.1	.2	.2	.1	.1	.7	1.4
Operating engineers	1.9	2.9	1.7	1.9	2.1	2.9	2.0	3.6	1.6	3.3
Painters	2.6	4.0	3.2	3.5	3.4	4.8	1.7	3.0	2.1	4.3
Plasters	.7	1.1	1.3	1.5	.5	.8	.2	.4	1.1	2.2
Plumbers and pipefitters	6.1	9.4	10.7	11.7	5.1	7.3	6.2	10.9	4.7	9.7
Roofers	.5	.7	.5	.5	.5	.7	.4	.7	.6	1.3
Sheet-metal workers	1.3	2.1	.4	.5	1.2	1.8	2.0	3.4	1.3	2.7
Soft-floor layers	.3	.5	.3	.4	.5	.7	.1	.1	.3	.7
Tile setters	.5	.7	.5	.6	.5	.8	.6	1.0	.3	.5
Other skilled trades	.9	1.3	.6	.6	.4	.8	1.4	2.4	.9	1.9
Laborers and other	18.2	28.0	23.9	26.2	25.9	36.4	12.5	22.0	9.2	19.1
Laborers, helpers, and tenders	16.7	25.8	22.1	24.3	24.1	34.0	11.3	19.7	8.3	17.1
Truckdrivers	.6	.9	.7	.8	.7	1.0	.5	.9	.4	.8
Custodial workers	.3	.5	.2	.2	.4	.6	.4	.6	.2	.3
Other semiskilled and unskilled workers	.6	.9	.9	1.0	.6	.9	.4	.7	.4	.9

NOTE: Detail may not add to totals due to rounding.

Occupation—Continued	Apprentices as percent of skilled workers—Continued
Iron workers-ornamental	1.5
Iron workers-reinforced	2.4
Iron workers-structural	5.2
Lathers	2.9
Machinists	14.2
Painters	4.9
Plasterers	1.8
Plumbers and pipefitters	29.2
Roofers	4.7
Sheet-metal workers	9.0
Soft-floor layers	12.5
Tilesetters	3.2

Employee-hours by type of contractor. National data show that general contractors used 21.7 percent and carpentry contractors 12.8 percent of onsite construction employee-hours (table 5). They were followed, in descending order, by contractors of plumbing, 9.0 percent; masonry, 8.8 percent; and wallboard, 7.9 percent.

The rankings of the various contractors varied within the regions. The general contractor ranked first and the carpentry contractor second in all regions except the Northeast where the general contractor occupied third place with 11.8 percent of the onsite employee-hours. In that area concrete work and masonry, with 23.2 and 12.1 percent, respectively, of the employee-hours, were in first and second place, and wallboard contractors, with 8.3 percent, and plumbers, with 8.0 percent of onsite employee-hours, ranked fourth and fifth. The variation in contractor rankings among the regions is illustrated by the list below showing the contractors who ranked third in each region:

Region	Type of contractor	Percent of employee-hours
Northeast	General	11.8
South	Masonry	11.1
North Central	Plumbing	10.7
West	Plumbing	13.4

Employee-hour requirements by building characteristics. Data on employee-hours by various building features indicate that in most cases employee-hour requirements were lowest in buildings using the most common materials and features. For example, wood was the most common framing material used, and projects with this type of framing had the lowest employee-hour requirements, about 46 employee-hours per $1,000 of construction costs (table 6). Similarly, poured concrete foundations, drywall interior walls, concrete floor base, carpet floor covering, and wood/plywood roof base followed the same trend. Furthermore, the pattern was the same for items other than materials. That is, sample projects with individual apartment heating occurred more frequently and required fewer employee-hours than individual building or central project heating. This finding was equally true of buildings with forced air heating, gas fuel, individual air-conditioning, of two to three stories, and buildings without elevators, incinerators, or compactors.

Generally, the most widely used materials and building practices are popular because they are the most efficient or least expensive. However, although brick was used most widely for exterior walls, projects with stucco outside walls had the lowest employee-hour requirements. Stucco, a concrete siding material, is used widely in the Southwest and southern California.

Table 5. Percent distribution of employee-hour requirements in apartment construction, by type of contractor, United States and regions, 1971

Contractor	United States	Northeast	South	North Central	West
Total	100.0	100.0	100.0	100.0	100.0
General contractor	21.7	11.8	28.6	19.4	20.1
Grading, footings, excavation, and foundation	3.1	4.7	2.3	3.6	2.8
Waterproofing	.2	.3	.2	.0	.1
Concrete work	9.9	23.2	6.6	4.7	9.8
Structural steel erection	.4	.7	.5	.4	.1
Carpentry	12.8	5.6	12.1	16.9	16.7
Masonry	8.8	12.1	11.1	7.8	1.2
Heating, ventilation, and air-conditioning	4.8	5.2	5.0	6.0	2.3
Plumbing	9.0	8.0	6.5	10.7	13.4
Electrical	6.8	7.0	5.9	7.5	7.6
Elevators	.6	1.7	.4	.5	.1
Insulation	.5	.3	.5	.5	.5
Wallboard	7.9	8.3	7.3	9.0	7.5
Plastering and lathing	1.8	3.4	.9	.5	4.0
Painting and paperhanging	3.1	3.1	4.0	2.1	2.5
Hardwood flooring	.3	.3	.4	.2	.0
Linoleum, vinyl tile, and carpeting	1.8	.5	1.7	2.7	1.9
Ceramic tile	1.0	1.4	.7	1.1	1.0
Roofing and gutter work	1.3	.6	1.4	1.5	1.8
Ornamental iron work	.5	.3	.4	.6	.6
Cleaning	.6	.2	.4	.3	1.7
Asphalt paving	.9	.3	1.0	1.1	1.0
Other	.9	1.1	1.9	3.0	3.0

NOTE: Detail may not add to totals due to rounding.

Table 6. Onsite employee-hour requirements in apartment construction, by building characteristics and region, 1971

Characteristic	United States		Northeast		South		North Central		West	
	Hours per $1,000 of cost	Hours per 100 square feet	Hours per $1,000 of cost	Hours per 100 square feet	Hours per $1,000 of cost	Hours per 100 square feet	Hours per $1,000 of cost	Hours per 100 square feet	Hours per $1,000 of cost	Hours per 100 square feet
All projects	50.0	64.8	49.2	91.7	59.8	71.1	45.1	57.1	41.2	47.7
Foundation:										
Concrete block	59.9	65.4	–	–	61.8	68.6	(1)	(1)	–	–
Concrete pilings	58.7	93.1	(1)	(1)	66.5	82.6	–	–	–	–
Poured concrete	47.7	60.2	51.4	80.3	57.2	66.3	45.8	57.7	41.6	48.3
Other	46.8	58.4	(1)	(1)	51.2	61.8	(1)	(1)	(1)	(1)
Frame:										
Wood	45.6	53.8	(1)	(1)	53.0	62.0	41.5	50.1	41.0	47.1
Steel	(1)	(1)	(1)	(1)	(1)	(1)	–	–	–	–
Brick	49.4	68.8	(1)	(1)	(1)	(1)	(1)	(1)	–	–
Concrete block	65.9	79.0	–	–	66.4	79.4	(1)	(1)	(1)	(1)
Reinforced concrete	49.2	82.4	(1)	(1)	(1)	(1)	49.9	67.8	(1)	(1)
Other	52.9	70.5	(1)	(1)	(1)	(1)	(1)	(1)	–	–
Exterior walls:										
Brick	53.1	73.4	47.5	89.6	59.4	70.6	47.6	64.1	–	–
Wood	(1)	(1)	–	–	–	–	(1)	(1)	(1)	(1)
Stucco	45.3	52.5	–	–	69.1	83.4	–	–	40.6	46.6
Aluminum siding	(1)	(1)	(1)	(1)	–	–	–	–	–	–
Curtain wall	(1)	(1)	(1)	(1)	–	–	(1)	(1)	–	–
Other	42.4	46.6	–	–	(1)	(1)	40.7	42.8	46.2	61.8
Interior walls:										
Drywall (sheetrock)	49.8	64.1	50.3	98.1	59.1	70.1	45.1	57.1	41.2	47.7
Plaster	52.8	78.8	(1)	(1)	(1)	(1)	–	–	–	–
Floor base:										
Concrete	49.1	64.0	50.6	102.3	55.8	68.5	45.7	55.2	39.8	44.2
Wood/plywood	53.1	68.7	(1)	(1)	70.0	77.1	44.2	61.7	(1)	(1)
Other	44.2	53.2	(1)	(1)	–	–	45.6	50.7	(1)	(1)
Floor covering:										
Hardwood	62.7	82.6	(1)	(1)	69.0	84.5	–	–	–	–
Asphalt tile	50.5	84.1	47.5	107.2	60.8	67.0	(1)	(1)	(1)	(1)
Vinyl/vinyl asbestos	52.8	66.6	(1)	(1)	57.0	67.0	49.6	64.9	48.6	65.7
Carpeting	42.8	50.3	–	–	51.6	62.6	41.6	50.9	39.0	43.1
Roof base:										
Concrete	52.2	87.7	50.2	101.6	(1)	(1)	54.4	72.8	(1)	(1)
Wood/plywood	48.6	58.1	46.8	72.5	59.3	67.9	42.1	52.5	41.0	47.2
Insulating board	(1)	(1)	–	–	(1)	(1)	–	–	–	–
Other	(1)	(1)	–	–	(1)	(1)	(1)	(1)	–	–
Roof covering:										
Built up	51.0	68.2	47.6	88.8	63.2	78.2	44.9	58.2	42.7	48.1
Asphalt shingle	47.4	56.3	(1)	(1)	55.2	60.9	43.7	52.8	(1)	(1)
Wood shingle	(1)	(1)	–	–	–	–	(1)	(1)	–	–
Other	52.5	75.3	(1)	(1)	(1)	(1)	(1)	(1)	–	–
Heating unit:										
Central to project	54.7	80.1	47.6	88.8	64.9	80.1	52.2	68.6	(1)	(1)
Individual building	47.8	59.6	–	–	55.9	59.6	41.8	58.5	(1)	(1)
Individual apartment	46.3	54.8	(1)	(1)	55.3	64.3	42.3	50.3	39.7	45.6
Other	(1)	(1)	–	–	(1)	(1)	–	–	(1)	(1)
Type of heat:										
Forced air	48.4	59.0	(1)	(1)	58.0	71.9	43.3	50.4	39.6	47.9
Hot water or steam	50.9	73.0	47.6	88.8	67.3	72.0	47.7	64.3	45.6	52.6
Baseboard electric	51.8	67.6	(1)	(1)	53.1	64.1	(1)	(1)	(1)	(1)
Wall unit	53.3	55.2	–	–	65.3	76.8	–	–	43.7	41.2
Heating fuel:										
Electricity	51.9	69.7	(1)	(1)	52.8	67.8	(1)	(1)	(1)	(1)
Gas	49.8	59.8	53.7	89.5	61.5	67.9	45.7	57.5	41.1	47.5
Oil	50.0	92.1	45.3	90.5	(1)	(1)	–	–	–	–
Air-conditioning:										
Central to project	61.7	81.6	(1)	(1)	64.9	80.1	(1)	(1)	(1)	(1)
Individual building	50.2	61.2	–	–	62.1	68.2	(1)	(1)	(1)	(1)
Individual apartment	46.7	54.0	–	–	53.3	62.5	40.5	45.7	45.8	55.4
Window units	(1)	(1)	–	–	–	–	(1)	(1)	–	–
None	46.5	63.6	46.6	91.0	56.5	65.0	49.6	62.1	40.3	46.5
Incinerators/compactors:										
Yes	51.8	85.2	47.2	88.2	(1)	(1)	54.4	72.8	–	–
No	49.2	58.5	(1)	(1)	59.2	67.5	42.2	52.6	41.2	47.7

See footnotes at end of table.

Table 6. Onsite employee-hour requirements in apartment construction, by building characteristics and region, 1971—Continued

Characteristic	United States		Northeast		South		North Central		West	
	Hours per $1,000 of cost	Hours per 100 square feet	Hours per $1,000 of cost	Hours per 100 square feet	Hours per $1,000 of cost	Hours per 100 square feet	Hours per $1,000 of cost	Hours per 100 square feet	Hours per $1,000 of cost	Hours per 100 square feet
Number of stories:										
1 story	(1)	(1)	—	—	(1)	(1)	—	—	—	—
2-3 stories	46.7	55.9	(1)	(1)	55.5	64.9	42.2	52.6	41.0	47.2
4 stories and over	55.0	83.4	48.7	90.0	67.3	82.2	54.4	72.8	(1)	(1)
Elevators:										
Yes	54.9	83.5	47.2	88.2	(1)	(1)	53.3	71.1	(1)	(1)
No	47.3	56.6	(1)	(1)	55.3	64.5	41.6	51.5	41.0	47.1

[1] Insufficient data.

NOTE: Dash denotes that the survey had no sample projects in this cell.

Most projects surveyed had poured concrete foundations, wood frames, brick exterior walls, and were two to three stories high with two bedrooms per unit and no elevators. This pattern was largely the same in all regions except the Northeast. In that region, the dominant type of frame was reinforced concrete and most projects were four stories and over with elevators.

The distinctive characteristics of projects in the Northeast region were reflected in the distribution of onsite employee-hours by type of contractor. For example, since a large proportion of these projects had reinforced concrete frames, concrete work contractors had the greatest proportion of total onsite employee-hours. Of course, the predominance of reinforced concrete frames was a direct result of the generally taller buildings in the Northeast.

Wages and earnings by building characteristics. Of the surveyed housing, the average project had 157 dwelling units with 979 square feet per dwelling unit. Each unit cost $12,686. In the Northeast, building characteristics differed sharply from those of the other regions. Projects in the Northeast had the largest number of dwelling units, 240, compared with the South, 149; the North Central region, 163; and the West, 135. However, units in the Northeast were smaller, 935 square feet, and cost more, $17,438, as shown in table 2.

Despite smaller average units in the Northeast, construction costs per unit were the highest because onsite employee-hours per 100 square feet were the highest (table 6), onsite average hourly earnings were second highest (table 7), and, because of the taller buildings of that region, over two-thirds of the projects had elevators.

There was not a perfect correlation between the proportion of total construction cost that was accounted for by wages, and average onsite hourly earnings, degree of unionization, or onsite labor hours per $1,000 of construction contract. However, there tended to be a close relationship among these variables, on a regional basis. The tabulation below provides some indication of these interrelations:

	Union contracts as a percent of total contracts	*Onsite employee-hours per $1,000*	*Onsite average hourly earnings*
United States	64.2	50.0	$5.60
Northeast	89.8	49.2	6.27
South	25.1	59.8	4.57
North Central	82.6	45.1	6.32
West	90.8	41.2	6.22

If one considers the ranking of each region in regard to the three variables listed, the interaction of these factors

Table 7. Onsite average hourly earnings and wages as a percent of contract cost in apartment construction, by building characteristics and region, 1971

Characteristic	United States		Northeast		South		North Central		West	
	Average hourly earnings	Wages as percent of contract	Average hourly earnings	Wages as percent of contract	Average hourly earnings	Wages as percent of contract	Average hourly earnings	Wages as percent of contract	Average hourly earnings	Wages as percent of contract
All projects	$5.60	27.9	$6.27	30.8	$4.57	27.3	$6.32	28.5	$6.22	25.2
Foundation:										
Concrete block	4.71	28.2	—	—	4.62	28.6	(1)	(1)	—	—
Concrete pilings	5.18	30.4	(1)	(1)	4.90	32.6	—	—	—	—
Poured concrete	5.87	28.0	6.33	32.5	4.11	23.5	6.37	29.2	6.20	25.8
Other	5.33	25.0	(1)	(1)	4.64	23.7	(1)	(1)	(1)	(1)
Frame:										
Wood	5.46	24.9	(1)	(1)	4.21	22.3	6.50	27.0	6.23	25.5
Steel	(1)	(1)	(1)	(1)	(1)	(1)	—	—	—	—

See footnotes at end of table.

Table 7. Onsite average hourly earnings and wages as a percent of contract cost in apartment construction, by building characteristics and region, 1971—Continued

Characteristic	United States		Northeast		South		North Central		West	
	Average hourly earnings	Wages as percent of contract	Average hourly earnings	Wages as percent of contract	Average hourly earnings	Wages as percent of contract	Average hourly earnings	Wages as percent of contract	Average hourly earnings	Wages as percent of contract
Brick	5.84	28.9	[1]	[1]	[1]	[1]	[1]	[1]	–	–
Concrete block	4.81	31.7	–	–	4.76	31.6	[1]	[1]	[1]	[1]
Reinforced concrete	6.12	30.1	[1]	[1]	[1]	[1]	6.10	30.4	[1]	[1]
Other	5.92	31.3	[1]	[1]	[1]	[1]	[1]	[1]	–	–
Exterior walls:										
Brick	5.35	28.4	6.30	29.9	4.48	26.6	6.32	30.1	–	–
Wood	[1]	[1]	–	–	–	–	[1]	[1]	[1]	[1]
Stucco	5.99	27.2	–	–	5.24	36.2	–	–	6.25	25.3
Aluminum siding	5.63	45.1	[1]	[1]	–	–	–	–	–	–
Curtain wall	[1]	[1]	[1]	[1]	–	–	[1]	[1]	–	–
Other	5.97	25.3	–	–	[1]	[1]	6.44	26.2	5.96	27.5
Interior walls:										
Drywall (sheetrock)	5.54	27.6	6.09	30.6	4.52	26.7	6.32	28.5	6.22	25.7
Plaster	6.41	33.8	[1]	[1]	[1]	[1]	–	–	–	–
Floor base:										
Concrete	5.58	27.4	6.26	31.7	4.66	26.0	6.25	28.6	6.12	24.4
Wood/plywood	5.52	29.3	[1]	[1]	4.39	30.8	6.32	27.9	[1]	[1]
Other	6.43	28.4	[1]	[1]	–	–	6.64	30.3	[1]	[1]
Floor covering:										
Hardwood	5.18	32.5	[1]	[1]	4.80	33.1	–	–	–	–
Asphalt tile	5.85	29.5	6.34	30.1	4.44	27.0	[1]	[1]	[1]	[1]
Vinyl/vinyl asbestos	5.50	29.0	6.33	33.4	4.54	25.9	6.16	30.6	6.41	31.2
Carpeting	5.78	24.7	–	–	4.30	22.2	6.42	26.7	6.11	23.8
Roof base:										
Concrete	6.07	31.7	6.28	31.5	[1]	[1]	6.00	32.6	[1]	[1]
Wood/plywood	5.47	26.6	6.23	29.1	4.45	26.4	6.43	27.1	6.22	25.5
Insulating board	[1]	[1]	–	–	[1]	[1]	–	–	–	–
Other	[1]	[1]	–	–	[1]	[1]	[1]	[1]	–	–
Roof covering:										
Built up	5.66	28.9	6.32	30.1	4.77	30.2	6.23	28.0	6.19	26.4
Asphalt shingle	5.34	25.3	[1]	[1]	4.14	22.9	6.43	28.1	[1]	[1]
Wood shingle	[1]	[1]	–	–	–	–	[1]	[1]	–	–
Other	5.99	31.4	[1]	[1]	[1]	[1]	[1]	[1]	–	–
Heating unit:										
Central to project	5.60	30.6	6.32	30.1	4.74	30.8	6.12	31.9	[1]	[1]
Individual building	5.21	24.9	–	–	3.49	19.5	6.30	26.3	[1]	[1]
Individual apartment	5.66	26.2	[1]	[1]	4.53	25.0	6.48	27.4	6.27	24.9
Other	[1]	[1]	–	–	[1]	[1]	–	–	[1]	[1]
Type of heat:										
Forced air	5.36	26.0	[1]	[1]	4.36	25.3	6.52	28.2	6.28	24.9
Hot water or steam	5.88	29.9	6.32	30.1	4.63	31.1	6.19	29.5	6.12	27.9
Baseboard electric	5.44	28.2	[1]	[1]	5.08	27.0	[1]	[1]	[1]	[1]
Wall unit	5.50	29.3	–	–	4.98	32.5	–	–	6.12	26.8
Heating fuel:										
Electricity	5.33	27.6	[1]	[1]	5.00	26.4	[1]	[1]	[1]	[1]
Gas	5.54	27.5	5.99	32.2	4.32	26.5	6.33	28.9	6.23	25.6
Oil	6.00	30.0	6.45	29.2	[1]	[1]	–	–	–	–
Air-conditioning:										
Central to project	5.09	31.4	[1]	[1]	4.74	30.8	[1]	[1]	[1]	[1]
Individual building	5.41	27.1	–	–	3.58	22.2	6.30	29.9	[1]	[1]
Individual apartment	5.47	25.5	–	–	4.49	23.9	6.48	26.2	6.19	28.4
Window units	[1]	[1]	–	–	–	–	[1]	[1]	–	–
None	6.00	27.9	6.36	29.6	4.59	25.9	6.28	31.2	6.28	25.3
Incinerators/compactors:										
Yes	5.94	30.8	6.34	29.9	[1]	[1]	6.00	32.6	–	–
No	5.44	26.8	[1]	[1]	4.47	26.5	6.45	27.2	6.22	25.7
Number of stories:										
1 story	[1]	[1]	–	–	[1]	[1]	–	–	–	–
2-3 stories	5.52	25.8	[1]	[1]	4.41	24.5	6.45	27.2	6.22	25.5
4 stories and over	5.77	31.7	6.31	30.7	4.92	33.1	6.00	32.6	[1]	[1]
Elevators:										
Yes	5.82	32.0	6.34	29.9	[1]	[1]	6.04	32.2	[1]	[1]
No	5.45	25.8	[1]	[1]	4.35	24.0	6.47	26.9	6.22	25.5

[1] Insufficient data.

NOTE: Dashes denote that there were no survey projects in this cell.

becomes evident. The South shows the classic relationship among the three series, e.g., the smallest amount of unionization, the greatest amount of onsite employee-hours per $1,000, and the lowest average hourly earnings. On the other hand, in the West the interaction of these three variables is somewhat more subtle. The West led in the degree of unionization, which would tend to raise the hourly wage rate. The reaction to this apparently was a more efficient use of labor; the West had the lowest number of onsite employee-hours per $1,000 and the second lowest onsite average hourly earnings. Lower hourly earnings are largely the result of a smaller percentage of total onsite labor hours being paid at overtime rates. Similar generalizations can be made about the other two regions. Obviously, there are extraneous factors which this survey was not able to measure.

Cost per square foot by building characteristics. Cost per square foot by characteristics of buildings, shown in table 8, exhibited the same trend as employee-hour requirements. That is, the more common a given characteristic, the more likely it was to have the lowest cost per square foot. Although this pattern was true less frequently than for employee-hours, nevertheless it was predominant in all regions. Wood frame buildings, for example, cost the least per square foot and wood was the most frequently used framing material for apartment construction. Exceptions were in foundations, exterior walls, floor base, and roof covering.

Offsite

Offsite employee-hours represent the builder's administrative office and warehousing activities, and the labor to produce and distribute the materials, supplies, and equipment required at the construction site. Major categories involved are: (1) Offsite construction, (2) manufacturing, (3) wholesale trade, transportation, and services, and (4) other industries either directly or indirectly involved in the production and distribution process.

For every hour of work performed at the construction site, an additional 1.5 employee-hours of effort were required to produce these materials, supplies, and services (including offsite construction). These expenditures amounted to 76 employee-hours for each $1,000 of construction.[18]

Builders' offsite employee-hours. Eight employee-hours per $1,000 of construction were expended in this category, which includes contractors' administrative, coordinating, estimating, scheduling, engineering, maintenance, and warehousing activities. Construction offsite hours, a relatively small portion of employee-hour requirements, constituted 6 percent of the total. This is inherent in an industry where an average of 31 subcontracts is involved in each project. The general contractor often limits his major responsibilities to overall coordination, scheduling, control, and supervision of construction.

Manufacturing employee-hours. The manufacturing sector was by far the largest and most important contributor of offsite employee-hours because of the materials, supplies, and equipment required for construction. Involved were 59 major industrial producer groups, requiring 43 employee-hours per $1,000 of construction or 63 percent of all offsite employee-hours, excluding offsite builder activities. Four major groups made up 50 percent of all manufacturing employee-hours: (1) Logging, sawmills, and planing mills; (2) millwork and plywood; (3) cement, clay, and concrete products; and (4) fabricated structural metal.

Wholesale trade, transportation, and service employee-hours. Fifteen employee-hours per $1,000 of construction were required to produce the items from this sector of the economy. Wholesale trade and transportation contributed 80 percent of this amount.

Mining and other industries employee-hours. This group included agriculture, maintenance, construction, communications, utilities, finance, insurance, real estate, and government enterprises. Ten employee-hours per $1,000 of construction were generated in these sectors.

This initial study of multifamily housing construction did not permit comparison of changes in cost relationships from previous years in this segment of residential construction. However, comparisons can be made with studies of other types of residential construction. Analysis of the bill of materials for a study of public housing construction for 1968, for example, indicated the same pattern of expenditures for each major materials group. The stone, clay, glass, and concrete products group made up over 25 percent of the cost of materials and equipment; lumber and wood products represented another 14 percent. These two categories of construction, i.e., multifamily and public housing, were similar in type of construction but building characteristics varied in many respects.

In a 1969 survey of single-family housing construction, the three most important categories of material expenditures, making up about 72 percent of total materials and equipment costs, were lumber and wood products; stone, clay, glass, and concrete products; and fabricated metal products. Disbursements for these three types of expenditures in multifamily housing construction were considerably more and their relative importance was quite different. For single-family housing, lumber and wood products required the greatest expenditure per $1,000 of construction and constituted 37 percent of all materials and equipment costs. Stone, clay, glass, and concrete products, which were second, made up 21 percent of the cost. These results were expected because of differences in the type of construction and building characteristics.

[18] Retail trade is excluded from this estimate because purchased transactions for materials are assumed to be made at the wholesale level only. Some retail transactions are made, but the extent of such purchases in construction is not known.

Table 8. Cost per square foot in apartment construction, by building characteristics and region, 1971

Characteristic	United States	Northeast	South	North Central	West
All projects	$12.96	$18.64	$11.89	$12.67	$11.57
Foundation:					
Concrete block	10.92	–	11.10	(1)	–
Concrete pilings	15.86	(1)	12.43	–	–
Poured concrete	12.63	15.61	11.58	12.60	11.61
Other	12.47	(1)	12.08	(1)	(1)
Frame:					
Wood	11.80	(1)	11.70	12.07	11.49
Steel	(1)	(1)	(1)	–	–
Brick	13.93	(1)	(1)	(1)	–
Concrete block	12.00	–	11.95	(1)	(1)
Reinforced concrete	16.75	(1)	(1)	13.58	(1)
Other	13.32	(1)	(1)	(1)	–
Exterior walls:					
Brick	13.83	18.87	11.87	13.47	–
Wood	(1)	–	–	(1)	(1)
Stucco	11.59	–	12.08	–	11.50
Aluminum siding	–	(1)	–	–	–
Curtain wall	(1)	(1)	–	(1)	–
Other	10.98	–	(1)	10.52	13.37
Interior walls:					
Drywall (sheetrock)	12.85	19.50	11.86	12.67	11.57
Plaster	14.93	(1)	(1)	–	–
Floor base:					
Concrete	13.04	20.22	12.28	12.08	11.08
Wood/plywood	12.94	(1)	11.01	13.98	(1)
Other	12.04	(1)	–	11.13	(1)
Floor covering:					
Hardwood	13.18	(1)	12.25	–	–
Asphalt tile	16.67	22.58	11.01	(1)	(1)
Vinyl/vinyl asbestos	12.63	13.79	11.75	13.08	13.51
Carpeting	11.76	–	12.11	12.24	11.05
Roof base:					
Concrete	16.81	20.27	(1)	13.38	(1)
Wood/plywood	11.97	15.50	11.44	12.45	11.50
Insulating board	(1)	–	(1)	–	–
Other	(1)	–	(1)	(1)	–
Roof covering:					
Built up	13.36	18.65	12.36	12.95	11.26
Asphalt shingle	11.89	(1)	11.02	12.06	(1)
Wood shingle	(1)	–	–	(1)	–
Other	14.35	(1)	(1)	(1)	–
Heating unit:					
Central to project	14.65	18.65	12.33	13.14	(1)
Individual building	12.46	–	10.68	13.98	(1)
Individual apartment	11.85	(1)	11.64	11.89	11.49
Other	(1)	–	(1)	–	(1)
Type of heat:					
Forced air	12.19	(1)	12.40	11.63	12.08
Hot water or steam	14.34	18.65	10.70	13.50	11.54
Baseboard electric	13.04	(1)	12.07	(1)	(1)
Wall unit	10.34	–	11.76	–	9.43
Heating fuel:					
Electricity	13.43	(1)	12.84	(1)	(1)
Gas	12.02	16.66	11.05	12.59	11.54
Oil	18.44	20.00	(1)	–	–
Air-conditioning:					
Central to project	13.22	–	12.33	(1)	(1)
Individual building	12.20	–	10.99	13.34	(1)
Individual apartment	11.57	–	11.72	11.28	12.10
Window units	(1)	–	–	(1)	–
None	13.68	19.53	11.51	12.51	11.55
Incinerators/compactors:					
Yes	16.45	18.67	(1)	13.38	–
No	11.89	(1)	11.40	12.47	11.57
Number of stories:					
1 story	(1)	–	(1)	–	–
2-3 stories	11.96	(1)	11.70	12.47	11.50
4 stories and over	15.16	18.47	12.21	13.38	(1)
Elevators:					
Yes	15.21	18.67	(1)	13.36	(1)
No	11.97	(1)	11.68	12.40	11.50

[1] Insufficient data.

NOTE: Dash denotes that the survey had no sample projects in this cell.

Chapter IV. Distribution of Costs and Wages

Relative cost shares

Onsite wages made up 28 percent of the total construction cost, as shown in the distribution of construction contract value below:

	United States	*North-east*	*South*	*North Central*	*West*
			(percent)		
Total costs	100.0	100.0	100.0	100.0	100.0
Onsite wages and salaries	27.9	30.8	28.5	27.3	25.2
Materials and supplies	44.2	37.6	46.8	46.5	43.7
Equipment	3.0	2.5	2.6	3.5	3.4
Overhead and profit	24.8	29.1	22.1	22.7	27.7

The largest share of these costs, 44 percent, went for materials and supplies. Equipment used to construct the projects made up another 3 percent of cost. The remaining 25 percent covered builders' and contractors' overhead costs[19] and profit.

Contractor costs

The distribution of construction contract value by contractor as shown in table 9 looks quite different from the employee-hour distribution discussed earlier. General contractors, for example, made up just under 32 percent of the total contract value but only about 22 percent of onsite employee-hours for the United States as a whole. On the other hand, carpenters provided nearly 13 percent of the employee-hours but received less than 10 percent of the contract value. This discrepancy is explained in part by the significant amount of overhead which the general contractor assumes on any project. Other contractors, accounting for a significant but decreasing proportion of contract value, were plumbing; concrete; heating, ventilating, and air-conditioning; electrical; wallboard; and masonry.

All the regions displayed the same general contract value pattern. However, a different mix of buildings in the four regions resulted in a considerable range in the contract value accounted for by some types of contractors. For example, concrete work received about 9 percent of the contract value for the United States as a whole, but by region the proportion ranged from about 5 percent in the South, where few high rise buildings were constructed, to over 18 percent in the Northeast, where several such large buildings were erected. The proportion of contract value going for carpentry did not have as wide a range but was considerably higher in the North Central region and the West where wood was used more in apartment buildings. The masonry contractors' share dropped off considerably in the West where wood is used primarily for framing and stucco is used for building exteriors.

The general contractor provided the major portion of the total cost for materials, equipment, and supplies; onsite labor; and administrative costs in all regions. Only in the Northeast was the concrete contractor the leading subcontractor in value of contract. This was a direct result of the structural characteristics of the nine sample projects in

[19] Overhead costs include salaries of offsite workers, supplemental benefits, interest expense, other overhead, and miscellaneous expenses.

Table 9. Percent distribution of contract cost in apartment construction, by type of contractor, United States and regions, 1971

Contractor	United States	North-east	South	North Central	West
Total	100.0	100.0	100.0	100.0	100.0
General contractor	31.9	21.9	40.0	31.5	29.1
Grading, footings, excavation, and foundation	3.0	4.6	3.0	2.8	1.7
Waterproofing	.1	.1	.1	.0	.0
Concrete work	8.8	18.2	5.4	4.6	10.5
Structural steel erection	.7	2.5	.3	.4	.1
Carpentry	9.9	5.3	7.4	13.2	14.3
Masonry	5.3	8.7	6.9	4.0	.8
Heating, ventilation, and air-conditioning	6.2	5.9	7.3	7.1	3.5
Plumbing	9.0	8.9	6.2	10.5	11.8
Electrical	5.9	6.5	5.4	6.0	6.1
Elevators	.8	2.3	.5	.7	.0
Insulation	.5	.1	.7	.5	.5
Wallboard	5.9	5.9	5.2	6.9	5.8
Plastering and lathing	1.3	2.0	.5	.2	3.3
Painting and paperhanging	2.0	1.8	3.0	1.1	1.5
Hardwood flooring	.3	.7	.4	.1	.0
Linoleum, vinyl tile, and carpeting	2.3	.8	2.0	3.2	3.1
Ceramic tile	.8	1.0	.7	.8	.8
Roofing and gutter work	1.2	.7	1.4	1.3	1.4
Ornamental iron work	.8	.6	.7	1.0	1.1
Cleaning	.1	.0	.1	.0	.5
Asphalt paving	1.2	.3	1.3	1.6	1.1
Other	2.0	1.2	1.5	2.5	3.0

NOTE: Detail may not add to totals due to rounding.

that region. For example, seven projects had poured concrete foundations, three had reinforced concrete frames, five had a concrete floor base, and four had concrete roof bases. The carpentry contractor was the leading subcontractor in the other regions. Table 9 provides a percent distribution of contract value by type of contractor, nationally and for the four regions.

Gross earnings by occupation

The percent distribution of gross wages by occupation (table 10) presents a different pattern from the distribution of employee-hours shown in table 4. Although skilled trades provided about 66 percent of U.S. total onsite hours, their proportion of earnings was higher, almost 72 percent. Conversely, laborers and other semiskilled and unskilled occupations contributed 28 percent of onsite employee-hours; but their proportion of total pay was only 21 percent.

Although carpenters ranked second after laborers and helpers in employee-hours, they were well above in gross earnings. These two groups received 46 percent of all wages paid in apartment construction. In descending order of total wages received, other important occupations were plumbers and pipefitters, superintendents and blue-collar supervisors, electricians, bricklayers, painters, cement finishers, and operating engineers.

All regions tended to follow a similar pattern. Carpenters receive the largest proportion of any occupation in each region except the South. Onsite wages received by carpenters ranged from just under 22 percent in the Northeast to almost 34 percent in the West because of the greater amount of wood used in that region. The proportion of wages paid to laborers and helpers ranged from about 13 percent of the total in the West to over 25 percent in the South.

Table 10. Percent distribution of gross earnings in apartment construction, by occupation, United States and regions, 1971

Occupation	United States	Northeast	South	North Central	West
All occupations	100.0	100.0	100.0	100.0	100.0
Professional, technical, and kindred workers	7.7	7.4	7.7	7.2	8.9
Professional/technical	.4	1.1	.3	.1	.3
Superintendents/blue-collar supervisors	7.2	6.0	7.2	7.0	8.5
Clerical workers	.2	.3	.2	.1	.1
Skilled trades	71.6	71.2	65.3	75.9	76.6
Bricklayers	5.5	6.8	7.5	5.4	.8
Carpenters	27.0	21.8	23.8	30.1	33.9
Cement finishers	3.6	5.2	3.0	3.1	3.4
Electricians	6.6	6.8	5.5	7.9	6.8
Elevator constructors	.4	.9	.3	.2	.1
Insulation workers	.4	.5	.4	.3	.4
Iron workers-ornamental	.6	.8	.5	.8	.4
Iron workers-reinforced	.7	1.0	.8	.5	.7
Iron workers-structural	1.4	4.3	.6	.8	.2
Lathers	.6	1.2	.3	.1	1.4
Operating engineers	3.1	2.1	3.0	3.6	3.5
Painters	4.1	3.2	5.3	3.0	4.5
Plasterers	1.3	1.7	1.1	.4	2.2
Plumbers and pipefitters	10.6	12.3	8.4	11.6	11.1
Roofers	.8	.5	.7	.7	1.3
Sheet-metal workers	2.2	.4	1.9	3.7	2.8
Soft-floor layers	.5	.4	.7	.1	.7
Tile setters	.8	.6	.8	1.0	.5
Other skilled workers	1.4	.8	.8	2.3	1.9
Laborers and others	20.7	21.4	27.0	16.9	14.5
Laborers, helpers, and tenders	19.0	19.8	25.2	15.4	12.8
Truckdrivers	.7	.7	.7	.7	.7
Custodial workers	.2	.1	.4	.3	.2
Other semiskilled and unskilled workers	.7	.8	.7	.5	.7

NOTE: Detail may not add to totals due to rounding.

Wages by occupation

Straight-time average hourly rates (unweighted) in this study generally were lower than average union hourly wage rates in the building trades as of July 1, 1970.[20] Exceptions are shown in the following tabulation:

Occupation	*Average hourly earnings from study*	*Union wage rate*
All occupations	$5.56	$6.18
Glaziers	6.25	6.08
Paperhangers	6.30	6.02
Plasterers	6.57	6.35
Terrazzo workers	6.66	6.46

NOTE: These unweighted wage rates are not comparable to the regional wage rates listed later.

The following tabulation shows the average hourly earnings developed by the study and the union wage rates for the four broad regions:

Region	*Average hourly earnings from study*	*Union wage rate*
United States	$5.60	$6.18
Northeast	6.27	6.41
South	4.57	5.21
North Central	6.32	6.38
West	6.22	5.86

The two rates differ the most in the South where earnings in this study were $4.57 compared with $5.21 for the union rate. Only 25.1 percent of the contracts in the

[20] See *Union Wages and Hours: Building Trades, July 1, 1970*, Bull. 1709 (Bureau of Labor Statistics, 1971).

study for the South were with unionized contractors compared with 90.8 percent for the West. The union wage rate exceeds the study's average earnings rate in all regions except the West. The higher earnings rate in the West is largely a reflection of the fact that a higher percentage of the onsite employee-hours were provided by skilled trades, i.e., 73.8 percent compared to the national average of 66.1 percent. The North Central region also employed a high proportion of skilled workers, 72.7 percent, and hourly earnings almost equaled the union rate.

Other factors that may account for some of the disparity between these two series are (a) the inclusion of overtime in the study's data (b) the exclusion of Alaska from the area covered by the survey.

Wage share

Onsite wages as a percent of total cost for the projects studied ranged from under 20.0 to over 40.1 percent. Although distributed fairly evenly over the range up to 32.5 percent, the proportion of projects dropped significantly for wage costs above this level, as shown in the following tabulation. The median class was 25.1 to 27.5 percent of contract cost.

Onsite wages as a percent of contract cost	*Percent of projects studied*
Under 20.0	13.5
20.1–22.5	12.4
22.6–25.0	14.6
25.1–27.5	13.5
27.6–30.0	12.4
30.1–32.5	14.6
32.6–35.0	7.9
35.1–37.5	3.4
37.6–40.0	2.2
40.1 and over	5.6

The following tabulations array the regions in ascending order with regard to: (a) percent of total contract cost represented by onsite wages and (b) number of onsite employee-hours per $1,000 of total contract cost.

Region	*Onsite wages as a percent of contract cost*
United States	27.9
West	25.2
South	27.3
North Central	28.5
Northeast	30.8

Region	*Onsite employee-hours per $1,000 of contract cost*
United States	50.0
West	41.2
North Central	45.1
Northeast	49.2
South	59.8

The West ranks first in both tabulations; that is, it had the lowest expenditure of employee-hours per $1,000 of contract cost and the lowest proportion of the cost allotted for onsite wages. However, the position of the South in the two distributions, at first, appears contradictory. That is, the South had the highest expenditure of employee-hours per $1,000 of total contract cost and the second lowest expenditure for onsite wages as a percent of total cost. This situation is the result of the South having the lowest average hourly earnings, $4.57.

Materials, supplies, and equipment.

Materials, supplies, and equipment costs for multifamily housing construction amounted to $476 per $1,000 of construction costs, or $617 per 100 square feet (table 11). Of this amount, 94 percent was spent for materials and supplies and the balance was allocated to the rental value or equivalent of equipment required during construction.

The stone, clay, glass, and concrete products category had the largest disbursements for materials, with $105 expended per $1,000 of construction costs or 22 percent of all materials and equipment costs. Lumber and wood products, except furniture, were $89 per $1,000 of construction, or 19 percent of materials and equipment costs. The fabricated metal products group, except ordnance and transportation equipment, was next most important at $74 or 16 percent. These three major categories constituted 57 percent of all purchased materials, supplies, and equipment costs. Other individual categories of materials ranked considerably below these figures in relative importance.

For convenience, construction machinery and equipment were included in the materials table as a separate category. Costs for construction equipment were based on rental or equivalent value of machinery or equipment at the construction site, exclusive of equipment operators. Expenditures amounted to $31 per $1,000 or slightly over 6 percent of all materials and equipment costs.

Table 11. Cost of materials, supplies, and equipment used in apartment construction, by product, 1971

Product	Cost per $1,000 of contract cost	Cost per 100 square feet	Percent distribution[1]
Total materials, supplies, and equipment	$476.25	$617.08	100.00
Total materials and supplies	445.33	577.02	93.51
Agricultural products	3.98	5.15	.83
Seeds and straw	.24	.31	.05
Nursery products including sod	3.74	4.85	.79
Mining and quarrying of nonmetallic minerals, except fuels	6.40	8.29	1.34
Sand and gravel and riprap	4.61	5.97	.97
Fill dirt, topsoil	1.79	2.32	.38
Textile mill products	9.28	12.03	1.95
Carpeting and pads	8.79	11.39	1.85
Acoustic felts	.37	.48	.08
Oakum and rope	.12	.16	.03
Apparel and other finished products made from fabrics and similar materials	1.24	1.61	.26
Draperies and curtains	1.13	1.46	.24
Miscellaneous apparel and other finished products	.11	.14	.02
Lumber and wood products, except furniture	88.94	115.26	18.67
Poles, timber (untreated)	.15	.19	.03
Dressed and rough boards, and dimension lumber	43.52	56.39	9.14
Flooring (hardwood) and other hardwood	3.32	4.30	.70
Wooden shingles and excelsior	.56	.73	.12
Millwork	20.10	26.04	4.22
Plywood	11.01	14.26	2.31
Fabricated structural laminates, prefabricated	7.56	9.80	1.59
Treated lumber	.82	1.07	.17
Plumbing accessories, fittings, and wood trim	.26	.34	.06
Miscellaneous wood products	1.63	2.13	.34
Furniture and fixtures	18.55	24.03	3.89
Kitchen cabinets and vanities, prebuilt	12.87	16.68	2.70
Wooden cabinets, radio/TV, kitchen, medicine	1.57	2.04	.33
Metal cabinets, radio/TV, kitchen, medicine	2.17	2.81	.46
Wood partitions	.38	.49	.08
Metal partitions	.20	.26	.04
Venetian blinds, shades, curtain tracks, rods	1.07	1.39	.23
Miscellaneous furniture and fixtures	.28	.36	.06
Paper and allied products	2.13	2.76	.45
Tape	.48	.62	.10
Pressed wood	.25	.33	.05
Enameled masonite tile	.12	.16	.03
Construction paper	.36	.47	.08
Insulation, fiberboard	.81	1.05	.17
Miscellaneous paper products	.10	.13	.02
Chemical and allied products	10.55	13.66	2.21
Oxygen, acetelyne, and other chemicals, not elsewhere classified	.31	.40	.06
Plastic vapor barrier sheets	.31	.40	.07
Miscellaneous cleaners, thinners, waxes, polishes, solvents	$ .11	$ .14	.02
Paint	6.56	8.50	1.38
Putty, calking, and glazing compounds	.52	.67	.11
Fertilizer	.20	.26	.04
Adhesives, all others	.78	1.02	.16
Concrete admixtures, hardeners	1.14	1.48	.24
Sealants	.30	.39	.06
Miscellaneous chemical products	.30	.42	.06
Petroleum refining and related products	8.29	10.74	1.74
Fuels, diesel fuel, gas oil, grease	.82	1.07	.17
Asphalt paving	3.65	4.74	.77
Insulation, asphalt board, rolls, and sheathing	1.52	1.96	.32
Asphalt and tar pitches	1.04	1.34	.22
Membrane waterproofing vapor barrier	1.26	1.63	.26
Rubber and miscellaneous plastic products	6.72	8.71	1.41
Rubber products	.45	.59	.10
Adhesives, rubber cement	.17	.22	.04
Conduit and conduit fittings (plastic)	.48	.62	.10
Plastic pipe, tubing, conduits, and fittings	2.18	2.82	.46
Plumbing fixtures, premolded plastic	.73	.95	.15
Insulation, styrofoam and other plastic insulation	.24	.31	.05
Vinyl tile	.88	1.14	.18
Laminated plastic panels and counter tops	1.34	1.74	.28
Other plastic products	.16	.20	.03
Miscellaneous rubber and plastic products	.10	.14	.02
Stone, clay, glass, and concrete products	105.35	136.51	22.12
Window glass	1.02	1.32	.21
Mirrors	.67	.87	.14
Cement	3.90	5.05	.82
(Clay) brick	11.30	14.64	2.37
Ceramic tile	2.73	3.54	.57
Clay refractories	.32	.41	.07
Clay sewer pipe	.83	1.08	.17
Other clay structural products	.14	.18	.03
Plumbing fixtures and accessories vitreous china	3.03	3.92	.64
Concrete block, brick	4.80	6.22	1.01
Concrete pipe	1.73	2.24	.36
Other precast concrete products	8.62	11.17	1.81
Ready mix concrete	29.92	38.76	6.28
Lime	.71	.93	.15
Gypsum products	20.25	26.24	4.25
Marble and other cut stone	.47	.61	.10
Asbestos cement products	.14	.19	.03
Vinyl asbestos tile	3.41	4.42	.72
Asphalt floor tile	1.04	1.35	.22
Adhesives, asbestos cement	.23	.30	.05
Insulation, asbestos (including sprayed-on)	.95	1.23	.20

See footnotes at end of table.

Table 11. Cost of materials, supplies, and equipment used in apartment construction, by product, 1971—Continued

Product	Cost per $1,000 of contract cost	Cost per 100 square feet	Percent distribution[1]
Crushed rock, slag, miscellaneous aggregate	$ 2.48	$ 3.22	.52
Insulation, perlite	.19	.25	.04
Plumbing fixtures, premolded fiberglass	1.56	2.02	.33
Insulation, fiberglass (mineral or glass wool)	3.60	4.66	.76
Acoustical tile, fiberglass (mineral wool)	.10	.12	.02
Fiberglass reinforced plastics	.19	.25	.04
Sand-lime brick	.39	.51	.08
Miscellaneous stone, clay, glass, and concrete products	.62	.82	.13
Primary metal products	42.17	54.64	8.85
Structural steel	7.63	9.89	1.60
Steel, galvanized and ferrous noncast iron pipe	5.26	6.82	1.10
Nails, wires, staples, ferrous	1.92	2.49	.40
Cable and wire, ferrous	1.67	2.17	.35
Cast iron products	.65	.84	.14
Cast iron pipe and fittings	9.40	12.18	1.97
Fire and water hydrants	.16	.20	.03
Lead	.31	.40	.06
Copper pipe and tubing	7.88	10.20	1.65
Cable and wire, nonferrous	6.61	8.56	1.39
Nails, wires, staples, nonferrous	.43	.55	.09
Miscellaneous primary metal products	.26	.34	.05
Fabricated metal products, except ordnance, machinery, and transportation equipment	74.27	96.23	15.59
Builders' hardware	5.91	7.66	1.24
Plumbing fixtures, metal and enameled iron	6.84	8.86	1.44
Plumbing accessories, fittings and trim, brass	4.13	5.35	.87
Warm air furnaces	3.33	4.31	.70
Incinerators	.29	.37	.06
Radiators and heaters (nonelectric)	3.98	5.16	.84
Unit heaters and ventilators	.82	1.06	.17
Prefabricated structural steel	2.09	2.70	.44
Metal doors	5.50	7.13	1.15
Metal windows	8.64	11.19	1.81
Fabricated metal plate products	.25	.33	.05
Storage tanks	.24	.31	.05
Aluminum sheet metal	1.28	1.66	.27
Galvanized sheet metal	4.64	6.01	.97
Fabricated sheet metal, all other	2.51	3.25	.53
Registers, grilles, diffusers	.71	.93	.15
Metal acoustical suspension systems	.12	.15	.02
Ornamental, architectural, and miscellaneous metal work	5.21	6.75	1.09
Scaffolding (metal)	.55	.71	.12
Prefabricated metal buildings, curtain walls, and parts	.24	.32	.05
Metal reinforcing bars	8.06	10.45	1.69
All-metal nuts, bolts, washers, screws, rivets	.64	.82	.13
Mail boxes	.26	.34	.05
Wire mesh	2.71	3.51	.57
Chain link fence	.41	.54	.09
Clips, fasteners	$ .24	$ .31	.05
Plumbing accessories, metal other than brass	2.21	2.87	.46
Miscellaneous fabricated metal products	2.45	3.18	.51
Machinery except electrical	17.68	22.92	3.72
Elevators, escalators, and dumbwaiters	5.01	6.49	1.05
Pumps	.95	1.23	.20
Blowers, exhaust and ventilating fans	1.15	1.49	.24
Sprinkler systems (fire prevention)	.48	.62	.10
Fire hose (except rubber), rack, drier	.16	.20	.03
Air-conditioning equipment	8.96	11.62	1.88
Water treatment equipment	.21	.27	.04
Miscellaneous machinery, except electrical	.76	.99	.16
Electrical machinery, equipment, and supplies	44.59	57.78	9.36
Electric meters and measuring equipment	1.30	1.69	.27
Transformers	.55	.71	.12
Electrical switchboards and panelboards	4.42	5.73	.93
Electric motors and generators	.19	.24	.04
Household cooking equipment	8.27	10.72	1.74
Household refrigerators, coolers	10.53	13.64	2.21
Household laundry equipment	.15	.19	.03
Household fans	1.14	1.48	.24
Electric household heaters	.94	1.22	.20
Miscellaneous household electric appliances	.11	.15	.02
Household hot water heaters	1.72	2.23	.36
Household dishwashers, garbage disposals	2.60	3.37	.55
Electric lamps and bulbs	.18	.24	.04
Lighting fixtures and nonelectric lamps and bulbs	3.88	5.03	.82
Current-carrying devices	1.83	2.37	.38
Conduit and conduit fittings (metal)	3.40	4.41	.71
Noncurrent-carrying devices	1.45	1.88	.30
Intercom and fire and burglar alarm systems	.53	.68	.11
T. V. systems	.23	.30	.05
Antenna	.15	.20	.03
Miscellaneous electric machinery, equipment, and supplies	1.01	1.33	.21
Instruments and related products	.81	1.04	.17
Gas and water meters, gauges, air thermometers	.23	.30	.05
Temperature controls	.57	.74	.12
Miscellaneous manufacturing industries	.61	.78	.13
Brushes and signs	.23	.30	.05
Linoleum	.26	.33	.05
Fire extinguishers, portable	.12	.15	.02
Miscellaneous materials and supplies, not elsewhere classified	3.79	4.89	.80

See footnotes at end of table.

Table 11. Cost of materials, supplies, and equipment used in apartment construction, by product, 1971—Continued

Product	Cost per $1,000 of contract cost	Cost per 100 square feet	Percent distribution[1]
Total contractors' construction equipment	$ 30.92	$ 40.06	6.49
Fabricated metal products	.70	.90	.15
Small handtools (nonpower)	.46	.60	.10
Scaffolding (metal)	.14	.18	.03
Miscellaneous fabricated metal products	.22	.30	.05
Machinery, except electrical	23.13	29.97	4.86
Power cranes, draglines, shovels (power)	4.55	5.89	.96
Tractors and bulldozers	4.03	5.22	.85
Backhoes and trenchers	2.87	3.72	.60
Drill rigs	.62	.80	.13
Scrapers, graders	1.57	2.04	.33
Rollers and all other heavy construction equipment	1.54	2.00	.32
Mixers, pavers, and related equipment	$ 1.09	$ 1.42	.23
Front-end loaders	2.31	3.00	.49
Hoists and monorails	.97	1.26	.20
Forklifts	1.19	1.54	.25
Power handtools	1.15	1.49	.24
Compressors, pumps, jackhammers, and accessories	1.13	1.46	.24
Miscellaneous machinery, except electrical	.10	.13	.02
Transportation equipment	6.00	7.77	1.26
Trucks (highway)	5.81	7.53	1.22
Trailers	.19	.25	.04
Miscellaneous construction equipment, not elsewhere classified	1.10	1.41	.23

[1] Distribution is the same for both columns.

NOTE: Detail may not add to totals due to rounding and exclusion of line items containing insufficient data.

Chapter V. Comparison With Other Surveys

Employee-hour requirements for multifamily housing construction were the lowest of any building construction sector studied in the BLS labor requirements series (table 12).[21] However, it is possible that requirements for single-family housing might have been the same as for apartment construction, or slightly lower, if the studies had been conducted in the same year.

In occupational requirements, multifamily housing did not closely match any of the other three residential studies in the BLS series—college housing, public housing, and single-family housing (table 13). Occupational requirements for multifamily housing were highest for administrative and supervisory workers and lowest for bricklayers, iron workers, plasterers and lathers, and laborers, helpers, and tenders.

Comparison of the cost figures in table 14 for multifamily housing with those for the other two recent residential surveys indicates that the proportion of onsite wages for multifamily housing, 27.9 percent, was higher than for single-family housing, 20.4 percent, but that public housing was the highest, at 32.4 percent. The ratio of materials for multifamily housing (44.2 percent) was very close to the ratios for the other two studies. On the other hand, among these three residential surveys, cost of equipment was the highest for multifamily housing, which indicates the more capital-intensive nature of taller buildings in that type of construction.

Material requirements for multifamily housing more closely resembled those for public housing than for other types of residential construction studied (table 15). Although multifamily housing required a larger proportion of lumber and a smaller proportion of metal products and stone, clay, glass, and concrete products than public housing, these three groups of materials made up the majority of materials in both types of construction. These three groups constituted 58 percent of total materials, equipment, and supplies for multifamily housing and over 62 percent for public housing. The proportion of construction equipment was considerably higher for multifamily housing than for other residential construction because of the heavy equipment required to build the generally higher multifamily structures.

[21] In comparing the multifamily housing construction survey with other surveys of construction labor requirements, it must be kept in mind that the studies cover different time periods. Furthermore, comparisons cannot reasonably be made with heavy construction (i.e. highways, sewer works, and civil works) which is entirely different from residential and other building construction in labor and material requirements.

Table 12. Employee-hour requirements per 1,000 current dollars of contract cost, by industry, all construction studies, 1958-73

Type of construction	Year of construction	Total, all industries	Onsite construction	Offsite construction	Manufacturing	Wholesale trade, transportation, and services	Mining and all other
Initial studies:							
Federally aided highways	1958	237	97	10	66	39	24
Federal office buildings	1959	227	97	12	72	31	16
Elementary and secondary schools	1959	222	86	10	74	32	19
Civil works:							
Land projects	1959-60	201	85	6	53	35	22
Dredging		237	134	11	57	23	12
Public housing	1959-60	236	114	14	62	29	18
General hospitals	1959-60	210	89	11	79	19	13
College housing	1960-61	226	94	11	73	30	17
Single-family housing	1962	202	72	12	61	31	26
Sewer works:							
Lines	1962-63	211	86	7	74	29	16
Plants		210	83	7	72	32	16
Multifamily housing	1971	126	50	8	43	15	10
Second studies:							
Elementary and secondary schools	1964-65	188	72	9	65	26	15
General hospitals	1965-66	178	76	10	64	18	10
Public housing	1968	160	80	14	42	16	8
Single-family housing	1969	137	52	10	41	20	14
Federally aided highways	1973	114	44	6	37	18	8

NOTE: Detail may not add to totals due to rounding.

Table 13. Percent distribution of onsite employee-hour requirements per 1,000 current dollars of contract cost, by occupation, all construction studies, 1958-73

Type of construction	Year of construction	All occupations	Administrative and supervisory	Bricklayers	Carpenters	Electricians	Ironworkers	Operating engineers	Painters	Plasterers and lathers	Plumbers and pipefitters	Other skilled construction trades	Laborers, helpers, and tenders	Other occupations (including truckdrivers)
Initial studies:														
Federally aided highways	1958	100.0	10.4	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[2]38.2	[1]	[3]51.4
Federal office buildings	1959	100.0	6.0	5.2	12.6	9.1	4.2	2.4	2.1	3.8	8.7	11.8	32.5	1.5
Elementary and secondary schools	1959	100.0	3.9	9.3	18.7	7.1	2.8	1.9	3.3	2.7	9.4	7.9	29.1	4.0
Civil works:														
Land projects	1959-60	100.0	10.1	–	6.4	–	3.1	24.1	–	–	–	6.9	23.0	26.4
Dredging		100.0	4.7	–	–	–	–	1.1	–	–	–	1.7	1.7	[4]90.8
Public housing	1959-60	100.0	4.0	7.6	19.1	4.1	2.1	2.7	4.4	6.8	7.8	6.5	30.9	4.0
General hospitals	1959-60	100.0	3.9	5.4	13.2	8.8	3.5	1.6	2.8	6.2	14.2	12.0	26.7	1.7
College housing	1960-61	100.0	3.4	10.0	16.9	6.6	3.9	1.7	3.6	3.4	9.7	7.8	31.8	1.1
Single-family housing	1962	100.0	3.0	5.5	34.6	2.8	–	1.4	9.5	2.0	5.2	12.2	23.3	.5
Sewer works:														
Lines	1962-63	100.0	10.1	1.3	2.4	.1	.4	19.6	–	–	.4	2.7	44.5	18.5
Plants		100.0	9.0	2.0	14.3	3.3	3.9	14.6	1.5	–	5.1	6.6	31.7	8.0
Multifamily housing	1971	100.0	5.8	5.0	25.4	5.9	2.3	2.9	4.0	1.7	7.6	11.3	25.8	2.3
Second studies:														
Elementary and secondary schools	1964-65	100.0	3.6	9.2	16.5	7.3	3.1	2.7	3.5	2.0	9.6	10.1	30.9	1.5
General hospitals	1965-66	100.0	3.2	5.0	13.0	9.9	3.1	1.8	2.6	6.1	15.6	13.1	25.7	.7
Public housing	1968	100.0	3.6	7.8	20.3	5.8	3.5	3.1	4.9	3.0	9.3	6.6	30.2	1.9
Single-family housing	1969	100.0	2.8	5.7	34.9	3.0	–	1.8	7.3	1.7	4.3	20.0	27.9	.5
Federally aided highways	1973	100.0	5.9	–	6.1	1.1	2.5	25.5	.3	–	.2	[5]8.9	34.0	[6]19.0

[1] Detail by occupation not available.
[2] Excludes apprentices and on-the-job trainees.
[3] Includes apprentices and on-the-job trainees and laborers, helpers, and tenders.
[4] Includes mostly ships' masters, captains, mates, crewmen, and support personnel.
[5] Includes apprentices and on-the-job trainees.
[6] Includes blue-collar supervisors.

NOTE: Detail may not add to totals due to rounding. Dash denotes zero.

Table 14. Percent distribution of contract costs, all construction studies, 1958-73

Type of construction	Year of construction	Total contract costs	Onsite wages	Materials	Equipment	Overhead and profit[1]
Initial studies:						
Federally aided highways	1958	100.0	23.9	50.6	[2]	25.5
Federal office buildings	1959	100.0	29.0	51.4	1.9	17.7
Elementary and secondary schools	1959	100.0	26.7	54.1	1.4	17.8
Civil works:						
Land projects	1959-60	100.0	26.0	35.0	19.3	19.7
Dredging		100.0	32.3	17.3	24.9	25.5
Public housing	1959-60	100.0	35.5	45.0	2.5	17.0
General hospitals	1959-60	100.0	28.2	53.2	1.2	17.4
College housing	1960-61	100.0	29.3	52.6	1.6	16.5
Single-family housing[3]	1962	100.0	22.1	47.2	1.0	29.7
Sewer works:						
Lines	1962-63	100.0	24.3	44.5	11.2	20.0
Plants		100.0	26.6	49.2	8.2	16.0
Multifamily housing	1971	100.0	27.9	44.2	3.0	24.8
Second studies:						
Elementary and secondary schools	1964-65	100.0	25.8	54.2	1.0	19.0
General hospitals	1965-66	100.0	29.6	50.4	1.3	18.7
Public housing	1968	100.0	32.4	41.9	1.5	24.2
Single-family housing[3]	1969	100.0	20.4	43.4	.9	35.3
Federally aided highways	1973	100.0	24.6	44.5	[2]	30.9

[1] Includes offsite wages, fringe benefits, construction financing costs, inventory, and other overhead and administrative expenses as well as profit.
[2] Equipment included with overhead and profit.
[3] Includes selling expenses.

NOTE: Detail may not add to totals due to rounding.

Table 15. Percent distribution of cost of materials, supplies, and equipment per 1,000 current dollars of contract cost, by product group, all construction studies, 1958-73

Type of construction	Year of construction	Total materials, supplies, and equipment	Lumber and wood products (including furniture)	Paint and chemicals	Petroleum products	Stone, clay, glass, and cement products	Metal products (except as indicated elsewhere)	Plumbing products	Heating, ventilating, and air-conditioning equipment (except electrical)	Electrical products	Other fixed equipment	Construction equipment[1]	All other
Initial studies:													
Federally aided highways	1958	100.0	1.8	(2)	17.1	28.1	19.5	(2)	(2)	(2)	(2)	(3)	33.6
Federal office buildings	1959	100.0	3.3	.9	.9	22.2	25.1	5.1	12.3	18.2	8.0	3.5	.5
Elementary and secondary schools	1959	100.0	8.6	1.4	2.0	24.4	28.9	5.8	9.6	10.9	2.9	2.5	3.0
Civil works:													
Land projects	1959-60	100.0	4.0	3.8	12.6	25.5	15.6	.3	.1	.2	.2	35.5	2.2
Dredging		100.0	(2)	3.9	28.1	.2	7.5	(2)	(2)	.4	.2	59.0	.7
Public housing	1959-60	100.0	14.1	1.8	1.7	27.9	22.8	10.0	3.6	4.8	6.1	5.3	1.7
General hospitals	1959-60	100.0	4.2	.8	.9	19.4	26.4	8.7	9.8	11.0	16.3	2.1	.5
College housing	1960-61	100.0	10.7	1.1	1.1	26.6	28.2	7.7	5.9	8.3	6.9	2.9	.7
Single-family housing	1962	100.0	40.0	2.1	2.3	24.2	11.4	5.6	3.8	3.6	2.8	2.0	2.0
Sewer works:													
Lines	1962-63	100.0	.8	.4	3.0	60.5	11.1	(2)	(2)	.6	3.1	20.2	(2)
Plants		100.0	1.6	1.0	1.8	19.0	27.6	.4	2.0	8.3	23.3	14.2	.6
Multifamily housing	1971	100.0	22.0	2.2	2.3	22.1	14.0	9.5	5.0	5.8	5.7	6.5	4.7
Second studies:													
Elementary and secondary schools	1964-65	100.0	9.4	1.0	2.3	24.0	24.8	7.2	9.6	9.8	6.8	2.8	2.4
General hospitals	1965-66	100.0	4.7	.8	.8	18.1	22.9	10.3	9.8	12.2	16.1	2.5	1.8
Public housing	1968	100.0	14.4	2.0	2.2	25.5	22.6	10.0	4.4	7.9	5.8	3.5	1.8
Single-family housing	1969	100.0	40.6	1.8	1.8	21.5	9.4	6.9	4.2	3.9	2.5	1.9	5.5
Federally aided highways	1973	100.0	1.7	2.0	17.3	32.2	22.8	(2)	(2)	4.5	(2)	(3)	19.7

[1] Rental cost and depreciation or equivalent value.
[2] None reported.
[3] Construction equipment included in all other.

NOTE: Detail may not add to totals due to rounding.

Appendix A. Survey Scope and Methods

The study was designed primarily to develop estimates of employee-hour requirements for the construction of private multifamily housing in structures of five units or more in Standard Metropolitan Statistical Areas.

Characteristics of universe and selection of sample

The sample frame was constructed by analyzing the distribution of building permits issued during calendar year 1969, as shown in the Bureau of the Census, *Construction Reports,* C40-69-13, "Housing Authorized by Building Permits and Public Contracts, 1969." A probability sample of metropolitan areas was drawn to represent all privately owned multifamily housing in structures of five units or more located in metropolitan areas, where building permits were issued during 1969 for 500 units or more of this type. The following 22 Standard Metropolitan Statistical Areas were selected:

Atlanta	Houston	New York
Baltimore	Kansas City	Oklahoma City
Boston	Los Angeles	Philadelphia
Chicago	Memphis	Phoenix
Cincinnati	Miami	San Diego
Dallas	Minneapolis	San Francisco
Denver	New Orleans	Washington
Detroit		

It was not feasible for the Bureau of the Census to provide a list of all completed projects in the survey universe. However, a significant portion of these projects were financed under the auspices of the Federal Housing Administration (FHA). FHA-insured starts of buildings with five units or more in metropolitan areas during calendar years 1969, 1970, and 1971 were estimated as 14, 35, and 27 percent respectively of the total starts in that class. Accordingly, the sample was drawn from FHA reports to represent the entire survey universe, which includes non-FHA starts.

A sample of 89 projects was selected from FHA reports on projects completed between July 1, 1970, and August 1, 1971, in the areas previously listed. (After completion of the survey it was learned that most construction took place in 1971.)

The survey excluded projects meeting any of the following criteria:

1. Ten percent or more of available footage is for commercial use.
2. Ten percent or more of available footage is of modular construction.
3. Ten percent or more of available footage is for townhouses. A townhouse is defined as a single-family house with common walls to adjacent buildings and independent utility connections (sewer, water, gas, electricity).
4. The entire project is a condominium or cooperative development.
5. The entire project is special-purpose housing such as senior citizens' housing, which has unique architectural features.

Data collection procedures

Three major stages were employed to fulfill the objective of reliable data for each project in the study: (1) Pretest and training, (2) Federal Housing Administration (FHA) area office visits, and (3) visits to project sites and contractors.

Pretest and training. Education and orientation were accomplished in two ways. First, experienced data collectors from three regional offices assembled in Washington, D. C., to discuss the survey and prepare for the pretest. The Washington staff explained the purpose of the complex study and proposed collection schedules. Informal discussion was conducted to clarify specific points, and agreement was reached on the data required to meet the objectives. Each regional representative was then assigned two projects for pretest. The representatives were to visit the FHA area office, general contractor, and subcontractors for each project. When this assignment was completed, all data were forwarded to Washington with a critique and recommendations for improvements and modifications to the survey approach. The Washington staff revised and improved final schedules and field instructions.

Next, representatives from all eight BLS regional offices met in Washington, D.C., for a training session. All facets of the program were explained in detail with the use of training aids, collection instructions, and schedules for data collection. Findings of the pretest survey were presented and potential problem areas were discussed. Regional coordinators generally transmitted this information to data collectors at a regional conference.

Federal Housing Administration area office visits. During the survey planning stage, the BLS requested that the FHA send a letter describing the survey to all FHA area offices to solicit their cooperation when a BLS representative would visit. This approach assured entree to the area offices with FHA endorsements for the survey.

The BLS data collectors had three missions to perform when visiting the area office; (1) Obtain project payrolls, (2) obtain building characteristics, and (3) obtain listings of all contractors involved in the project construction.

The data collectors arranged to have payroll data of the general contractor and subcontractors forwarded to the BLS regional office on loan. (Contractors are required to keep these records for 3 years to comply with the Davis-Bacon Act.) In some cases, the payrolls had been placed in a Federal storage depository and authorization had to be obtained to secure them. In other cases, copies of the original payrolls were made and forwarded to the BLS regional office.

Next, the BLS data collectors obtained the name, address, contract value, and type of contract for all general and prime contractors and subcontractors on the sample project. Missing payrolls were identified so that the contractor could later furnish supplemental information.

Visits to project sites and contractors. After completing their research at the FHA area office, data collectors visited the construction site to become as familiar as possible with the structural characteristics of the project before visiting the general contractor. If the general contractor should refuse to cooperate, the project would have to be dropped and another one substituted. The substitution of sample projects is time consuming and costly and, in addition, could bias the survey results. Therefore, every effort was made to enlist the cooperation of the general contractor by explaining the nature of the survey and the reasons for conducting it. Of the approximately 2,800 contractors who were interviewed in the sample of 89 projects, only a small number refused to cooperate or could not be located.

If the contractor agreed, he was asked to verify the final contract value, including change orders, and the list of subcontractors and their current addresses. Additional payroll data were obtained for onsite workers who were not covered by the Davis-Bacon Act, such as the superintendent, technical personnel, and watchmen. Finally the data collectors recorded the type of each material, its purchase cost, and the name and fair rental value or equivalent of any equipment used on the job. Each of the subcontractors also was contacted to obtain similar data.

After all the data for a sample project were collected, they were checked for completeness and internal consistency by the regional office and forwarded to Washington, D.C., for final analysis, editing, and coding for computer processing.

Data collected for the private multifamily construction survey were very complex and required experienced personnel for processing.

Procedures used to develop employee-hour estimates

Onsite and offsite employee-hour estimates were combined to obtain estimates of total employee-hour requirements for private multifamily housing.

Onsite (direct) **employee-hours,** as explained in the previous section, were obtained from payrolls submitted by the contractors to the FHA. Offsite (indirect) employee-hour requirements, representing the hours to produce, transport, and sell the materials, supplies and equipment used in construction, were developed by use of the 1963 Interindustry Study of the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce. The basic data on materials, supplies, and equipment were collected by the BLS field representatives from each prime contractor and his subcontractors (or estimated in a relatively small number of cases).

The materials listings thus obtained were categorized according to the 4-digit industry classification of the *Standard Industrial Classification Manual* (1967 edition, Office of Management and Budget). For each product group, the average amount required for $1,000 of construction cost was calculated. This bill of materials was deflated to the 1963 price level by application of the appropriate wholesale price indexes. The resulting deflated value for each group was reduced by a ratio representing the difference between valuation by the purchaser and valuation by the producer. (This ratio was based on data provided by BEA.) The differences between purchaser and producer valuation were allocated to trade and transportation sectors. The deflated values were matched to the sector coefficients in the 1963 interindustry study of BEA. For each group of materials, the interindustry study provided information on the amount of products required from each of the 367 industry sectors. The product data were converted to employee-hours by use of output per employee-hour ratios for each industry. While processing the data, the Economic Growth Division of BLS adjusted for price and productivity changes from the base year of the tables (1963) to the study year. The results were the average total (indirect) employee-hours per $1,000 of contract cost required to produce, transport, and sell the materials used to construct the projects covered by this survey.

These employee-hours, plus the builders' offsite employment, were combined with direct or onsite employee-hours to determine total employee-hours within the definition of the study. Offsite employment of each construction contractor was not obtained directly from the contractors since it would be difficult to allocate a portion of total offsite employment to a particular project. Instead, an estimate for these employee-hours was developed by applying the ratio of construction workers to all employees in the special trade contractors industry for 1971, as reported in *Employment and Earnings, United States, 1909–72* (BLS Bulletin 1812–9) to the onsite employee-hours collected for this study.

An additional measure of employee-hours expended in construction, i.e., employee-hours per 100 square feet of construction, was developed by applying the cost per 100 square feet of construction to employee-hours per $1,000 of construction contract cost.

Appendix B. Forms Used for Data Collection

BLS 2652.01A

Office of Management and
Budget No. 44R1381
Approval expires: 12-31-72

U.S. DEPARTMENT OF LABOR
Bureau of Labor Statistics
Washington, D.C. 20212

PROJECT INFORMATION

SURVEY OF
CONSTRUCTION LABOR REQUIREMENTS
FOR
MULTI-FAMILY HOUSING

The Bureau of Labor Statistics will hold all information furnished by the respondent in strict confidence.

OFFICE USE ONLY	Survey Ident	FHA Project No.	Region	City	Weight
	0 1				

GENERAL INSTRUCTIONS

I. CONSTRUCTION DATES

a. The beginning date of the project operation is the date of the first day of on-site construction activity.

b. The ending date is the day the building is ready for tenant occupancy (the Beneficial Occupancy Date). Even if additional work is done after the BOD date for repairs or replacement of materials, use the BOD date as the ending date. Do not report any equipment, labor, or materials costs occurring after the BOD date anywhere on this schedule.

c. The "number of construction weeks" means the number of weeks the project was under construction, including the weeks during which work was completely stopped. It is the time period from the beginning date to the ending date.

II. VALUE OF CONTRACT

Round all entries to whole dollars. The sum of II.b., II.c., II.d., and II.e. should equal the contract value of II.a.

a. For the contract amount, use the total FHA contract amount adjusted for all change orders. Land cost and land development, such as demolition and site improvement prior to grading and excavation, should be excluded. Validate this contract amount when you go to the general and prime contractors.

NOTE: Land development and site improvement take place prior to construction and should be excluded from the contract amount. Landscaping takes place after building construction begins and is usually included in the contract amount.

The total contract price is the general contract, plus all the prime contracts, plus any materials and supplies purchased separately by the developer. Be careful to watch for materials and supplies purchased separately by the developer. (The costs of materials and supplies provided by a developer will not be reflected in any general, prime, or sub contract and must be added to the B form prepared for the general contractor.)

Frequently "change orders" will occur during construction. These are changes which are made in the original contract plans or specifications. The contract amount you report must reflect all change orders.

b. These normally will not be included in the contract price. Enter "0" if this is the case.

c. The commercial portion refers to space rented by companies and organizations, except the offices of the building management. Include hallways, elevators, or other parts of the building if they are used primarily to service the commercial rental units.

I. CONSTRUCTION DATES

a. Beginning (mo./day/yr.)	/ /	1
b. Ending (mo./day/yr.)	/ /	2
c. Total number of construction weeks		3

II. VALUE OF CONTRACT

a. What is the total contract price of the project (excluding land and land developments)? Round entries to whole dollars.	$	4
b. What real estate commissions, closing costs, or other sales expenses are included in the total contract price?	$	5
c. How much of the contract price was for the commercial portion of the project?	$	6
d. How much of the contract price was for "under cover" parking (indoor garage, carport, canopied areas, etc.)?	$	7
e. How much of the contract price was for the residential portion of the project?	$	8

Notes _____

d. Include the value of parking which is under cover--indoor parking, carports, and canopied parking areas. Exclude outdoor parking such as paved lots.

e. The residential portion includes the living area, hallways, elevators and associated parts of the building, such as basement utility rooms and laundry rooms. The residential portion is everything in the project except commercial areas and under-cover parking. Any separate building, e.g., power plant or other residential service facilities, should be considered residential. Also, a number of facilities outside the project buildings should be included with residential value. These include outdoor parking, outdoor recreational facilities, sidewalks, street lights, landscaping, drainage and sewer systems, utility lines, and fences.

III. GENERAL CHARACTERISTICS OF PROJECT

a. Record the appropriate code.

b. Do not count basements as stories.

NOTE: Townhouses are out-of-scope of this survey if they have independent, self-contained facilities such as plumbing, heating, electricity, garages, and cellars. If the facilities are not independent and self-contained for each townhouse, however, they are in-scope and each "row" of houses should be considered as one building. Each "house" should be considered as a rental unit.

c. Enter the number of units for each category.

d. Use the square footage which corresponds to the commercial portion used in II.c. Note that this is gross commercial square footage, including hallways, elevators, and other facilities used to service the commercial areas. The FHA calculation for "net rentable commercial area" can not be used.

e. Record the square footage of under-cover parking (indoor, carport, and canopied areas) which corresponds to the parking portion used in II.d. This is not necessarily the total amount of parking available for tenants.

f. The residential square footage is the total square footage of the project buildings minus the commercial and the under-cover parking areas. Note that this is gross residential square footage, including hallways, elevators, laundry rooms, utility rooms, and other facilities used to service the residential areas. The FHA calculation for "net rentable residential area" can not be used.

g. Include buildings having freight and service elevators and elevators servicing commercial areas.

III. GENERAL CHARACTERISTICS OF PROJECT

a. What does this project contain? ..... | | 9 |

Code

1. A single building (residential only)
2. A single building (residential and commercial)
3. A complex of two or more residential buildings
4. A complex of two or more residential and commercial buildings

b. How many residential apartment buildings are there with the following stories? (Enter number of buildings.)

One story		10
Two or three stories		11
Four to six stories		12
Seven to twelve stories		13
Thirteen to nineteen stories		14
Twenty or more stories		15

c. How many of the following types of residential rental units are there? (Enter number of units.)

Efficiency or studio units		16
One bedroom units		17
Two bedroom units		18
Three or more bedroom units		19

d. What is the total square footage of commercial rental units (excluding parking)? ..... | | 20 |

e. How many square feet are provided of "under cover" parking (indoor garage, carport, canopied areas, etc.)? ..... | | 21 |

f. What is the total square footage of residential area? ..... | | 22 |

g. How many buildings in this project have elevators? ..... | | 23 |

IV. PRINCIPAL BUILDING MATERIALS AND FIXTURES

a.-j. Code for the building material that accounted for the highest cost in the construction of each item. For example, if wood paneling is used along with drywall (wallboard, sheetrock) in interior wall construction, and the material and labor costs associated with drywall construction accounts for most of the interior wall construction costs, use code "1," drywall.

Enter only one code for each item.

Give an explanation when ever an item cannot be coded.

IV. PRINCIPAL BUILDING MATERIALS AND FIXTURES

What is the principal building material used for each of the following:

a. Foundation ..... | | 25 |

Code

1. Concrete block
2. Concrete pilings
3. Steel pilings
4. Vertical poured concrete
5. Other (specify) _____

b. Frame ..... | | 26 |

Code

1. Wood
2. Steel
3. Brick
4. Concrete block
5. Reinforced concrete
6. Other (specify) _____

c. Wall sheathing ..... | | 27 |

Code

1. Plywood
2. Asphalt paper or board
3. None
4. Other (specify) _____

d. Exterior walls ..... | | 28 |

Code

1. Brick
2. Wood
3. Stucco
4. Aluminum siding
5. Asbestos or asphalt shingles
6. Stone
7. Composition board
8. Curtain wall (specify type of material) _____
9. Other (specify) _____

Notes:

IV. PRINCIPAL BUILDING MATERIALS AND FIXTURES—Continued

e. Interior walls ..... | | 29 |

Code

1. Drywall (sheetrock)
2. Plaster
3. Wood paneling
4. Other (specify) _____

f. Floor base ..... | | 30 |

Code

1. Concrete
2. Wood/plywood
3. Steel
4. Other (specify) _____

g. Floor covering ..... | | 31 |

Code

1. Hardwood
2. Asphalt tile
3. Vinyl and vinyl asbestos tile
4. Linoleum
5. Carpeting
6. Other (specify) _____

h. Roof base ..... | | 32 |

Code

1. Concrete
2. Wood/plywood
3. Insulating board
4. Other (specify) _____

i. Type of roof covering ..... | | 33 |

Code

1. Built up
2. Asphalt shingle
3. Wood shingle
4. Other (specify) _____

k.-o. Code the characteristic which accounts for the highest cost in constructing each item. Enter only one code for each question.

k. Enter code "1" ("central to project") for a one-building project having central heating.

IV. PRINCIPAL BUILDING MATERIALS AND FIXTURES—Continued

j. Ceiling ..... | | 34 |

Code

1. Accoustical tile
2. Drywall
3. Plaster
4. Other (specify) _____

What is the principal characteristic of each of the following:

k. Type of heating unit ..... | | 35 |

Code

1. Central to project
2. Individual building heating in multi-building project
3. Individual apartment heating
4. Other (specify) _____

l. Type of heat ..... | | 36 |

Code

1. Forced air
2. Hot water or steam
3. Baseboard electric
4. Wall unit
5. Other (specify) _____

m. Heating fuel ..... | | 37 |

Code

1. Electricity
2. Gas
3. Oil
4. Coal
5. Other (specify) _____

n. Enter code "1" ("central to project") for a one-building project having central air conditioning. "Window units" are room air conditioners which are not permanently attached to the building.

p. "Compactors" are used to compress trash and/or garbage before disposal.

q. Write a brief description of the recreational facilities which were included in the contract value. This is not necessarily those facilities available for use by the tenants. Explain, when necessary, whether the facilities are located inside or outside the buildings (e.g., "outdoor pool," "indoor pool").

IV. PRINCIPAL BUILDING MATERIALS AND FIXTURES—Continued

n. Air conditioning ..... | | 38 |

Code

1. Central to project
2. Individual building air conditioning in multi-building project
3. Individual apartment air conditioning
4. Window units
5. None

o. Laundry facilities ..... | | 39 |

Code

1. Central laundry room(s)
2. Laundry room on each floor
3. Laundry equipment in each apartment
4. None
5. Other (specify) _____

p. Is this project equipped with incinerators or compactors? ..... | | 40 |

Code

1. Yes
2. No

q. List number and type of recreational facilities included in in the contract value:

_____

_____

_____

_____

_____

_____

_____

_____

r. Modular or completely pre-fabricated buildings are out-of-scope for this survey. This question, however, deals with pre-fabricated items which are used in non-modular buildings.

IV. PRINCIPAL BUILDING MATERIALS AND FIXTURES—Continued

r. Were any of the following pre-fabricated materials used in the construction of the project? (If yes, enter "1.")

Interior walls		41
Exterior walls		42
Pre-finished siding		43
Pre-assembled windows		44
Pre-hung doors		45
Roof trusses		46
Gable ends		47
Cornices and/or roof overhangs		48
Pre-finished or panelized floors		49
Pre-stressed concrete floor panels		50
Pre-wired electrical circuits		51
Offsite fabricated duct work		52
Fireplaces and chimneys		53
Staircase units		54
Plumbing trees		55
Complete bathrooms		56
Shower units		57
Partial kitchens		58
Kitchen cabinets		59
Other (specify) _____		60

e. Cross-check the appliances reported here with the materials recorded on the B forms to make sure that no appliance costs have been omitted. If appliances were purchased by the developer, include these costs in the contract values II.a. and II.e. of the A form, and adjust the general contractor's B form to include these items in his contract amount and materials costs.

V. WORK STOPPAGES

Count the number of days during the construction period when all on-site work was completely stopped. When there are several complete stoppages, add the number of days the work was stopped. Convert this to an equivalent number of work weeks and round to a whole number.

IV. PRINCIPAL BUILDING MATERIALS AND FIXTURES—Continued

s. How many of each of the following appliances were installed in the project? (Exclude appliances supplied by outside firms for rent or concession.)

Stoves		61
Refrigerators		62
Dishwashers		63
Garbage disposals		64
Washers		65
Dryers		66
Extractors		67

V. WORK STOPPAGES

a. If there were any complete work stoppages during the construction of this project, such as material shortages, strikes, or disruptive weather, enter the total number of work weeks lost due to such stoppages. (Round to whole numbers.)

	68

b. Please explain any complete stoppages:

VI. NUMBER OF CONTRACTS

If this information cannot be accurately completed at the initial interview with the general contractor, it should be completed later by the agent after all contractors have been scheduled.

VI. NUMBER OF CONTRACTS

a. How many contracts were let for this project?

General and prime contracts		69
Subcontracts		70
Sub subcontracts		71
TOTAL		72

b. How many B schedules are attached for this project? .....

	73

Notes _____

BLS 2652.01B

Office of Management and
Budget No. 44R1381
Approval expires: 12-31-72

U.S. DEPARTMENT OF LABOR
Bureau of Labor Statistics
Washington, D.C. 20212

CONTRACT INFORMATION

SURVEY OF CONSTRUCTION LABOR REQUIREMENTS FOR MULTI-FAMILY HOUSING

The Bureau of Labor Statistics will hold all information furnished by the respondent in strict confidence.

GENERAL INSTRUCTIONS

This form must be completed for each contract that has been let on the sample project. If ABC Construction Company was awarded three separate contracts, three "B" forms for ABC will ordinarily be prepared. An exception to this rule occurs when ABC records are such that labor and material costs cannot be identified by contract. In this case, only one "B" is to be prepared.

I. GENERAL IDENTIFICATION

This information is intended for use of the Regional Office.

f. Question I.f. is used to assign 3-digit contract numbers to sub subcontracts. Sub subcontracts should be numbered consecutively, starting with the number immediately following the highest contract number previously assigned on the "Agent Worksheet." Care should be taken to avoid assignment of duplicate numbers.

I. GENERAL IDENTIFICATION

a. FHA Project No. _____

b. Contract No. _____

c. Name and address of project _____

_____

d. Name, address, and telephone of contractor/subcontractor _____

_____

e. Record of contacts with contractor/subcontractor

Date of visit	Person contacted	Field Representative

f. (Ask only subcontractors.) Did any sub subcontractor perform any operations for you for this contract? If so, who did the work, what operation(s) did he perform, and what was the value of his contract?

Contract number	Name, address, and telephone of sub subcontractor	Sub subcontract operation	Value of sub subcontract

The following codes are necessary for computer processing of the schedule.

"FHA Project No." - The "FHA project number" is copied from the A form to all the corresponding B forms for the project.

"Contract No." - The 3-digit "contract number" is different for each B form within a project. Enter the number which uniquely identifies this contract (and this B form) and which was assigned to it on the "Agent Worksheet" or in question I.f. of a subcontractor's B form.

"Major Operation Code" - Enter "01" to identify the general contract. Enter the "contract operations code" (see contract operations code list) for each prime or subcontract. When a single sub-contract involves more than one contract operations code, code for the operation that accounts for the greatest part of the contract value, excluding any operation that has been sub subcontracted.

"Contract No. of Contract for Which Work Was Done" - Leave this blank for the general and prime contracts. Otherwise, enter the code of the contractor who let the subcontract. If, for example, this is the B form for contract number 012, which was a subcontract let by the general contractor (who is always identified by contract number 001), your entries should be:

Contract No.
0 1 2

(If sub or sub subcontract) Contract No. of contract for which work was done	0	0	1

If, however, this is the B form for contract number 043, which was a sub subcontract let by subcontractor 012, then your entries should be:

Contract No.
0 4 3

(If sub or sub subcontract) Contract No. of contract for which work was done	0	1	2

II. CONTRACT AMOUNT

The contract amount should reflect all change orders which took place during construction. When determining the contract amount, exclude any items (such as land and land development) which were also excluded from question II.a. of A form.

The contract amounts for the general and all the prime contracts, when added together, should equal the project contract amount recorded in question II.a. of the A form.

When a contractor lets a subcontract, include the value of that subcontract on the B form of both contractors.

Round to whole dollars.

III. CONTRACT OPERATIONS—See page 6.

FHA Project No.	Contract No.	Major operation code

(If sub or sub subcontract) Contract No. of contract for which work was done	

II. CONTRACT AMOUNT

What was the final contract amount, including all change orders? (Round to whole dollars)	$	1

III. CONTRACT OPERATIONS

Which operations are covered by this contract? (Enter "1" for the appropriate operations.)

Grading, footings, and excavation		2
Foundation		3
Waterproofing		4
Concrete work		5
Structural steel erection		6
Curtain wall		7
Carpentry		8
Masonry		9
Heating, ventilation, and air conditioning		10
Sheet metal work		11
Plumbing		12
Electrical		13
Elevators		14
Insulation		15
Wallboard		16
Plastering		17
Painting		18
Wall papering		19

III. CONTRACT OPERATIONS

Identify all the operations which were covered by the contract being scheduled. If a contractor let a subcontract for part of the original contract, indicate only the contractor's operations on his B form and report the subcontract operations on the subcontractor's B form. All contract operations completed during construction of a project must be reflected on at least one B form for the project.

IV. HEAVY EQUIPMENT

Code all heavey equipment used on-site for the contract. Exclude small tools, hand or power, since these costs should be recorded under "materials." "Heavy equipment" refers to large construction equipment which ordinarily outlives any single project. The "rental cost" you report should, therefore, be less than the total cost of the equipment and should reflect only that part of the total value that was "used up" during work on the sample project.

Give each type of equipment the appropriate 3-digit equipment code from the "Material and Equipment Code List." First use the alphabetical index to the SIC manual to determine the appropriate 4-digit SIC code, and then use the "Material and Equipment Code List" to find the corresponding 3-digit code.

Enter the rental cost or the depreciation (which can be estimated by a "rental cost equivalency"). The "hours operated" can be omitted if cost figures are available. If, however, accurate cost estimates are not available, enter the number of hours the equipment was used. The hours worked by the equipment operator can sometimes be used to estimate "hours operated."

For rented equipment, enter the actual rental cost here and the operator's hours and pay under "labor requirements." Operator's wages should never be included under "heavy equipment," even if the equipment is rented on a "fully operated" basis.

If no heavy equipment was used for this contract, write "none" under "type of equipment." If additional space is needed, use the continuation sheet.

Round entries to the nearest hour or the nearest whole dollar.

SAMPLE ENTRY

Type of equipment	Equip. code	Hours operated	Rental cost	
Bulldozer	802		$960	100
				101

III. CONTRACT OPERATIONS—Continued

Hardwood flooring		20
Linoleum, vinyl tile, and vinyl-asbestos tile		21
Ceramic tile		22
Carpeting		23
Roofing and gutter work		24
Garage door		25
Ornamental iron work		26
Termite extermination		27
Cleaning		28
Asphalt paving		29
Landscaping		30
Other (specify) _____		31

IV. HEAVY EQUIPMENT

What types of heavy equipment (e.g., crane, tractor) were used on-site for this contract? What were the "rental costs" of rented equipment, or the "rental cost equivalencies" (depreciation) for the time period during which owned equipment was used? (If rental cost cannot be estimated, report instead the number of hours the equipment was used on-site.)

Type of equipment	Equip. code	Hours operated	Rental cost	
			$	100
				101
				102
				103
				104
				105
				106

Total rental cost of heavy equipment ..... (Office use only)

V. MATERIALS AND SUPPLIES

a. Enter the total value of all materials and supplies used in construction. Include sales tax. Exclude any contractor profit or overhead. Also exclude the value of materials and supplies the contractor may have used to construct temporary buildings on-site (superintendant's shack; project director's office, etc.).

The delivered, on-site cost of materials and supplies is the purchase price plus any costs that the contractor accrued preparing and delivering those materials to the site. For example, a contractor may purchase semi-fabricated materials and then, in his own shop, perform additional fabrication. The cost of this additional fabrication should be included in the total value you report.

b. Use this section to describe, in detail, the different materials and supplies and their on-site cost that are included in V.a.

When describing the materials, make sure you include for each different material, (1) a description of the product and (2) the composition of the product (e.g., copper, iron, plastic). The composition frequently determines the materials code that you assign to the product.

The correct code for any material or supply can be determined as follows: (1) classify the product by 4-digit SIC (use the alphabetical index in your SIC manual): (2) cross reference that SIC code to your "Materials and Equipment Code List." Materials codes 088, 098, 198, 298, 398, 498, 598, 698, 798, 898, and 998 should be used only as a last resort and only when a more descriptive code cannot be found.

Different products that have the same materials code can be combined and reported on one line. If you cannot easily determine the sales tax to be included for any single entry, report instead the sales tax rate. (The computer will use the rate to adjust the cost figure you report.)

If there are no materials or supplies involved in a contract, enter "none" in the description column of this form.

If additional space is needed, use the continuation sheet for this item.

Round all cost figures to the nearest dollar.

Report materials and supplies in the greatest detail possible. For example, if a contractor purchased $10,000.00 worth of concrete and steel pipe, report each type of pipe separately by materials code and value.

SAMPLE ENTRY

Name and description of material	Material code	Material cost	Percent of sales tax to be added	
Concrete pipe	102	$4275	4.5	200
Steel pipe	502	$5725	4.5	201

V. MATERIALS AND SUPPLIES

a. What was the total delivered, on-site cost of materials and supplies for this contract, excluding overhead and profits? .....

$	32

b. What materials were used on this contract, were any prefabricated, and what was the delivered, on-site cost of each?

Name and description of material	Material code	Material cost	Percent of sales tax to be added	
		$		200
				201
				202
				203
				204
				205
				206
				207
				208
				209
				210
				211
				212
				213
				214
				215
				216
				217
				218
				219

Notes:

V. MATERIALS AND SUPPLIES—Continued

Name and description of material	Material code	Material cost	Percent of sales tax to be added	
				220
				221
				222
				223
				224
				225
				226
				227
				228
				229
				230
				231
				232
				233
				234
				235
				236
				237
				238
				239
				240
				241
				242

VI. LABOR REQUIREMENTS

a. Complete this question for all contracts.

b. If complete payroll records are available from FHA for on-site occupations, skip VI.b. If no information is available from FHA, complete this section for all on-site jobs. If one or more of the contractor's payrolls are missing from the FHA file, enter the missing payroll data in VI.b. If FHA payrolls do not list all on-site occupations, complete VI.b. for any other on-site workers, especially workers in occupations not covered by FHA/WHPC reporting requirements.

When equipment is rented on a "fully operated" basis, record the operator's wages in VI.b.

Under "occupation code," enter the code number (see Job List 1 and 2) that best describes the occupation being reported.

The payroll period ending date for an array of data relating to the same pay period need be entered only once and on the first line of pertinent data. If aggregate data are reported, enter the ending data of the last pay period included in the aggregate data.

Under the "man-hours" column, enter total hours worked (straight time plus overtime). Round to a whole number. Record only the man-hours actually worked. Do not include man-hours for holidays, paid vacations, sick leave, annual leave, etc.

Under "earnings related to hours," enter gross pay before any deductions for federal or state income tax, employees' social security taxes, employees' health, welfare, or retirement payments, etc. Exclude from gross pay any payments the contractor made to FICA, insurance, vacation and pension funds, etc. Exclude pay for holidays, vacations, sick leave, annual leave, etc. Also exclude subsistence allowances and travel allowances (except when travel time is paid at the worker's hourly pay rate).

The following is an example of an entry for 2 employees who worked 40 and 48 hours and who earned $160 and $200 respectively.

SAMPLE ENTRY

Occupation code	Payroll period ending date	Hours	Earnings related to hours	
010	10 / 5 / 70	40	$160	600
011	/ /	48	$200	601

VI. LABOR REQUIREMENTS

a. Did this contractor have a labor agreement covering any of the work performed on this contract? ..... | | 33 |

Code

1.- Yes
2 - No

b. Complete the following for any on-site labor not already reflected on the payrolls filed with the FHA, (e.g., missing payrolls, hours and earnings of exempt employees who performed on-site work but who are not subject to FHA reporting requirements).

Occupation Code	Payroll period ending date	Hours	Earnings related to hours	
	/ /			600
	/ /			601
	/ /			602
	/ /			603
	/ /			604
	/ /			605
	/ /			606
	/ /			607
	/ /			608
	/ /			609
	/ /			610
	/ /			611
	/ /			612
	/ /			613
	/ /			614
	/ /			615
	/ /			616
	/ /			617

Total earnings ..... | | (Office use only)

VII. SCHEDULE STATUS

A separate B form must be completed for each contract let on the sample project. When actual data for a contract cannot be obtained because of refusals, out-of-business, etc., data will have to be estimated for that contract. See Technical Memorandum P-1 for guidance about how to estimate for missing data.

VI. LABOR REQUIREMENTS—Continued

Occupation code	Payroll period ending date	Hours	Earnings related to hours	
	/ /			618
	/ /			619
	/ /			620
	/ /			621
	/ /			622
	/ /			623
	/ /			624
	/ /			625
	/ /			626
	/ /			627

VII. SCHEDULE STATUS

a. (To be completed only by agent.) Is this a complete B form for this contract? ..... | | 34 |

Code

1. Yes
2. No

b. If "no," please explain:

_____

_____

_____

_____

_____

_____

_____

BLS 2652.01C

Office of Management and
Budget No. 44R1381
Approval expires: 12-31-72

U.S. DEPARTMENT OF LABOR
Bureau of Labor Statistics
Washington, D.C. 20212

AGENT WORKSHEET

SURVEY OF CONSTRUCTION LABOR REQUIREMENTS FOR MULTI-FAMILY HOUSING

The Bureau of Labor Statistics will hold all information furnished by the respondent in strict confidence.

GENERAL INSTRUCTIONS

This form is for agent and Regional Office use only. This document will not be keypunched and will not be transmitted to the Washington Office.

Use this worksheet to record information about the contracts and contractors associated with a sample project...information usually available from local FHA Offices and/or a project's General Contractor. Also, use it to assign the "contract number" you will need in order to code the "B" form for any given contract.

Information secured from FHA Offices and recorded on this form should be verified and, if necessary, supplemented when you call on the General Contractor for a project. Be careful about listing "material suppliers." This term often appears on FHA or General Contractor records and may refer to a contractor's source of supply rather than to a contractor to the project.

A "Contractor" may be defined as follows:

General Contractor - The person or organization who accepts a contract from the project developer and who organizes, subcontracts and oversees all or nearly all construction performed on the project.

Prime Contractor - Like the General Contractor, accepts a contract from the project developer. However, a Prime Contractor organizes, subcontracts, and oversees only one aspect (e.g., plumbing; ventilation) of construction.

Subcontractor - The person or organization who accepts a contract from the General Contractor or Prime Contractor. Subcontracts are usually limited to one or a few construction activities.

Sub-Subcontractor - Accepts a contract from a Subcontractor to perform part of the work specified in the subcontract.

I. PROJECT IDENTIFICATION

a. FHA Project No. _____

b. Name and address of project _____

_____

II. FHA INFORMATION

a. Name, address, and telephone of FHA Office _____

_____

b. Record of contacts with FHA Office

Date of visit	Person contacted	Field Representative

III. GENERAL CONTRACTOR IDENTIFICATION

Record the name, address, and telephone number of the general contractor, the contract operations which he performed, and the value of the general contract. Use "001" to identify the general contractor on the B form.

Contract number	Name, address, and telephone of general contractor	Contract operations	Value of general contract
001			

IV. PRIME CONTRACTOR IDENTIFICATION

Record the names, addresses, and telephone numbers of the prime contractors, the operations which each performed and the value of each prime contract. Use the contract numbers "002" through "010" to identify the prime contractors on the B forms.

Contract number	Name, address, and telephone of prime contractor	Contract operations	Value of prime contract
002			
003			
004			
005			
006			
007			
008			
009			
010			

Notes: _____

_____

_____

V. SUBCONTRACTOR IDENTIFICATION

For each subcontract performed on the project, list the name, address, and telephone number of the subcontractor, the subcontract operations performed, and the value of each subcontract. In order to identify each additional contract on the B forms, assign contract numbers starting with "011," and consecutively number until all subcontracts are identified with a distinct number.

(The corresponding sub subcontract information is recorded in question I.f. of the B form of the subcontract for which the work was done. Continue numbering the sub subcontracts so that each contract has a distinct number.)

Contract number	Name, address, and telephone of subcontractor	Contract operations	Value of sub-contract
011			
012			
013			
014			
015			
016			
017			
018			
019			

V. SUBCONTRACTOR IDENTIFICATION—Continued

Contract number	Name, address, and telephone of subcontractor	Contract operations	Value of sub-contract

V. SUBCONTRACTOR IDENTIFICATION—Continued

Contract number	Name, address, and telephore of subcontractor	Contract operations	Value of sub-contract

Notes

GPO 825-497

Appendix C. Bibliography

The following are publications in the series of construction labor requirements studies by the Office of Productivity and Technology, Bureau of Labor Statistics.

Civil works construction

Labor and Material Requirements for Civil Works Construction by the Corps of Engineers (BLS Bulletin 1390), 1964, 28 pp.

A statistical study of onsite and offsite employee-hour and wage requirements for dredging and land projects in the U.S. Corps of Engineers' civil works program from 1959 to 1960.

College housing construction

Labor and Material Requirements for College Housing Construction (BLS Bulletin 1441), 1965, 34 pp.

A survey of 43 college housing projects which were administered by the Community Facilities Administration. The survey is designed primarily to determine the employee-hours required per $1,000 of college housing construction.

Miller, Stanley F., "Labor and Material Required for College Housing," *Monthly Labor Review,* September 1965, pp. 1100-04.

A summary of BLS Bulletin 1441.

Federally aided highways

Ball, Robert, "Labor and Materials Required for Highway Construction," *Monthly Labor Review,* June 1973, pp. 40-45.

Discussion of labor and material trends in highway construction between 1958 and 1970.

Labor and Material Requirements for Construction of Federally-Aided Highways, 1958, 1961, and 1964 (BLS Report 299, 1966), 17 pp.

Study providing measures for 1958, 1961, and 1964 of the labor and material requirements for federally aided highways, with separate measures of the requirements for onsite and offsite construction. For onsite construction, the study also provides a comparison of annual labor requirements for 1947–64.

Kutscher, Ronald E. and Waite, Charles A., "Labor Requirements for Highway Construction," *Monthly Labor Review,* August 1961, pp. 858-61.

Summary of findings of the 1958 highway survey.

Wakefield, Joseph C., "Labor and Material Requirements: Highway Construction, 1958 and 1961," *Monthly Labor Review,* April 1963, pp. 394-98.

A summary comparison of the 1958 and 1961 highway surveys.

Federal office building construction

Labor Requirements for Federal Office Building Construction (BLS Bulletin 1331), 1962, 43 pp.

A statistical study of onsite and offsite labor requirements for constructing 22 Federal office building projects in various localities of the United States over a 3-year period from the fall of 1957 to 1960.

Murray, Roland V., "Labor Requirements for Federal Office Building Construction," *Monthly Labor Review,* August 1962, pp. 889-93.

A summary of BLS Bulletin 1331.

Hospital construction

Labor Requirements for Hospital Construction (BLS Bulletin 1340), 1962, 46 pp.

A statistical study of onsite and offsite labor requirements for construction of selected public and private, profit and nonprofit, general hospitals in various localities of the United States between mid-1958 and mid-1959.

Rothberg, Herman J., "Labor Requirements for Hospital Construction, 1959–60," *Monthly Labor Review,* October 1962, pp. 1120–24.

A summary of BLS Bulletin 1340.

Labor and Material Requirements for Hospital and Nursing Home Construction (BLS Bulletin 1691), 1971, 50 pp.

A study similar to the one done in 1962 but with data shown per square foot as well as per $1,000 of construction contract. Covers hospitals and nursing homes constructed in 1965–66.

Riche, Martha Farnsworth, "Man-hour Requirements Decline in Hospital Construction," *Monthly Labor Review,* November 1970, page 48.

Summary of BLS Bulletin 1691.

Private multifamily housing construction

Ball, Robert, "Labor and Material Requirements for Apartment Construction," *Monthly Labor Review,* January 1975, pp. 70–73.

Summarizes the first construction labor requirements study of private multifamily housing construction.

Private single-family housing construction

Labor and Material Requirements for Private One-Family House Construction (BLS Bulletin 1404), 1964, 37 pp.

A statistical study of onsite and offsite labor requirements for constructing a sample of one-family houses built in 1962 in various localities of the United States.

Rothberg, Herman J., "Labor and Material Requirements for One-Family Houses," *Monthly Labor Review,* July 1964, pp. 797–800.

A summary of BLS Bulletin 1404.

Labor and Material Requirements for Construction of Private Single-Family Houses (BLS Bulletin 1755), 1972, 30 pp.

Updates Bulletin 1404.

Ball, Robert and Ludwig, Larry, "Labor Requirements for Construction of Single-Family Houses," *Monthly Labor Review,* September 1971, pp. 12–14.

Summary of a study of labor and material requirements for single-family housing construction in 1969.

Public housing construction

Labor and Material Requirements for Public Housing Construction (BLS Bulletin 1402), May 1964, 42 pp.

A report based on findings of a survey of 31 public housing projects which the Public Housing Administration administered. Projects were selected in various States to represent four broad geographic regions of the conterminous United States.

Finn, Joseph T., "Labor Requirements for Public Housing," *Monthly Labor Review,* April 1972, pp. 40–42.

Summary of a study of labor requirements for public housing construction in 1968.

School construction

Labor Requirements for School Construction, (BLS Bulletin 1299), 1961, 50 pp.

A study of primary and secondary employee-hours required per $1,000 of new school construction based on contracts awarded for 85 elementary and 43 junior and senior high schools throughout the United States.

Epstein, Joseph, and Walker, James F., "Labor Requirements for School Construction," *Monthly Labor Review,* July 1961, pp. 724–30.

A summary of BLS Bulletin 1299.

Labor and Material Requirements for School Construction, June 1968 (BLS Bulletin 1586), 23 pp.

A survey of selected elementary and secondary public schools constructed primarily during 1964–65. In addition to providing information on labor requirements, the study also includes data on the types and value of materials used, wages paid, occupations, and use of apprentices.

Finn, Joseph T., "Labor Requirements for School Construction," *Monthly Labor Review,* August 1968, pp. 40–43.

A summary of BLS Bulletin 1586.

Sewer works construction

Labor and Material Requirements for Sewer Works Construction (BLS Bulletin 1490), 1966, 31 pp.

Study designed to measure the total employee-hours of labor required for each $1,000 of new sewer facilities construction contract. The basis for this study was 138 contracts for new sewer work in the years 1962–63.

The following are studies related to the construction labor requirements series.

Ball, Claiborne M., "Employment Effects of Construction Expenditures," *Monthly Labor Review,* February 1965, pp. 154–58.

A summary of labor requirements for eight types of construction broken down by offsite and onsite hours, by occupation, and by region.

Ball, Robert, "The Contract Construction Industry," *Technological Trends in Major American Industries* (BLS Bulletin 1474), 1966, pp. 32–38.

Discusses economic trends in the industry with emphasis on the impact of technological change on employment, occupations, job skills, and productivity.

"Construction Labor Requirements," reprint of Chapter 28 of *Handbook of Methods for Surveys and Studies* (BLS Bulletin 1711), 1971.

Description of techniques of construction labor requirements studies.

Mark, Jerome A., and Ziegler, Martin, "Measuring Labor Requirements for Different Types of Construction," Paper before the Conference on the Measurement of Productivity in the Construction Industry, sponsored by the National Commission on Productivity and the Construction Industry Collective Bargaining Commission, September 14, 1972, Washington, D. C.

Discussion of the BLS program of labor and material requirements and analysis of the potential of using data from the program to measure productivity by type of construction.

Weinberg, Edgar, *Mechanization and Automation of Building Site Work,* National Response Paper for the Economic Commission for Europe, Committee on Housing, Building, and Planning, Third Seminar on the Building Industry, Moscow, October 1970.

Discussion of current technology and labor requirements at the construction site.

Weinberg, Edgar, "Reducing Skill Shortages in Construction," *Monthly Labor Review,* February 1969, pp. 3–9.

Discussion of methods for reducing occupational shortages.

Ziegler, Martin, "BLS Construction Labor Requirements Program," paper before the North American Conference on Labor Statistics, San Juan, Puerto Rico, June 1971.

Construction labor requirements program and objectives are discussed.

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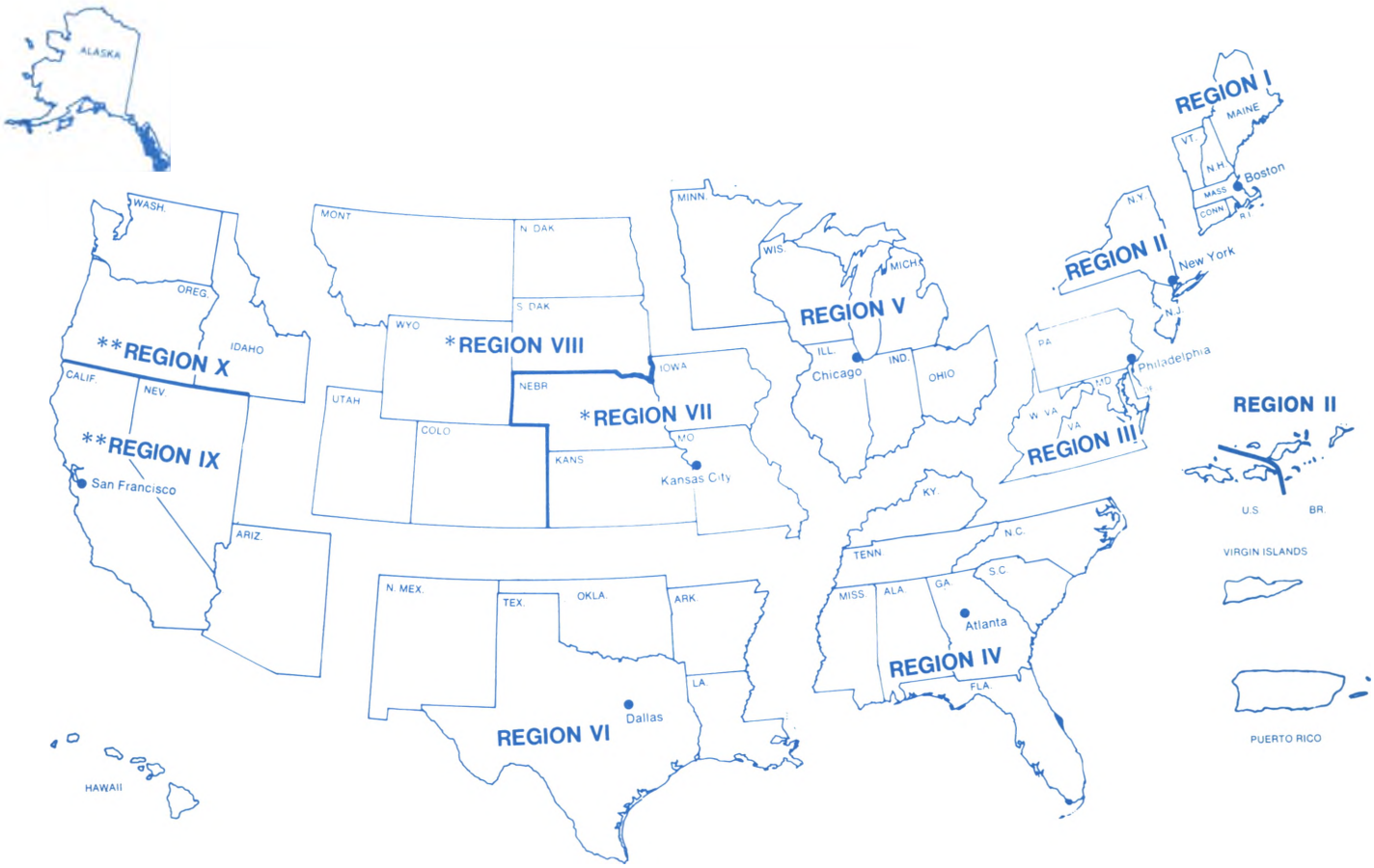

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