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**Labor and Material
Requirements for
Construction of
Private Single-family
Houses**

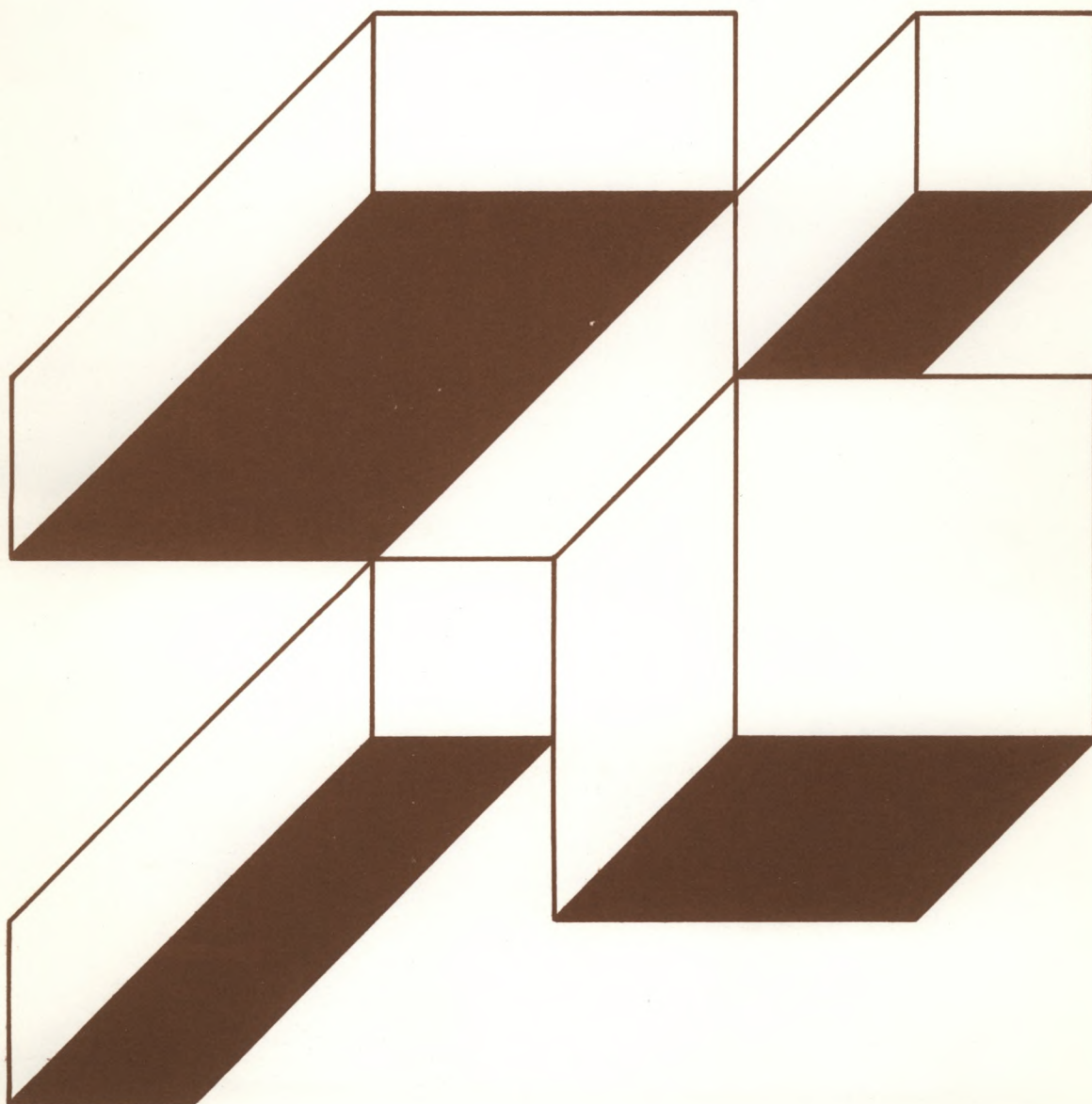
Bulletin 1755

U.S. DEPARTMENT OF LABOR
Bureau of Labor Statistics
1972

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U.S. DEPARTMENT OF LABOR

J. D. Hodgson, Secretary

Bureau of Labor Statistics

Geoffrey H. Moore, Commissioner

1972



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Preface

The current program of construction labor requirements studies was started in 1959 in recognition of the need for information on the possible employment generating effects of various types of construction activities. Several labor requirements studies which were more limited in scope and content were completed in the 1930's and 1940's. Since 1959, the Bureau of Labor Statistics has conducted a series of studies presenting data on the total amount of employment and man-hours, both onsite and offsite, per dollar of construction expenditure and per square foot of space. The studies provide not only detailed occupational, contractor, and man-hours data but also information on the amount and type of material required. Completed construction studies include civil and sewer works, college housing, public housing, federally aided highways, Federal office buildings, elementary and secondary schools, hospitals and nursing homes, and private single-family houses.

The study of new private single-family housing construction was conducted in cooperation with the Department of Housing and Urban Development (HUD) to evaluate the labor and material requirements needed to meet the Nation's housing goals. It is similar to, but not entirely comparable with, a study done in 1962. Selective data from the 1962 study are included, however, for illustrative purposes.

The Bureau is indebted to the more than 4,200 general and special trade contractors who provided information for this survey, to the Bureau of the Census who provided the sample, and to HUD who provided guidance and financial assistance.

The study was prepared in the Bureau's Office of Productivity and Technology by Robert Ball, assisted by Larry Ludwig and Joseph T. Finn, under the general supervision of Martin Ziegler, Chief, Division of Productivity Research.

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Chapter I. Introduction

Single-family home building is a major component of the Nation's output of goods and services and a major source of employment. Jobs are created not only at the site of construction but also in the many manufacturing, mining, trade, transportation, and service industries which furnish the materials and services for construction. This study is the result of a survey of labor and material requirements for constructing private single-family houses in 1969 by the Bureau of Labor Statistics under contract with the Department of Housing and Urban Development.

Labor and material requirements to meet the Nation's housing goals were evaluated and employment-generating effects of new private, single-family housing were determined. The study shows (1) the amount of labor time used to complete single-family houses; (2) detailed characteristics by types of houses, contractors, and occupations; (3) ratios per 100 square feet and per \$1,000 of construction costs in current (1969) and constant (1962) dollars; (4) the change in direct labor requirements between this study and the 1962 study; (5) data on materials used; and (6) total labor requirements generated by the manufacture, sale, and delivery of these materials.

Scope of survey

The survey is based on a sample of 250 single-family houses constructed during 1968 and 1969 in the continental United States. Most of these houses, however, were completed and sold in 1969. The sample was stratified by geographic location, estimated cost of houses, and degree of urbanization where they were built. Data were collected by field agents of the Bureau of Labor Statistics through personal visits to over 4,200 general and special trade contractors. On the average, 17 contractors were visited for each house; however, the number of visits (including callbacks) was considerably larger. (See appendix C.)

Although some data for the 1962 study are included with this report for illustrative purposes, the two studies are not comparable. For example, the previous study covered only FHA and VA approved houses, whereas the current study covers all new, conventionally-

constructed, private single-family units built for sale or custom built under contract, and costing \$75,000 or less.

Comparison with Bureau of the Census data

The basic sampling frame was developed from Bureau of the Census data on construction starts and permits issued for single-family homes during 1968. (See appendix A.) Since the sample largely reflected permits issued, construction took place mostly between June 1968 and July 1969; most of the homes were completed and sold in 1969. Single-family housing in the BLS sample and the 1969 Census study are compared:

	<i>BLS Study</i> ¹	<i>Census Study</i> ²
Average cost per house	\$25,856	\$22,700
Average cost per square foot . . .	\$15.94	\$13.45
Average square foot per house . .	1622	1640

¹New houses built for sale and custom built under contract excluding land but including selling expenses and change orders.

²New houses sold excluding value of improved lot.

The differences between these data can be explained by several factors:

1. The conceptual basis for the two samples is different. The Bureau of the Census sample consists of new houses sold. The BLS sample consists of new houses built for sale and custom built under contract by a general contractor. (See Construction Reports, C25-69-13, Characteristics of New One-Family Homes, 1969, U.S. Department of Commerce, Bureau of the Census, July 1970.)

2. Census uses the sales price at the time the contract is signed or the deposit is made. Thus, subsequent price changes resulting from change orders are not reflected. Furthermore, the Census sales price does not include cash options, extras, or charges otherwise not included in the original sales price. On the other hand, BLS figures include all charge orders before occupancy or the date of the survey, whichever comes first, and any cash options or extras in the structure so long as the construction was done by a contractor and not by an unpaid worker, such as the owner or member of his

family. These inclusions tend to raise the BLS total unit cost and man-hours higher than the cost of the census homes.

3. Census does not include any work on the grounds around the house. This survey, however, includes all items in the original contract, such as landscaping, paving, termite control, and grading. Excluded are out buildings, fences, swimming pools, and operations for general land development, i.e., drainage, streets, clearing of trees, etc.

4. The definition of square footage in the two surveys was not comparable. For example, the Census study included square footage for all completely finished areas, including basements and attics. The BLS survey had a more restricted definition which included only livable floor space. (See footnote 4.)

5. The BLS survey excluded modular and section-alized houses as well as houses which cost over \$75,000 (including land), but final averages probably were not affected.

Nature of the industry

To maintain perspective, the unique nature of the homebuilding industry must be kept in mind throughout this discussion of man-hour and material requirements. For example, the typical contractor operates a small firm which has little capital providing only a few housing units per year, or he works for himself as a special trade contractor. (General contractors and builders in the current survey built a median of about 30 houses in 1969.) That this multiplicity of diverse firms of small average size permeates the construction industry is

indicated by the 1967 Census of Construction (the latest data available.) According to the Bureau of the Census, the construction industry is made up of almost 800,000 establishments, employs more than 4 million workers (including proprietors and working partners), and conducts an annual business of more than \$101 billion. Over three-fourths of these establishments gross less than \$250,000 annually, and half make less than \$25,000. On the other hand, less than 1 percent of the establishments reported receipts of \$2.5 million or more and accounted for more than 38 percent of all receipts.

Homebuilding construction is highly varied, relatively unmechanized, and requires a labor force which has a high proportion of manual craftsmen and laborers. Unskilled and semiskilled workers, for example, constituted 28 percent of the work force for single-family houses in 1969, and these workers may be on the increase.

Another characteristic of the industry is seasonality which causes high unemployment rates for construction workers and a low number of annual hours for most crafts. Among surveyed contractors construction workers averaged 82 percent as much time in January as in July 1969. (See table 14.)

The industry also is characterized by a multiplicity of diverse building codes and zoning regulations, widely varying customs and practices, lack of extensive research and development, union jurisdictional problems, localized markets, customized products, and a volatile money supply sensitive to changes in interest rates. A full review of these characteristics properly belongs elsewhere, but these factors do restrict homebuilding, drive up costs, and bring delays and inefficiencies.

Chapter II. Highlights Of Findings

Total man-hour requirements. An average new private single-family house in 1969 required 1,337 onsite man-hours of labor, 254 offsite man-hours in contractors' offices and warehouses, and 1,925 indirect man-hours in industries providing materials and services.¹ This time is equivalent to about three-fourths of a man-year for on-site construction workers and slightly more than a man-year for all other workers—including offsite construction employees.

Expanding these findings to reflect total employment in 1969, private single-family house construction provided full-time jobs for an estimated 450,000 construction workers and additional jobs for 74,000 offsite construction personnel, such as administrators, appraisers, engineers, architects, secretaries, and clerks. These figures account for over 12 percent of the more than 4 million workers in construction that year. In addition, about 561,000 jobs were generated in industries which provide materials and services.²

¹Not covered by the survey were construction inspection by government employees, installations by public utility employees, and labor required for swimming pools, fences, and outbuildings. Excluded from other industry man-hour requirements was labor generated by money spent by builders or contractors for taxes (including payroll taxes) and other overhead items, such as real estate commissions, rent, bonds, insurance, financing, utilities and business services, and legal and professional services. These payments probably generate little direct employment. Employment created by the respending of wages and profits of the workers and their employers—the multiplier effect—was also outside the scope of the study.

²These estimates, although representing only jobs created by new houses built for sale and custom-built under contract, actually accounted for the vast majority of jobs in private single-family housing construction, because the other major grouping, owner-built houses, probably provides few onsite and offsite construction jobs. If the effects of owner-built houses were included in these calculations, single-family homebuilding would account for an estimated 15 percent of all construction jobs in 1969. In industries providing materials or services, however, perhaps one-fifth more jobs would be created when owner-built houses are included. Although owner-built houses make up about one-fourth of all single-family homes, they tend to be smaller and less expensive; thus, the value of materials would be proportionately less. Estimates were derived by using 1,800 hours a year for onsite construction workers and 2080 hours for other workers.

Each \$1,000 of cost exclusive of land³ generates about 137 man-hours of labor in all sectors of the economy. Of these man-hours, 62 are expended in construction—52 onsite and the rest offsite, as indicated by table 1. Thus, for every hour of onsite construction work, an additional 0.2 hour is spent in contractors' offices and warehouses and 1.4 hours in other industries.

In addition to the direct employment generated in the construction industry, 75 man-hours of employment per \$1,000 of construction were created in industries which mine, manufacture, distribute, and sell the materials used in single-family house construction.

On a square footage basis, each 100 square feet of livable floor space (calculated area)⁴ provided 98 man-hours of construction work—82 of which were onsite. In other industries, 119 man-hours were created per 100 square feet. (See charts 1 and 2.)

Man-hour requirements for all industries except construction were developed by translating the materials purchased into man-hours required to mine, process, transport and distribute the materials used in construction. These man-hour estimates were derived by first classifying and aggregating material values by type, deflating by appropriate price indexes, and applying the data to input-output tables. Productivity factors were then used to develop estimates of employment and man-hours by industry group. (See appendix B.)

Change in onsite man-hour requirements. A comparison of current data with 1962 results reveals a decline in onsite man-hour requirements. This change reflects a host of economic factors including new processes and materials, geographic shifts in demand, shifts in types of

³Construction cost refers to the cost of the house exclusive of the price of improved lot and any closing costs, and includes onsite and indirect labor, materials, overhead and profit, and selling expenses. Also included are the cost of change orders executed after the initial contract and before occupancy or time of survey, whichever came first.

⁴Livable Space (calculated area) as used throughout this report is defined as all living spaces in the house above basement or foundation from outside surfaces of exterior walls. Excluded are all space in garage and finished attic covering less than 50 percent of ground floor area, and any area which has a ceiling of less than 5 feet.

Chart 1

Man-Hour Requirements Per 100 Square Feet of Private Single-Family Housing Construction, by Sector, 1969 and 1962

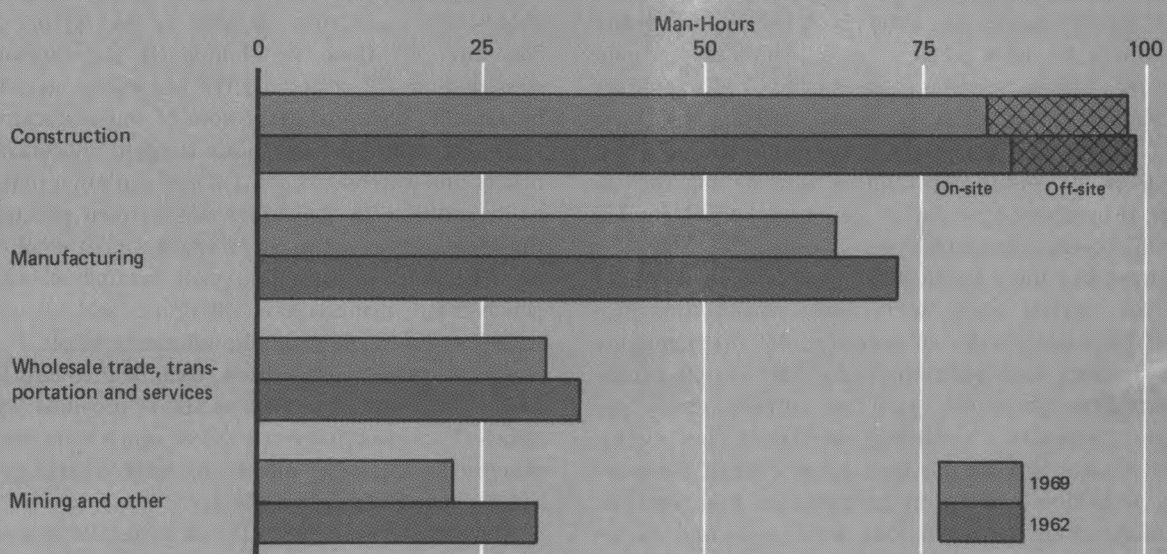
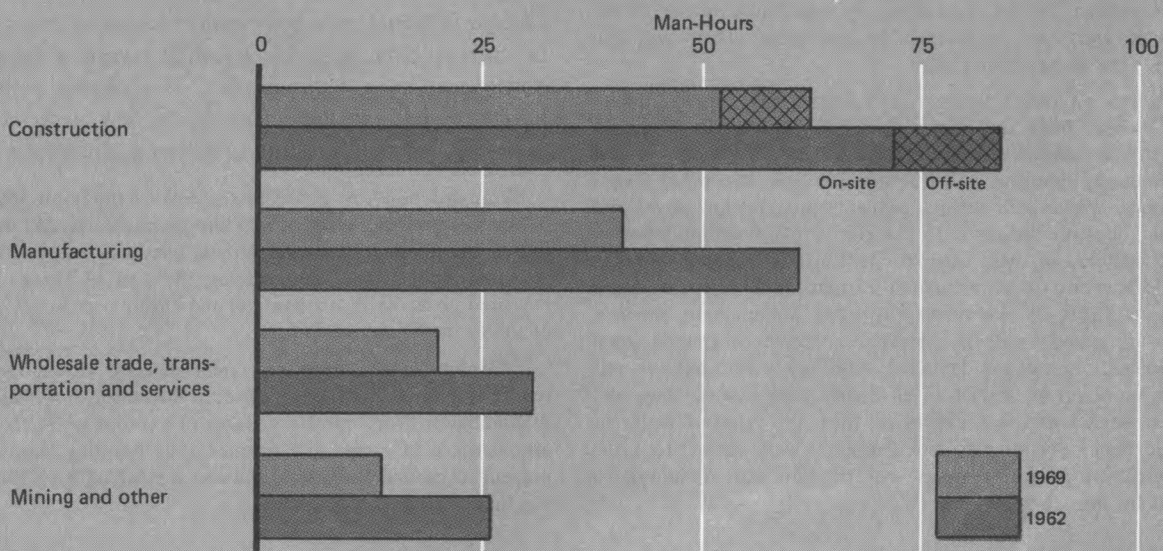


Chart 2

Man-Hour Requirements Per \$1,000 of Private Single-Family Housing Construction, by Sector, 1969 and 1962



housing, and productivity growth. Isolating the effects of productivity change on labor requirements from these other factors is extremely difficult.

In addition, the sample in 1962 was considerably smaller, had only about a third as many respondents, and was limited to FHA and VA-approved houses compared with the current study which covers all new, conventionally-constructed, private, single-family houses built for sale or custom-built under contract and costing \$75,000 or less.

With these limitations, two measures of change in onsite man-hour requirements were developed: one based on square footage; the other on constant dollars. A Bureau of the Census single-family housing price index was used to deflate the current dollar value.⁵

On a square footage basis, man-hours per unit of output declined slightly more than one-half of 1 percent a year. On a constant (1962) dollar basis—the effects of price increases having been removed—the decline was almost 2 percent a year, as shown.

	1969	1962	Average ⁶ annual percent change
Man-hours per 100 square feet	82	85	-0.6
Man-hours per 1000 constant dollars . .	64	72	-1.9

Since homes built in 1969 have more bathrooms, air conditioning, and other improvements than those built in 1962, real value increased substantially faster than output based on square footage alone. These improvements also required a greater number of man-hours to install, but the increase in labor time was not proportionate to the rise in real value.

Offsite man-hours. Although man-hour requirements in the construction industry declined from the earlier study, the decline in all other industries was much sharper and reflected the effects of higher productivity in the manufacture and distribution of materials as well as changes in the composition of material inputs. (See table 1.) Prefabricated materials were used to a greater extent in the construction of single-family housing, and as a result jobs were shifted from construction into manufacturing. Increasing use of ready-made concrete and gypsum products, for example, creates some new jobs in the concrete and gypsum industries, but reduces onsite labor requirements in construction. Despite this trend, man-hour requirements are declining considerably

⁵See John C. Musgrave, "The Measurement of Price Changes in Construction," *Journal of the American Statistical Association*, September 1969, pp. 771-786.

⁶Compounded 6½ years to mid-1969 when the majority of houses surveyed were completed. Rates of change calculated on unrounded data.

faster in manufacturing and other industries than in construction.

Other highlights. Construction costs of houses in this survey ranged from about \$8,000 to \$52,000; a weighted average was \$25,856. (See table 2.) Onsite labor was just over 20 percent of this average; supplemental benefits for onsite workers accounted for about 3 percent.

—square feet of livable space averaged 1622 and ranged from 800 to 3800. Cost per square foot was \$15.94.

—average hourly earnings were \$3.94, considerably less than the union wage scale for comparable occupations in the building trades because homebuilding is basically a nonunion activity. About 65 percent of contractors surveyed, for example, were nonunion.

—builders surveyed constructed a medium of about 30 houses during the fiscal year covered by the study (i.e., July 1968 through June 1969).

—ninety-six percent of builders surveyed provided no on-the-job training or registered apprenticeship programs.

—ninety-one percent of business, in dollar value, of builders surveyed were in single-family house construction. (See table 18.)

—most frequently quoted obstacles to efficiency were: building codes, lack of skilled workers, and adverse work practices. (See table 15.)

—inclement weather was the most persistent problem and a major deterrent to house construction.

—most frequently-mentioned prefabricated items were kitchen cabinets, vanities, preassembled windows, and prehung doors. (See table 17.)

—average time to build survey houses was about 21 weeks. Several builders encountered delays due to inclement weather although a few experienced other drawbacks such as work stoppages.

—overtime was of little consequence and amounted to less than 1 percent in pay for each worker. Overtime was used only when absolutely necessary, and then usually in subcontracts, such as stucco and concrete, which could not be halted abruptly at the end of a day.

—about 1300 contractors, over 30 percent of the more than 4,200 general and special trade contractors in the survey, had labor-management agreements. Of this number, all workers were covered in about 90 percent of the agreements. (See table 13.) Nearly all skilled workers were covered where an agreement was in force.

—the average land value per lot was just under \$5,000 and included utilities, street paving, and sewer hookup for the majority of houses surveyed. (See table 16.) Community recreation facilities were included for 15 percent of houses.

Chapter III. Onsite Man-Hour Requirements and Characteristics of Houses

Occupational requirements. According to the study, 69 percent of the onsite man-hours were worked by skilled tradesmen, 28 percent by semiskilled and unskilled workers, and 3 percent by nonproduction employees (supervisors, engineers, clerks). (See table 3.) Four major building crafts—carpenters, painters, bricklayers, and plumbers—accounted for three-fourths of the skilled employees. Carpenters, the most frequently used occupation, accounted for over one-third of the man-hours at the site. Over one-fourth of the man-hours were expended by laborers, helpers, and tenders.

The current study indicates two important trends—a decline in the proportion of skilled man-hour requirements and an increase in semiskilled and unskilled man-hours. In a 1947 study, skilled workers provided 76.7 percent of all onsite man-hours for single-family housing construction.⁷ This proportion dropped to 73.2 in 1962 and to 68.8 in 1969. The reverse is shown for laborers, helpers and tenders. The 1947 study indicates that these workers accounted for 21.2 percent of total onsite man-hour requirements, which increased to 23.3 percent in 1962 and 27.9 in 1969. To a very large extent, these trends reflect the greater use of prefabricated materials, which often require less skill to install. Except for these shifts, the mix of occupational requirements showed little change.

Contractor man-hours. The study found that general contractors accounted for over 30 percent of the man-hours in onsite construction, although carpentry contractors accounted for 17 percent, almost double the level in 1962. (See table 4.)⁸ Compared with the earlier

study, carpentry man-hours have increased considerably, while hours worked by general contractors have declined; general contractors are concentrating more of their efforts on coordinating, financing, and purchasing while subcontracting more onsite work to carpentry contractors.

The share of labor input of masonry, concrete, wallboard, and electrical contractors has increased substantially since the 1962 study. Increasingly, homeowners' demand for patios, fireplaces, basements, garages, more electrical appliances and outlets, and the substitution of wallboard for plaster have brought about these shifts in labor.

Characteristics of houses. Most of the houses in the 1969 study were located within metropolitan areas and had one story, a wood frame, basement, two or more bathrooms, forced air heating, and a garage or carport. Compared with homes built 7 years earlier, the 1969 home was roomier, had more bathrooms and air conditioning, and was considerably more expensive to build.

The number of onsite man-hours per \$1,000 of construction cost and per 100 square feet was considerably higher in nonmetropolitan areas than in metropolitan areas. (See table 5.) Homes built in metropolitan areas required 44 man-hours per \$1,000 of construction cost, compared with 79 for nonmetropolitan areas. On a 100 square foot basis, 71 man-hours were required in metropolitan areas compared with 120 in nonmetropolitan areas. Higher onsite man-hours in nonmetropolitan areas also were observed in the earlier study. A number of factors may contribute to this difference: the inclusion of more basements and garages, greater use of wood for exterior wall or framing, the use of less-skilled workers, and smaller average size homes in nonmetropolitan areas.

There is a strong inverse correlation between average hourly earnings and the number of man-hours required in single-family home construction. That is, as hourly earnings increase, unit man-hour requirements decrease.

In costs, a different pattern emerged. Costs were higher in metropolitan areas, and tended to increase as

⁷Edward M. Gordon, "Home Construction: Man-hours by Occupation 1946-47," *Monthly Labor Review*, December 1948.

⁸Classification of man-hours and costs by major type of operation, according to the Standard Industrial Classification (SIC) method, proved difficult since contractors often do several related jobs. A concrete subcontractor, for example, frequently performs duties other than concrete work, such as foundations (a separate SIC grouping) while a carpentry subcontractor also may do flooring, siding, and roofing in addition to rough and finish carpentry. Such problems were resolved on the basis of the major component of work performed in costs.

earnings increased. (See table 6.) Of course, costs are determined by other factors in addition to labor. Although larger houses require fewer man-hours per square foot and per \$1,000 (as measured by number of stories and bathrooms), total cost per square foot

increased as the house size increases. Thus, the labor cost share tends to decline as houses increase in size although total cost per unit tends to rise as the house size increases.

Chapter IV. Distribution of Costs

Relative cost shares. Private single-family housing had the lowest labor input of any type of construction studied by the Bureau. (See table 7.) Onsite wages and salaries, declining slightly as a percent of total house costs since 1962, represented 20.4 percent of construction costs in the current study. This decline is the continuation of a long-term trend from 1947, when onsite labor was 32.7 percent of total costs.⁹ Materials representing the largest share, as in other construction labor requirements studies except dredging projects, also declined as a percent of all costs from 47.2 to 43.4 percent. As a percent of total costs, equipment remained about the same—1 percent. Although not available separately for the 1962 study, in 1969 supplemental wage benefits accounted for 2.7 percent and selling expenses 2.9 percent of total costs. (See chart 3.)¹⁰ The relative share of residual costs, which include construction financing, inventory, administration, clerical work, warehousing, other overhead costs, and builders' and contractors' profits, was 29.7 percent. Including supplemental wage benefits and selling expenses as in the previous study, the increase in residual was just over 6 percentage points. Factors contributing to this rise in the residual share included increased interest rates for builder loans and increased employer contributions for unemployment insurance, social security, and fringes, such as paid vacations and retirement.

Contractor costs. More than half of the total cost of a house is paid to the general contractor for materials, administration, and onsite labor. (See table 8.) Plumbing, heating, ventilating, and air-conditioning contractors make up the second largest group; carpentry contractors receive a close third. These three types of contractors account for over two-thirds of the construction cost.

Wages by occupation. Earnings in the study were consistently lower for every occupation than the average

hourly wage scales for all unionized building trades. (See table 9.) This comparison reflects the largely nonunion status of the private single-family homebuilding industry (about 65 percent of the contractors in the survey). Only three occupations in the study approached union scales: cement finishers, plasterers, and roofers. The largest difference in scale is between union and non-union laborers, helpers, and tenders, and is consistent with the increasing proportion of these workers in single-family housing construction.

Wage share. In 1969, the median onsite wage share of construction costs, reflecting a slight downward shift from the earlier study, fell in the 15.1-20.0 percent category. (See table 10.) Over 18 percent of the houses had a wage share of over 25 percent, although less than 10 percent had 15 percent and under.

In addition, labor's share of total cost showed a wider dispersion in the current study. At the lower end of the scale, the number of houses in which the onsite labor share was 15 percent and under increased from 3.0 to 9.8 percent. This increase may reflect a greater improvement in productivity, increasing use of prefabricated components, and more efficient construction equipment. All of these factors tend to reduce onsite labor costs. Similarly, at the upper end of the scale, the number of houses in which labor's share was 30.1 percent or more of costs increased from 3.0 percent to 4.4. This increase is consistent with the large amount of building in the South where building is generally more labor intensive. The sample used for this study reflects this increased homebuilding activity in the South.

Material costs

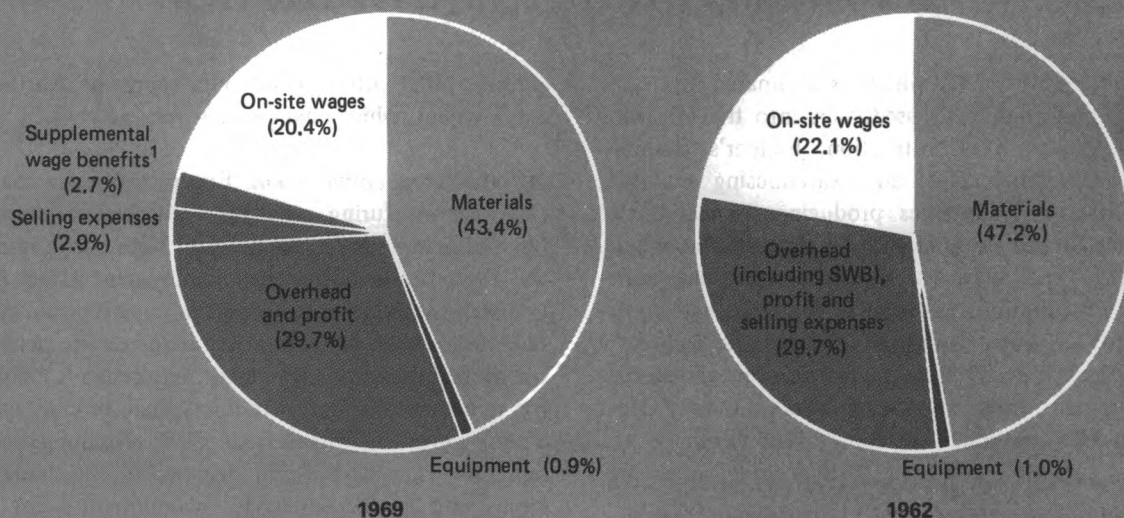
Materials and equipment represented \$443 per \$1,000 or \$707 per 100 square feet. (See table 11.) The most important materials category was lumber and wood products (including furniture), accounting for about 18 percent of the total or \$180 per \$1,000. The second most important material grouping was stone, clay, and glass products (including sand, gravel and dirt fill) representing \$95 per \$1,000 of construction cost.

⁹Adela L. Stucke, "Labor Share in Construction of New Houses," *Monthly Labor Review*, May 1949.

¹⁰Selling expenses normally would not be included in construction costs. However, since they were reported in the 1962 study and cannot be identified or removed, selling expenses are shown in the 1969 figures for comparison.

Chart 3

Distribution of Construction Costs for Single-Family Houses, 1969 and 1962



¹ Supplemental wage benefits (SWB) includes social security (FICA), unemployment insurance, vacation pay, retirement funds, health and life insurance and other fringe benefits for on-site workers.

Materials include cost of supplies, fixed equipment incorporated into the structures, and major appliances that were covered by the original construction contracts. For convenience, the materials tables also include the rental cost or equivalent value of the construction equipment used at the site. Equipment accounted for about \$9 per \$1,000 of construction.

The dollar values in table 11 reflect changes both in the physical volume and the relative costs of various materials. One method for determining relative importance of material utilization is the use of percentage distributions of the list of materials. Substantial declines are shown in table 11 for stone, clay, and glass; metal; and petroleum products. On the other hand, substantial increases occurred for plumbing products, carpets and

rugs, and plastics products. These trends mirror the practice of providing more bathrooms, rugs, and carpets, numerous plastics products such as cold water and drainage pipes, and interior and exterior plastic wall panels. Other major groupings remained relatively constant; however, numerous substitutions within these major groupings took place (as in the use of wallboard for plaster, both of which are made of gypsum and classified in the same grouping) for a number of reasons (i.e., due to prefabrication, relative price changes, new products, personal preference and scarcity or abundance).

A more detailed breakdown of material is shown in table 12.

Chapter V. Estimated Offsite (Indirect) Employment Requirements

Offsite employment, which is estimated from the materials and equipment used, falls into the following industry groups: (1) Construction: Builder's, administrative, estimating, office and warehousing activities; (2) manufacturing activities producing fabricated and raw materials and equipment; (3) transportation, wholesale trade, and services: Industries providing warehousing, distribution, and sale of materials and equipment; (4) all other industries directly or indirectly affected by the production and distribution of materials and equipment. Interindustry transfers ultimately affect industries such as agriculture, forestry and mining.

Some workers in architectural firms, utility companies, and State and local governments who contribute to the construction of private single-family houses are not covered by this report. (See footnote 1.)

Builders' offsite employment. Because offsite employment includes work not only on projects studied but also on concurrent projects, no attempt was made in this study to measure directly contractors' offsite employment. Instead, builder's offsite labor was estimated using published sources. The estimated man-hours for each \$1,000 of construction and 100 square feet of livable space of single-family house construction were based on the difference between construction workers' employment and total employment in the special trade contractors component of the contract construction industry for 1969. The level of offsite man-hour requirements remained relatively stable between the two

studies. Most offsite man-hours represent white-collar employment, which changes relatively slowly.

Manufacturing employment. Except for onsite construction, manufacturing constitutes the largest component of total man-hour requirements in both the current and the 1962 studies. Thus, the employment effect in this industry is second only to that in construction. Almost one-third of all man-hour requirements are accounted for by manufacturing, but labor requirements are declining more rapidly in this industry than in construction. This change in offsite man-hour requirements may represent changes both in demand for particular materials and in the industry's productivity. The same industries provided most of the offsite man-hours in manufacturing for both studies: wood and lumber products; stone, clay and glass products; metal products; and plumbing products. These four industry groups accounted for about three-fourths of the man-hours in manufacturing.

Employment in other industries. Wholesale trade, transportation, and services accounted for about 15 percent of total man-hour requirements. Between the two studies, this sector declined at a slightly higher rate than manufacturing. Mining and all other industries represent about 10 percent of all construction labor requirements. Although this sector declined more than manufacturing and transportation, trade and services, the employment effect is not as great because fewer employees were involved.

Table 1. Man-hour requirements for new private single-family houses by industry, 1969 and 1962

Industry	1969				1962 ¹		
	Per 1,000 current dollars of construction	Per 1,000 constant (1962) dollars of construction ²	Per 100 square feet	Percent distribution	Per 1,000 current dollars of construction	Per 100 square feet	Percent distribution
All industries	137	169	217	² 100.0	202 _r	238	³ 100.0
Construction	62	76	98	45.3	84	99	41.6
Onsite	52	64	82	38.0	72	85	35.6
Offsite	10	12	16	7.3	12	14	5.9
Other industries	75	92	119	54.7	118 _r	139	58.4
Manufacturing	41	50	65	29.9	61 _r	72	30.2
Wholesale trade, transportation, and services	20	25	32	14.6	31 _r	36	15.3
Mining and all other	14	17	22	10.2	26 _r	31	12.9

¹ *Labor and Material Requirements for Private One-Family House Construction* (BLS Bulletin 1404, 1964), and *Monthly Labor Review*, July 1964, pp. 797-800.

² Deflator used is Bureau of the Census price index for new single-family houses, rebased to 1962, adjusted to remove value of land, and fitted to mid-1969 when virtually all houses in survey were sold.

³ Calculated on basis of man-hours per \$1,000. Except for rounding, percent distribution would be the same on a square footage basis.

r = revised data

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

Table 2. Summary data for new private single-family houses, 1969 and 1962

Characteristics	1969	1962	Percent change	Average annual percent change
Cost per square foot . .	\$15.94	\$11.76	35.5	4.8
Cost per house	\$25,856	\$14,585	77.3	9.3
Average hourly earnings	\$3.94	\$3.07	28.3	4.0
Average square feet per house	1,622	1,240	30.8	4.3

Table 3. Onsite man-hour requirements for new private single-family houses, by occupation, 1969 and 1962

Occupation	Man-hours per 100 square feet		Percent distribution ¹		Man-hours per \$1,000 of construction cost	
	1969	1962	1969	1962	1969	1962
All occupations	82	85	100.0	100.0	52	72
Supervisory, professional, technical, and clerical	2	3	2.8	3.0	1	2
Carpenter	29	29	34.9	34.6	18	25
Painter	6	8	7.3	9.5	4	7
Bricklayer	5	5	5.7	5.5	3	4
Plumber	4	4	4.3	5.2	2	4
Cement finisher	2	3	2.5	3.9	1	3
Electrician	2	2	3.0	2.8	2	2
Plasterer and lather	1	2	1.7	2.0	1	1
Sheet-metal worker	1	2	1.3	1.8	1	1
Roofer	1	1	.9	1.4	(²)	1
Operating engineer	2	1	1.8	1.4	1	1
Tile setter	1	1	1.4	1.0	1	1
Soft floor layer	1	1	.6	.8	(²)	1
Other skilled trade	3	3	3.3	3.3	2	2
Laborer	12	13	14.1	14.8	7	11
Helper and tender	11	7	13.8	8.5	7	6
Truckdriver and misc. worker	(²)	(²)	.5	.5	(²)	(²)

¹ Calculated on unrounded data.

² Less than .5 hour.

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

Table 4. Distribution of onsite man-hours for new private single-family houses by type of contractor, 1969 and 1962

Type of contractor ¹	Percent of onsite man-hours	
	1969	1962
All types	100.0	100.0
General	31.3	45.6
Carpentry	16.9	9.4
Plumbing, heating, ventilating and air conditioning	8.7	8.6
Painting and paper hanging	6.5	6.6
Masonry and stonework	9.0	5.6
Concrete and stucco work	7.2	4.2
Electrical (except heating)	3.7	2.8
Plastering and lathing	1.4	2.6
Roofing and siding	2.0	2.0
Ceramic tile, terrazzo and marble work	2.2	1.6
Excavation and grading	1.6	1.6
Wood flooring . . . . .	.9	1.2
Other flooring	1.6	.8
All other types	6.9	7.5
Wallboard (included in all other)	(4.0)	(N.A.)

¹ Contractors are classified according to the major cost component of work since many performed more than one operation.

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

Table 5. Man-hour requirements for new private single-family houses, by selected characteristics, 1969 and 1962

Characteristics	Man-hours per 100 square feet		Man-hours per \$1,000 of con- struction cost		Characteristics	Man-hours per 100 square feet		Man-hours per \$1,000 of con- struction cost	
	1969	1962	1969	1962		1969	1962	1969	1962
All houses . . .	82	85	52	72	1 and 2 bedrooms . . .	112	99	78	---
In metropolitan areas . . .	71	81	44	70	3 bedrooms	87	88	55	73
In nonmetropolitan areas .	120	100	79	81	4 bedrooms or more . .	76	72	47	67
Construction price:					½ and 1 bathrooms . .	77	85	55	71
\$30,000-over	81		45		1½ bathrooms	100	98	64	77
\$27,000-\$29,999 . .	75		43		2 bathrooms	81	74	49	67
\$24,000-\$26,999 . .	78	99	54	78	2½ bathrooms or more .	82	94	50	80
\$21,000-\$23,999 . .	88		60		Basement (full and				
\$18,000-\$20,999 . .	80		54		partial)	87	---	55	75
\$15,000-\$17,999 . .	102	89	72	73	No basement	73	---	46	69
\$12,000-\$14,999 . .	84	82	72	70	Garage	79	78	48	67
Under \$12,000 . . .	80	72	75	68	Carport	119	98	88	86
Average hourly earnings:					Neither	81	98	59	79
\$5.50-over	57		32		Framing:				
\$4.50-\$5.49	68	64	39	56	Wood	84	86	53	72
\$3.50-\$4.49	82		52		Masonry	74	80	42	73
\$2.50-\$3.49	111	92	77	73	Exterior wall material:				
Under \$2.50	119	108	111	99	Brick	88	97	62	83
Number of square feet:					Wood	107	82	60	71
2000-over	70		45		Stucco	63	67	37	60
1800-1999	78		47		Other	75	82	46	68
1600-1799	99	82	60	73	Interior wall material:				
1400-1599	103		62		Drywall	82	80	52	69
1200-1399	74	75	45	64	Plaster	77	107	48	84
1000-1199	94	97	62	78	Heating:				
Under 1000					Warm air	78	83	49	72
square feet . . .	80	78	57	68	Hot water	109	92	59	75
Construction cost per					Electric	90	89	59	---
square foot:					Floor covering:				
\$17-over	87		45		Wood	85	96	52	77
\$16-\$16.99	88		54		Asphalt tile,				
\$15-\$15.99	71	106	46	73	vinyl tile,				
\$14-\$14.99	86		59		linoleum . . .	114	59	74	59
\$13-\$13.99	83		62		Other	75	74	48	71
\$12-\$12.99	81	104	65	84	Annual builder volume:				
\$11-\$11.99	74	76	65	66	200-over	51	62	31	56
\$10-\$10.99	69	71	61	67	100-199	74	76	41	68
Under \$10.00 . . .	79	66	91	72	50-99	75	80	48	68
1 story	88	---	57	70	Under 50	91	101	59	82
Split level	79	---	48	78					
2 stories	73	---	44	---					
3 stories	61	---	35	---					

Table 6. Construction costs of new private single-family houses, 1969 and 1962

Characteristics	Construction cost per house		Construction cost per square foot		Characteristics	Construction cost per house		Construction cost per square foot	
	1969	1962	1969	1962		1969	1962	1969	1962
All houses . . .	\$25,856	\$14,585	\$15.94	\$11.76	1 and 2 bedrooms . . .	\$15,383	---	\$14.38	---
In metropolitan areas . .	27,360	14,656	16.14	11.61	3 bedrooms	22,083	\$13,917	15.72	\$12.06
In nonmetropolitan areas	21,848	14,296	15.31	12.45	4 bedrooms or more . .	33,332	18,118	16.27	10.78
Construction costs:					½ and 1 bathrooms . .	15,823	11,992	14.04	11.96
\$30,000-over . . .	37,784		17.92		1½ bathrooms	20,575	14,963	15.53	12.77
\$27,000-\$29,999 . .	28,168		17.32		2 bathrooms	25,307	15,436	16.50	11.04
\$24,000-\$26,999 . .	25,449	21,949	14.45	12.76	2½ bathrooms or more	34,368	20,160	16.38	11.74
\$21,000-\$23,999 . .	22,377		14.73		Basement (full and				
\$18,000-\$20,999 . .	20,054		14.97		partial)	25,912	15,792	15.94	12.96
\$15,000-\$17,999 . .	16,139	16,328	14.12	12.23	No basement	25,743	13,534	15.94	10.75
\$12,000-\$14,999 . .	13,488	13,537	11.69	11.64	Garage	28,401	15,108	16.39	11.67
Under \$12,000 . .	10,175	10,623	10.64	10.54	Carport	19,286	13,103	13.57	11.35
Average hourly earnings:					Neither	15,161	14,122	13.88	12.40
\$5.50-over	28,776		17.99		Frame:				
\$4.50-\$5.49 . . .	29,599	14,765	17.21	11.50	Wood	25,714	14,713	15.72	11.88
\$3.50-\$4.49 . . .	27,415		15.68		Masonry	26,742	13,792	17.42	11.02
\$2.50-\$3.49 . . .	21,193	15,274	14.39	12.60	Ext. wall:				
Under \$2.50 . . .	13,856	13,200	10.80	10.90	Brick	23,862	14,777	14.25	11.70
Number of square feet:					Wood	31,130	12,786	17.91	11.98
2000-over	36,638		15.53		Stucco	27,060	14,940	17.09	11.15
1800-1999	30,919		16.51		Other	24,708	15,106	16.42	11.98
1600-1799	28,244	18,895	16.59	11.19	Interior wall:				
1400-1599	24,335		16.53		Drywall	25,849	14,099	15.99	11.63
1200-1399	21,106	15,156	16.42	11.74	Plaster	26,942	16,682	15.88	12.28
1000-1199	16,389	13,554	15.22	12.47	Heating:				
Under 1000 square feet . .	12,073	10,980	13.96	11.59	Warm air	26,154	14,363	15.99	11.60
Construction cost per square foot:					Hot water	34,822	16,702	18.46	12.74
\$17-over	32,754	---	19.39	---	Electric	24,985	---	15.27	---
\$16-\$16.99	25,295	---	16.31	---	Floor covering				
\$15-\$15.99	25,904	---	15.51	---	Wood	25,968	15,244	16.24	12.36
\$14-\$14.99	25,111	---	14.56	---	Asphalt tile,				
\$13-\$13.99	19,997	---	13.46	---	vinyl tile,				
\$12-\$12.99	22,681	---	12.40	---	linoleum	20,077	13,342	15.35	10.55
\$11-\$11.99	15,876	---	11.48	---	Other	26,893	13,131	15.74	10.75
\$10-\$10.99	15,765	---	10.39	---	Builder volume:				
Under \$10.00 . .	11,500	---	8.71	---	200 and over	25,443	13,487	16.35	11.09
1 story	\$23,081	\$13,807	\$15.53	\$11.53	100-199	30,046	13,647	18.11	11.28
Split level	29,165	18,944	16.34	14.08	50-99	21,782	15,309	15.48	11.83
2 stories	31,193	---	16.48	---	Under 50	25,979	15,302	15.51	12.28
3 stories	37,409	---	17.57	---					

Table 7. Percent distribution of costs by type of construction, 1959-69.

Type of construction	Year of construction	Total	Materials	Equipment	Onsite wages	Overhead and profit ¹
Private single-family housing ²	1969	100.0	43.4	0.9	20.4	35.3
Private single-family housing ²	1962	100.0	47.2	1.0	22.1	29.7
Nursing homes	1965-66	100.0	³ 54.9	(³)	25.6	19.5
Hospitals (Hill-Burton)	1965-66	100.0	50.4	1.3	29.6	18.7
Hospitals (Hill-Burton)	1959-60	100.0	53.2	1.2	28.2	17.4
Elementary and secondary schools	1964-65	100.0	54.2	1.0	25.8	19.0
Elementary and secondary schools	1959	100.0	54.1	1.4	26.7	17.8
Public housing	1968	100.0	³ 43.4	(³)	32.4	24.2
Public housing	1959-60	100.0	45.0	2.5	35.5	17.0
College housing	1960-61	100.0	52.6	1.6	29.3	16.5
Federal office buildings	1959	100.0	51.4	1.9	29.0	17.7
Federally aided highways	1970	100.0	45.0	(⁴)	25.6	⁴ 29.4
Federally aided highways	1967	100.0	47.8	(⁴)	24.8	⁴ 27.4
Federally aided highways	1964	100.0	50.3	⁵ 11.1	26.0	12.6
Federally aided highways	1961	100.0	52.6	⁵ 11.7	24.7	11.0
Federally aided highways	1958	100.0	50.6	⁵ 12.0	23.9	13.5
Civil works (Corps of Engineers):						
Land operations	1959-60	100.0	35.0	19.3	26.0	19.7
Dredging	1959-60	100.0	17.3	24.9	32.3	25.5
Sewer works:						
Lines	1962-63	100.0	44.5	11.2	24.3	20.0
Plants	1962-63	100.0	49.2	8.2	26.6	16.0

¹ Includes offsite wages, construction financing costs, inventory, and other overhead, and other overhead, and administrative expenses, as well as profit.

² For single-family housing, construction costs includes selling expenses in addition to construction contract costs.

³ Equipment included with materials.

⁴ Equipment included with overhead and profit.

⁵ Estimated by BLS.

Table 8. Distribution of construction costs for new private single-family houses, by type of contractor, 1969

Type of contractor ¹	Percent of construction cost
All contractors	100.0
General	53.5
Carpentry	7.5
Plumbing, heating, ventilating and air conditioning	10.3
Painting and paper hanging	2.6
Masonry and stonework	3.9
Concrete and stucco work	4.4
Electrical (except heating)	3.2
Plastering and lathing . . . . .	.7
Roofing and siding	2.0
Ceramic tile, terrazzo and marble work	1.6
Excavation and grading	1.2
Wood flooring . . . . .	.7
Other flooring	2.1
Wallboard	2.9
All other types	3.4

¹ Contractors are classified according to the major cost component of work since many performed more than one operation.

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

Table 9. Average hourly earnings and average hourly union wage rates paid for new private single-family houses, by occupation 1969

Occupation	Average hourly earnings	Average union hourly wage rate ¹
All occupations	\$3.94	\$5.14
Carpenter	4.11	5.35
Painter	3.99	5.01
Bricklayer	4.76	5.63
Plumber	4.85	5.73
Cement finisher	4.53	5.12
Electrician	4.86	5.57
Plasterer	5.02	5.34
Sheet-metal worker	4.60	5.48
Roofer	4.78	5.11
Operating engineer	4.36	N.A.
Tile setter	4.14	5.25
Soft floor layer	4.68	N.A.
Laborer	2.93	4.05
Helper and tender	2.56	
Truckdriver	3.54	N.A.

¹ Covers all building trades in residential and nonresidential construction as of July 1, 1969.

N.A. = Not available.

Table 10. Distribution of on-site wage share of costs for new, private single-family houses, 1969 and 1962

Onsite wages as percent of contract cost	Percent of houses surveyed	
	1969	1962
All groups.	100.0	100.0
15.0 and under.	9.8	3.0
15.1 - 20.0	41.7	31.7
20.1 - 25.0	30.4	45.5
25.1 - 30.0	13.7	16.8
30.1 and over.	4.4	3.0

Table 11. Comparison of materials and equipment in new private single-family houses, 1969 and 1962

Material type	Cost of material per \$1,000 of construction		Cost of material per 100 square feet		Percent distribution ¹	
	1969	1962	1969	1962	1969	1962
All materials	\$442.90	\$482.40	\$707.00	\$567.40	100.0	100.0
Lumber and Wood products (including furniture).	179.60	193.20	286.30	227.20	40.6	40.0
Rough and dressed lumber	101.60	² 110.10	162.00	⁴ 129.50	22.9	⁴ 22.8
Millwork	38.10	51.30	60.70	60.30	8.6	10.6
All other lumber products ³	40.00	31.80	63.60	37.40	9.0	6.6
Stone, clay and glass products	95.30	116.60	153.40	137.10	21.5	24.2
Cement, concrete & gypsum	54.50	76.70	87.00	90.20	12.3	15.9
Structural clay products	22.00	19.70	35.00	23.20	5.0	4.1
Other stone, clay & glass products ⁴	18.90	20.20	31.40	23.80	4.3	4.2
Metal products (except plumbing and heating)	41.80	55.00	66.60	64.70	9.4	11.4
Fabricated metal products	31.20	36.40	49.80	42.80	7.0	7.5
Other metal products	10.60	18.60	16.80	21.90	2.4	3.9
Plumbing Products	30.60	26.80	48.70	31.50	6.9	5.6
Heating, ventilating and air conditioning equipment.	18.40	18.50	29.20	21.80	4.2	3.8
Electrical equipment, fixtures and wires (except heating)	17.40	17.60	27.80	20.70	3.9	3.6
Built-in major appliances (refrigerators, dishwashers, dryers, washers, ranges, disposals)	11.20	13.70	17.80	16.10	2.5	2.8
Petroleum products	8.00	11.10	12.70	13.10	1.8	2.3
Paints and other chemicals	8.00	10.30	12.80	12.10	1.8	2.1
All other	32.50	19.60	51.80	23.10	7.3	4.1
Carpets, rugs, mats and pads	8.30	1.00	13.20	1.20	1.9	.2
Plastics products	5.20	3.00	8.30	3.50	1.2	.6
Construction equipment (rental cost or equivalent)	8.60	9.80	13.70	11.50	1.9	2.0
Miscellaneous.	10.40	5.80	16.60	6.90	2.3	1.2

¹ Based upon materials per \$1,000. Percents are the same on a square footage basis except for rounding.

² Includes data for prefabricated or packaged houses not broken down into separate wood components.

³ Includes wood kitchen and bathroom cabinets and vanities.

⁴ Includes sand, gravel, and dirt fill.

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

Table 12. Cost and type of materials and equipment in new private single-family houses, 1969

Type of material and equipment	Value per \$1,000 of construction price	Value per 100 square feet of livable space	Percent of total materials and equipment
Material and equipment			
Total	\$442.85	\$706.95	100.0
Material			
Total	434.02	692.87	98.00
Agricultural production	2.19	3.50	.50
Nursery stock, shrubberies, grass seed	2.16	3.44	.49
Mining and quarrying of nonmetallic minerals, except fuels	3.93	6.27	.89
Sand and gravel	3.44	5.48	.78
Dirt fill . . . . .	.49	.78	.11
Textile mill products	8.40	13.40	1.90
Carpets, rugs, mats and pads	8.28	13.20	1.87
Oakum . . . . .	.11	.18	.02
Apparel and other finished products made from fabrics and similar materials	(¹)	(¹)	(¹)
Curtains	(¹)	(¹)	(¹)
Lumber and wood products, except furniture	165.64	264.03	37.40
Softwood flooring, and all other softwood, rough lumber and finished lumber	101.60	161.95	22.94
Hardwood flooring and all other hardwood lumber, including parquet floor	7.20	11.47	1.62
Shakes, shingles	3.32	5.30	.75
Millwork, including windows, moulding, trim, doors, porches, staircases, weatherstrip, cornices, ready-made roof trusses, structural members, prefab wood panels	38.21	60.91	8.63
Plywood, veneers	12.76	20.34	2.88
Ladders, scaffolds, miscellaneous	2.52	4.02	.57
Furniture and fixtures	14.53	23.16	3.28
Ready-made wood kitchen cabinets, vanities	14.00	22.32	3.16
Metal cabinets . . . . .	.43	.69	.10
Venetian blinds, curtains and drapery rods, window shades	(¹)	(¹)	(¹)
Paper and allied products	2.90	4.62	.66
Masking tapes, adhesive tape . . . . .	.50	.80	.11
Wallpaper . . . . .	.48	.77	.11
Construction paper, fiberboard insulation, asbestos board insulation and acoustical tile	1.91	3.04	.43
Chemicals and allied products	8.04	12.83	1.82
Plastics adhesives, plastics vapor barrier sheets . . . . .	.16	.26	.04
Floor wax, paint cleaner, thinners, polish . . . . .	.22	.35	.05
Lacquer, paint, putty, sealers	6.29	10.03	1.42
Fertilizer . . . . .	.21	.32	.05
Adhesives: glue, epoxy, paste . . . . .	.50	.79	.11
Grouts, insulating compounds, synthetic rubber and plastics sealants, silicones (damp-proofing) . . . . .	.35	.55	.08
Other inorganic chemicals . . . . .	.23	.37	.05
Petroleum refining and related industries	7.95	12.69	1.80
Fuels: diesel fuel, gas, oil, grease . . . . .	.44	.69	.10
Asphalt paving . . . . .	.38	.61	.09

Table 12. Cost and type of materials and equipment in new private single-family houses, 1969—Continued

Type of material and equipment	Value per \$1,000 of construction price	Value per 100 square feet of livable space	Percent of total materials and equipment
Material-Continued			
Petroleum refining and related industries—Continued			
Roof pitch, asphalt board insulation and rolls, asphalt shingles, asphalt sheathing and siding, building felts, composition, asphalt tar, mastics and emulsions	7.07	11.30	1.60
Miscellaneous petroleum products	(¹)	(¹)	(¹)
Rubber and miscellaneous plastics products	5.97	9.52	1.35
Rubber products, foam rubber mats, rubber flooring, weatherstrip . . . . .	.75	1.20	.17
Plastics products, plastics pipes, fiberglass shower stalls, plastics tile, plastics fixtures and conduits, styrofoam insulation, vinyl wall covering	5.22	8.32	1.18
Stone, clay, glass and concrete products	94.45	150.55	21.33
Window glass, insulating glass . . . . .	.15	.23	.03
Mirrors, shower doors, glass porch doors	2.60	4.14	.59
Hydraulic cement	3.75	5.97	.85
Clay brick, chimney block, structural clay tile	14.80	23.59	3.34
Ceramic tile	5.88	9.38	1.33
Refractory brick, fire brick and tile . . . . .	.44	.70	.10
Clay drain tile, adobe brick, clay chimney pipe, clay roofing tile, clay sewer pipe	1.30	2.07	.29
Vitreous china bathroom accessories, closet bowls, plumbing fixtures	2.96	4.72	.67
Concrete block, concrete brick, cinder block	7.34	11.70	1.66
Concrete pipe, concrete laundry trays, concrete drain tile, precast terrazzo . . . . .	.91	1.44	.20
Ready-mix concrete	28.79	45.90	6.50
Lime . . . . .	.28	.45	.06
Plaster, wallboard, gypsum	13.54	21.59	3.06
Building marble, roof slate, other cut stone	1.74	2.77	.39
Sandpaper, abrasives, steel wool . . . . .	.10	.16	.02
Asbestos cement shingles, siding, asphalt tile flooring, asbestos cement pipe, vinyl asbestos tile, asbestos cement adhesives	2.76	4.40	.62
Asbestos (pipe) insulation . . . . .	.59	.94	.13
Perlite, crushed rock vermiculite	1.31	2.09	.30
Fiberglass insulating and acoustical tile, mineral wool, pre-moulded fiberglass (FRD products) . . .	4.27	6.81	.96
Stucco, other nonmetallic minerals . . . . .	.92	1.46	.21
Primary metal products	22.37	36.65	5.05
Structural steel, bars, beams, floors, and other structural shapes	2.64	4.21	.60
Ferrous nails, staples, including insulated wire	2.62	4.17	.59
Cast iron products, including cast iron pipe	3.88	6.18	.88
Lead . . . . .	.42	.68	.10
Copper pipe and tubing	7.72	12.31	1.74
Solder . . . . .	.14	.22	.03
Nonferrous wire, including insulated wire	4.87	7.77	1.10
Nonferrous nails, staples	(¹)	(¹)	(¹)
Fabricated metal products, except ordnance, machinery and transportation equipment	57.14	91.07	12.90
Builders hardware, including door locks, hinges, angles irons	6.06	9.66	1.37
Metal bathroom and enameled iron fixtures, metal shower stalls	13.96	22.25	3.15
Brass plumbing fittings and trim	6.34	10.10	1.43

Table 12. Cost and type of materials and equipment in new private single-family houses, 1969—Continued

Type of material and equipment	Value per \$1,000 of construction price	Value per 100 square feet of livable space	Percent of total materials and equipment
Material-Continued			
Fabricated metal products, except ordnance, machinery and transportation equipment—Continued			
Warm air furnaces, boilers, furnaces and radiators, except electrical radiators, unit heaters, incinerators, condensers	3.91	6.23	.88
Metal doors and windows, sash, frames, molding and trim; overhead rolling doors	8.03	12.79	1.81
Metal oil tanks, metal septic tanks, fabricated metal plate products	1.24	1.98	.28
Sheet metal products, including spouts, ducts, gutters, etc	9.87	15.74	2.23
Ornamental metal work, registers, grilles, diffusers . .	1.65	2.63	.37
Reinforcing rods, bars, prefab panels, curtain walls . .	1.88	3.00	.42
Bolts, nuts, screws, rivets, washers . . . . .	.12	.18	.03
Reinforcing mesh wire, lath wire, clips	1.67	2.67	.38
Nonbrass pipe fittings and plumbing fixtures, pipe hangers, valves	1.03	1.64	.23
Steel ladders and plankings, other fabricated metal products	1.32	2.10	.30
Machinery, except electrical	8.41	13.41	1.90
Pumps . . . . .	.68	1.08	.15
Sprinkler systems (fire prevention) . . . . .	.26	.42	.06
Complete air conditioning units, humidifiers	6.91	11.01	1.56
Sewage disposal equipment, water treatment equipment (filters, softeners, etc.) . . . . .	.56	.90	.13
Electrical machinery, equipment and supplies	29.98	47.80	6.77
Fuses, panelboards, switchboards	2.10	3.35	.47
Gas ranges, ovens	5.74	9.16	1.30
Refrigerators, freezers . . . . .	.70	1.11	.16
Dryers, washing machines	(¹)	(¹)	(¹)
Fans, baseboard heating units, electric ovens, wall heaters	2.25	3.58	.51
Dishwashers, water heaters (electric and nonelectric), garbage disposal units	8.63	13.77	1.95
Fluorescent fixtures, light fixtures	5.39	8.60	1.22
Current carrying devices (switches, connections, receptacles)	2.32	3.69	.52
Noncurrent carrying devices (boxes, insulators, conduits)	1.77	2.82	.40
Intercom, T.V. systems, clock and electric timing systems . . . . .	.42	.66	.09
Electric bells and chimes, automatic gates . . . . .	.44	.71	.10
Professional, scientific, and controlling instruments, photographic and optical goods; watches and clocks . . .	.63	1.00	.14
Gas and water meters, gauges . . . . .	.34	.54	.08
Thermostats, temperature controls . . . . .	.29	.46	.06
Miscellaneous manufacturing industries	1.41	2.24	.32
Paint rollers, paint brushes	(¹)	(¹)	(¹)
Linoleum	1.34	2.13	.30
Equipment			
Total	8.83	14.08	2.00

Table 12. Cost and type of materials and equipemnt in new private single-family houses, 1969—Continued

Type of material and equipment	Value per \$1,000 of construction price	Value per 100 square feet of livable space	Percent of total materials and equipment
Fabricated metal products, except ordnance, machinery, and transportation equipment . . . . .	.26	.41	.06
Non-power hand tools . . . . .	.15	.22	.03
Saws and blades	(¹)	(¹)	(¹)
Machinery, except electrical	5.27	8.43	1.19
Non-electric engines and motors . . . . .	.28	.44	.06
Tractors, bulldozers, backhoes, trenchers, drill rigs, scrapers, graders, rollers, mixers, pavers, front end loaders, payloaders, power cranes, draglines, power shovels	4.38	6.99	.99
Forklifts . . . . .	.13	.21	.03
Power handtools, drills . . . . .	.32	.51	.07
Compressors, jack-hammers, accessories . . . . .	.11	.18	.02
Electrical machinery, Equipment and supplies	(¹)	(¹)	(¹)
Electric motor and generators	(¹)	(¹)	(¹)
Transportation equipment	3.28	5.22	.74
Trucks (highway)	3.26	5.19	.74

¹ Less than 10 cents reported per \$1000. Due to rounding and exclusion of items in detail worth less than 10 cents per \$1000 detail may not add to subtotals.

Table 13. Surveyed contractors working under labor-management agreement, by type and class of worker covered, 1969

Type of contractor	Number of contractors	Class of workers covered			
		All workers	Skilled only	Unskilled only	Combination but not all
All contractors covered . .	1,347	1,212	96	4	35
General	44	30	6	3	5
Carpentry	177	155	14	0	8
Plumbing, heating, ventilating and air conditioning . . .	166	154	11	0	1
Painting and paper hanging	57	51	5	0	1
Masonry and stonework	74	71	3	0	0
Concrete and stucco work	108	97	3	0	8
Electrical (except heating)	78	69	8	0	1
Plastering and lathing	12	11	1	0	0
Roofing and siding	91	87	3	0	1
Ceramic tile, terrazzo and marble work . . .	58	45	11	0	2
Excavation and grading	53	49	3	0	1
Wood flooring	39	36	1	0	2
Other flooring	89	81	8	0	0
Wallboard	75	67	6	0	2
All other types . . .	226	209	13	1	3

Table 15. General contractors' most common obstacles to efficiency, 1969

Obstacles to efficiency	Percent of Replies
Total Replies	100
Inadequately skilled workers	23
Restrictive building codes	20
High interest rates, shortage of financing	14
Bad work practices, union interference	14
Government interference, red tape	5
High labor costs	4
Sub-contractor problems	3
Zoning problems	2
Lack of worker training programs	2
High cost of land, scarcity of land	2
High building materials costs	2
Skilled supervisor shortages	2
Miscellaneous	7

Table 14. Construction workers employed by surveyed contractors in January and July 1969, by type of contractor

Type of contractor	January 1969	July 1969	Percent January of July
Total . . .	64,199	78,664	81.6
General	3,120	3,756	83.1
Carpentry	9,307	12,503	74.4
Plumbing, heating, ventilating and air conditioning	9,211	10,906	84.5
Painting and paper hanging	2,265	2,767	81.9
Masonry and stonework	3,525	4,678	75.4
Concrete and stucco work	6,723	9,505	70.7
Electrical (except heating)	4,164	4,562	91.3
Plastering and lathing	755	767	98.4
Roofing and siding	4,721	5,458	86.5
Ceramic tile, terrazzo and marble work	1,365	1,506	90.6
Excavation and grading	879	1,387	63.4
Wood flooring	3,809	3,642	104.6
Other flooring	2,358	2,725	86.5
Wallboard	5,171	6,058	85.4
All other types . . .	6,826	8,444	80.8

Table 16. Capital improvements included in land value of surveyed houses, 1969

Capital improvements	Percent of lots containing improvement ¹
Utilities (except sewers) ²	81.2
Streets	74.8
Sewer hookup	62.4
Curbs and gutters	26.4
Sidewalks	16.4
Community recreation facilities	14.8
Storm drains	11.6
Street lighting	7.2

¹ Not additive.

² May be gas, electricity, water, or any combination.

Table 17. Prefab items included in surveyed houses, 1969

Prefab item	Percent of houses containing item ¹
Preassembled windows	78.4
Kitchen cabinets	77.6
Prehung doors	64.4
Bathroom or bedroom dressing vanities	46.4
Precut lumber	30.4
Offsite fabricated ductwork	28.4
Staircase units	24.8

¹ Not additive.

Table 18. Distribution of surveyed contractors' work, by type of construction, 1969

Type of construction	Percent of total volume
Total	100.0
Single-family	91.0
Multifamily (1-4 stories)	6.4
Multifamily (5 or more stories). . . . .	.6
Other construction	2.1

NOTE: Due to rounding, detail may not add to 100.0 percent.

Appendix A. Survey Techniques and Methods

The basic sample for this survey consisted of a subsample of the single-family houses in the Bureau of the Census "Housing Starts Survey." The Housing Starts sample consists of residential buildings from two types of areas—those that require building permits and those that do not. The Housing Starts sample covers 122 areas comprising 304 independent counties and cities. A sample of building permits, obtained each month from 600 permit issuing jurisdictions (including cities, towns, villages, townships, or counties), is selected in proportion to the number of housing units reported on the permit. All buildings and housing units covered by the permits are included. This procedure yields a sample of about 4,000 buildings a month, approximately 65 percent of which are single-family houses.

Within the 122 areas, 91 contain some nonpermit jurisdictions. In these areas a sample of buildings is obtained each month as follows:

1. A list of residential construction that has been started in these areas during the preceding month is obtained from a group of persons most likely to know about new housing construction. This list is verified by field visit or telephone call.

2. A subsample of 290 predesignated land area segments, located throughout the nonpermit portion of the 91 areas, is canvassed by Census field interviewers to obtain a list of all residential construction not reported by the method described above. The list is weighted to compensate for houses missed outside of the canvassed segments. The sample obtained by this procedure consists of 800 to 1000 buildings, of which 95 percent or more are single-family homes. From this sample, the BLS subsample was provided by the Bureau of the Census in two sections. The first section covered jurisdictions which had issued permits during the calendar year 1968. The second section covered houses started in nonpermit areas during calendar year 1968.

The Census data on permits are compiled from public records of the local building permit offices. Data for areas that do not require permits are collected in interviews by Census agents, are confidential, and therefore cannot be given to another agency. Consequently, Census conducted a special survey for BLS of houses in the nonpermit portion of the sample.

In addition to the address of each house, this special survey provided information that enabled BLS to stratify properly the Census sample before selecting the subsample and to identify houses on which the owner or other unpaid help did part or all of the construction. These owner-built houses were out-of-scope for the BLS survey, and thus had to be identified and discarded from the Census sample.

Before selecting the BLS subsample, which was restricted to the 48 contiguous states, the Bureau of the Census stratified the houses in their "Survey of Construction", as follows:

1. In building permit areas by:
 - a. The four broad geographic regions
 - b. Metropolitan and nonmetropolitan areas
 - c. Permit value
2. In nonbuilding permit areas by:
 - a. The four broad geographic regions
 - b. Metropolitan and nonmetropolitan areas

The subsample supplied by the Bureau of the Census consisted of approximately 1800 houses, 1300 in permit areas and 500 in nonpermit areas. The oversize sample, compared with the final BLS sample of 250 houses, allowed substitutions where absolutely necessary. BLS stratified the Census subsample before picking a final working subsample of 250 houses as follows:

- a. The nine Census divisions
- b. Metropolitan and nonmetropolitan areas
- b. Cost class

The BLS subsample was divided between permit and nonpermit areas, in the same proportion as the Census sample (i.e., 72 percent in permit areas and 28 percent in nonpermit areas).

Quota sampling was used to pick the 250 houses from the strata produced by the above procedure. That is, a certain percentage of the 250 houses was picked from each group of strata. These quota percentages were developed for the portion of the sample allotted to permit issuing areas by analyzing the geographic distribution of permits issued for single-family houses as shown in "Construction Reports" C 40/C 42-67-13, an annual

publication compiled by the Bureau of the Census. Similar percentages for the nonpermit areas were supplied from unpublished data.

The following types of houses were considered out-of-scope for the survey:

- a. Prefabricated houses. These included sectionalized and modular homes.
- b. Houses for which the owner or other unpaid help did more than a token part of the work.
- c. Houses valued at \$75,000 or more, including the cost of the land.

Appendix B. Procedures Used to Develop Offsite (Indirect) Man-Hour Estimates

Offsite employment estimates were derived from the materials and equipment cost information obtained from the contractors and subcontractors cooperating in the study. Contractors provided a list of the value of each type of material used in the construction of sample projects. For those few contractors who were inaccessible, estimates were derived from similar jobs; control totals were supplied by the general contractor or owner. These material listings were grouped into categories consistent with the 4-digit Standard Industrial Classification (SIC) code. For each of these product groups, average amounts of material (in dollars) required for each \$1,000 of contract construction cost were determined. (See table 12.) The value of materials 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 the U.S. Department of Commerce, Office of Business Economics.) This latter step was required because all data reported by contractors were in purchasers' value, and reduction to producers' value was necessary to match the Bureau's interindustry sales and purchase grouping definitions for the interindustry growth model. Value differences were allotted to trade and transportation sectors.

Each materials grouping then was matched to a corresponding wholesale price index and deflated to 1958 prices. This step was required because the input-output table was on a 1958 dollar basis.

Employment in manufacturing was defined as the labor required to produce the construction bill of materials in the final stage of fabrication. Mining and other industry employment was the labor in all indus-

tries involved in production and transportation of building materials and equipment from basic extraction to, but not including, the final manufacturing stage. Employment in the trade, transportation, and service industries was determined by the difference between producers' and purchasers' value for each construction material. The 1958 Interindustry Study of the Office of Business Economics was used to obtain these employment estimates. For each group of materials, the interindustry study provided information on the amount of products required from each of its 78 industry sectors. The product data were converted to man-hours by use of output per man-hour ratios for each industry within the sectors. Adjustments for price and productivity were estimated for years after 1958, consistent with the year of construction and bill of materials.

For each offsite stage, a man-hour figure per \$1,000 of construction was obtained. When these man-hours, plus the builders' offsite employment, are combined with the direct or onsite man-hours, the total employment effect, within the definition used by the study, was determined. Offsite employment of each construction contractor was not collected directly from contractors since it is almost impossible to relate accurately such employment to the projects studied. Builders' offsite employment was occupied not only with the sample projects studied, but also with other current or future projects. Instead, contractors offsite man-hours for each \$1,000 of construction contract were estimated from the difference between construction worker employment and total employment in the special trade contractors' construction industry for 1969 as reported in Employment and Earnings, U.S. Department of Labor Bulletin 1312-7.

Appendix C. Data Collection Procedures

The collection of adequate and reliable data from construction contractors was mandatory if the survey was to accomplish its desired goals. Two major efforts were involved to achieve these objectives: training and data collection by personal visits.

Training

Education and orientation in program rudiments were accomplished in two ways: First, collection instructions, aids, and schedules were used as a basis for discussions at a Washington conference which survey coordinators from each of the eight BLS regional offices attended. Staff members explained all facets of the study in detail: background, purpose, sampling procedures, and kinds of data to be collected from respondents. Open discussions clarified misinterpretations of data collection schedules. Second, regional coordinators, generally, held conferences with field representatives to resolve any questions about data collections.

Data collection by personal visit

Before visiting each general contractor, data collectors were advised, when feasible, to visit the sample house being surveyed and make a pass-by surveillance. This contact would provide a background of general specifications (type of roof, frame, siding, number of stories, car accommodations, type windows, etc.) and would enable the agent to establish better rapport with the respondent.

Compliance of the general contractor was crucial, for without his cooperation and release of firm data the entire project had to be dropped and a substitute assigned. If after exhausting every effort to obtain information a data collector was unable to elicit cooperation, a substitute project was assigned. Substitution was avoided if at all possible for it was time-consuming and costly as well as an awkward sampling technique to deal with.

The data collector initially explained the purpose of the survey to the general contractor and obtained general specifications of the sample house as well as

related information. Next, the data collector obtained detailed labor and materials information which the general contractor supplied for the project house. This assignment involved an examination of billings and receipts and a summation of itemized materials and costs after excluding overhead and profit. Frequently records were kept in more than one file, and in many cases, material was billed in quantity for more than one house. The agent was required to analyze this information and obtain the necessary adjustment from the respondent. The data were reviewed to make certain no materials were overlooked and that they were categorized in acceptable classifications (approximating, as closely as possible, four digit SIC groupings).

Payrolls or similar records were used where possible to obtain labor requirements data which included occupations, hours worked, rates of pay, and total gross wages. If these were not available or adjustments were necessary, consultation with the general contractor usually yielded reliable estimates. The final important piece of information obtained from the general contractor was a list of subcontractors' addresses, total value of each subcontract, and current status of each subcontractor. This information proved to be extremely helpful in locating subcontractors, and was essential if a subcontractor could not be located or refused to cooperate.

Initially, subcontractors were contacted for appointments either by phone or by direct walk-in—whichever seemed most expeditious to the data collector. The purpose of the visit was explained, the particular house identified, and the subcontract value verified. With assistance from the subcontractor, data on labor requirements were normally extracted from some type of time records to match the job occupation and the workers' gross pay. Information was obtained on employer contributions for supplemental benefits as well as data on overtime and unionization. Type and cost of materials were obtained either from billings, receipts, or in some cases estimates by the subcontractor. The data collector who was familiar with each operation reviewed labor and materials requirements to make certain no items had been omitted and that data conformed to the survey criteria. Each completed project with all schedules then was forwarded to the regional office coordinator

for edit and transmittal to Washington. A thorough edit was done in Washington and questions were referred back to the original data collector. In some cases the respondent was recontacted for clarification.

Data collection for single-family housing was very intricate and difficult due to the unusual nature of the respondents, the industry, and the complexity and detail of information. Many small subcontractors operating from their homes were not available during the day. Attempting to locate them and arrange an interview was difficult. Often a subcontractor would be traced to a job site but would not have accurate records. Some were "in-and-out-of-business" or transients. Occasionally, contractors would refuse to provide data and summary information was obtained from the general contractor or owner.

Data collectors occasionally were required to keep unorthodox business hours; contacts would start very early in the morning and end late at night. Weekend visits and two or more calls at the convenience of the respondent were not uncommon. In some cases a considerable amount of travel was required.

Adequate training under experienced data collectors overcame most of these obstacles and resulted in excellent cooperation from respondents. Out of nearly 4,250 special trade contractors in the survey, only a small number (i.e., well under 10 percent) refused, could not be located, or provided no information. In each of these cases, the general contractor or owner supplied some information, such as contract value and type of operation.

Bibliography

Publications of Construction Labor Requirements Studies
Office of Productivity and Technology
Bureau of Labor Statistics
U.S. Department of Labor

Sales publications may be purchased from the Superintendent of Documents, Washington, D.C. 20402, or from the Regional Offices of the Bureau of Labor Statistics. Free copies may be obtained, so long as supply lasts, from the Bureau's Office of Productivity and Technology, U.S. Department of Labor, Washington, D.C. 20212.

BULLETINS, REPORTS, AND ARTICLES

Civil works construction

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

A statistical study of onsite and offsite man-hour and wage requirements for dredging and land-type 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), May 1965. 34 pages.

A report based on findings in a survey of 43 college housing projects which were administered by the Community Facilities Administration. The survey is designed primarily to determine the man-hours required for \$1,000 of college housing construction.

Miller, Stanley F., "Labor and Material Required for College Housing," *Monthly Labor Review*, September 1965, pp. 1100-1104.

This is a summary of BLS Bulletin 1441.

Federally aided highways

Labor and Material Requirements for Construction of Federally-Aided Highways, 1958, 1961, and 1964 (BLS Report No. 299), 17 pages.

This study provides 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 man-hour requirements for 1947-64.

Kutscher, Ronald E. and Waite, Charles A., "Labor Requirements for Highway Construction," *Monthly Labor Review*, August 1961, 4 pages.

Summarizes findings of the 1958 highway survey.

Wakefield, Joseph C., "Labor and Material Requirements: Highway Construction, 1958 and 1961", *Monthly Labor Review*, April 1963, pp. 394-398.

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 pages.

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. 889-893.

A summary of BLS Bulletin 1331.

Hospital construction

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

A statistical study of onsite and offsite labor requirements for construction of selected public and private, profit and non-profit, 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. 1120-1124.

A summary of BLS Bulletin 1340.

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

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. p. 48.

Summarizes BLS Bulletin 1691.

Private housing construction

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

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 Housing," *Monthly Labor Review*, July 1964, pp. 797-800.

A summary of BLS 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 pages.

A report based on findings of a survey of 31 public housing projects which were administered by the Public Housing Administration. 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 Construction," *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 pages.

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

Epstein, Joseph, and Walker, James F., "Labor Requirements for School Construction," *Monthly Labor Review*, July 1961, pp. 724-730.

A summary of BLS Bulletin 1299.

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

A survey of selected elementary and secondary public schools constructed primarily during the period of 1964-65. In addition to providing information on man-hours, the study also includes data on the types of 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 pages.

This study was designed to measure the total man-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 1962-1963.

Summaries, comparisons, and other papers

Ball, Claiborne M., "Employment Effects of Construction Expenditures," *Monthly Labor Review*, February 1965, pp. 154-158.

A summary of the man-hour requirements broken down by offsite and onsite hours, by occupation and regions for eight types of construction.

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

Describes techniques of CLR studies.

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

CLR program and objectives are discussed.

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.

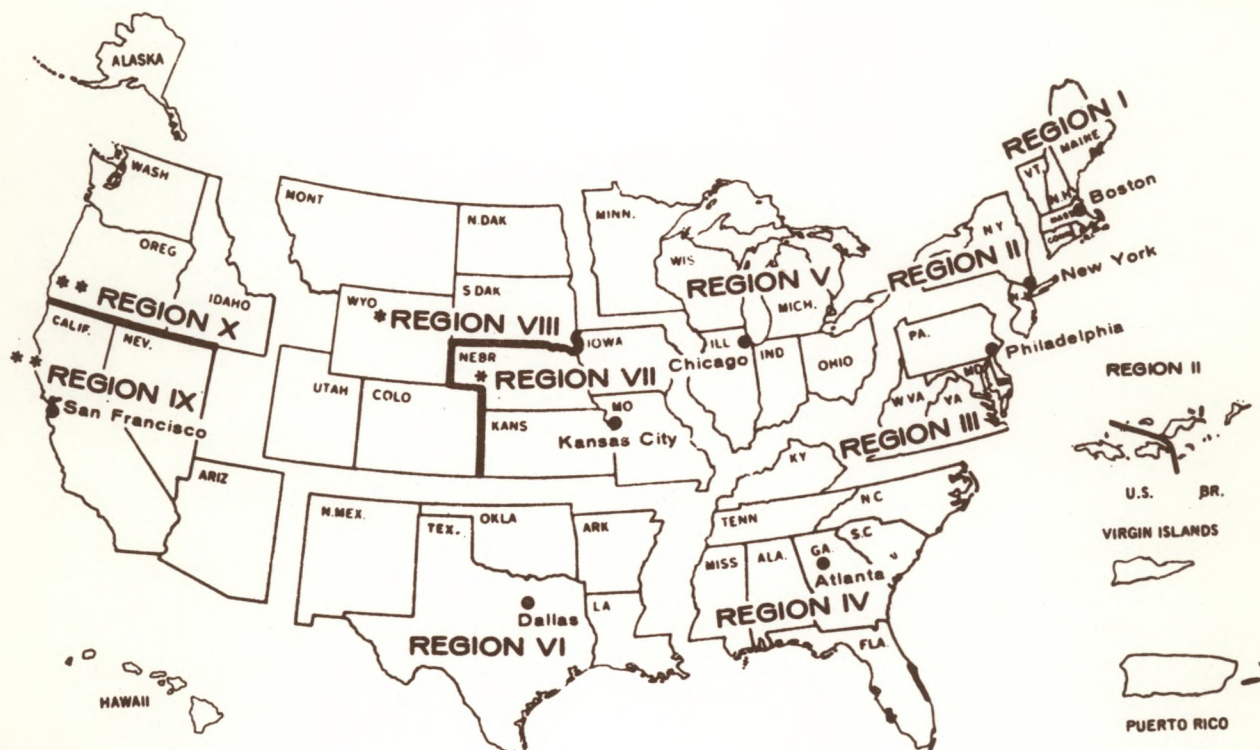
Discusses current technology and labor requirements at the construction site.

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

Discusses methods for reducing occupational shortages.

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