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LABOR REQUIREMENTS FOR SCHOOL CONSTRUCTION

Bulletin No. 1299

UNITED STATES DEPARTMENT OF LABOR
Arthur J. Goldberg, Secretary

BUREAU OF LABOR STATISTICS
Ewan Clague, Commissioner

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Preface

New construction is a major component of the Nation's output of goods and services and an important source of employment. The jobs it creates occur not only at the site of employment but also in the many manufacturing, trade, and transportation industries which furnish materials required in the construction process. Because of their far-reaching employment impact, construction projects are often regarded as a means of counteracting cyclical unemployment.

This study on public school construction, authorized by the 86th Congress, is the first of a series designed to determine the labor requirements of various types of construction that might be affected by Government action. Additional studies underway deal with the construction of highways, hospitals, and public buildings. Subsequent studies are expected to cover public housing, sewer and water projects, and, eventually, all major types of construction.

The studies are being made by the Bureau of Labor Statistics, Division of Productivity and Technological Developments, under the supervision of James F. Walker. Herman J. Rothberg directed the collection of statistical data in the field and Ronald E. Kutscher was in charge of the group determining the total labor requirements.

The Bureau is grateful to the staff of the Housing and Home Finance Agency for their excellent cooperation and for making available the data on federally aided school projects, which comprise an important part of this study.

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LABOR REQUIREMENTS FOR SCHOOL CONSTRUCTION

Introduction

Public school construction was selected for the first of this series of construction labor requirements studies because of the substantial proportion it represents of all new public construction expenditures and because of the widespread expression of need for new classrooms. Expenditures for public school construction, at an annual rate of over $2.5 billion in 1960, accounted for about one-sixth of total public construction outlays and were second in volume only to those for highways.

The need for new classroom space has been emphasized in recent publications of the U.S. Office of Education. More than 427,000 classrooms will be needed over the next 5 years, according to estimates by that Office, which take into account current replacement needs, and the backlog accumulated as of the fall of 1960. The current annual rate of construction, at almost 70,000 (or 347,000 over the next 5 years), would result in an annual deficit of 16,000, cumulating to a total of 80,000. If current construction were increased to eliminate this deficit, the Office of Education would estimate requirements for the next succeeding 5-year period at almost 200,000 classrooms, or about 38,000 a year.

New building accounted for most of the new classrooms created in 1958-59. An indeterminate number resulted from conversions of facilities not originally planned for classroom use or from provision of temporary facilities; some were provided through additions to existing schools.

Nature of Survey

This study is based on a survey of selected elementary and secondary schools constructed in various regions of the United States. Data were collected from 128 projects (85 elementary and 43 junior and senior high schools) throughout the United States. They were chosen as a representative sample of the schools built under contracts awarded between July 1958 and June 1959. In order to establish a maximum degree of comparability in the characteristics studied, the projects included in the survey were limited to new, whole school projects, excluding additions. 1/

1/ For a more detailed description of method and for a list of States included in each region, see appendix A.

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The study was designed primarily to determine the man-hours implicit in a fixed dollar volume ($1,000) of school construction. Man-hours, as defined for the survey, include both the on-site construction employment and the off-site employment required to produce and deliver the materials used in construction. Data for on-site labor included total man-hours for workers in each occupation utilized on the project. For about half of the projects, additional data were obtained on wages and timing of employment.

Project data were developed to show for various characteristics the differences among four broad geographic regions, between metropolitan and non-metropolitan areas, and between elementary and secondary schools.

The planning, developing, and building of new school facilities varies greatly among systems. Although, in some instances, the application of local laws and procedures affect labor requirements or construction costs, the survey was not designed to reflect such local differences.

Certain types of employment were not covered by the survey. No estimate was made of the employment used in planning and designing of schools. This omission was necessary because of the wide variations among the 13,000 school systems of the country. The larger systems, with thousands of full-time employees, frequently maintain their own architectural and engineering departments. In smaller systems, sometimes under the direction of single school authorities, these functions are largely performed by part-time workers. Also excluded from the survey was the labor time involved in installations by public utility employees as well as any site preparation or landscaping work not covered by the construction contract. In addition, the labor time required to produce school furnishings was generally excluded. Some equipment, if attached to the school building, such as blackboards or wardrobes installed by building contractors, was included.

Employment created by the respending of the wages and profits of the workers and their employers--the multiplier effect--was not considered within the scope of the study.

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General Survey Findings and Characteristics

Each $1,000 of construction contract involved in the building of elementary, junior, and senior high schools in 1959 resulted in 212 man-hours of employment. Of these, 84 hours were for on-site employment in the construction industry. A total of 128 hours were required for various off-site activities to produce and deliver the materials and equipment used by construction contractors, plus off-site employment required by the construction industry. (See chart 1.) The man-hours of employment were allocated as follows:

	Man-hours per $1,000 of contract	
	Number	Percent
Total man-hours	212	100
Construction:		
On-site	84	39
Off-site	10	4
Manufacturing	78	37
Transportation	8	4
Trade and service	20	9
Other industry employment	12	6

On the average, schools constructed in 1959 cost about $730,000 (exclusive of site and planning costs) and took about a year to build. This construction created a year's employment for 81 workers--38 in direct construction and 43 in the various other activities indirectly required to furnish the building materials, equipment, and supplies used in construction. 2/

Recently, about $2.5 billion a year have been spent on construction of public schools. This would indicate that school building has been the source of more than 115,000 jobs annually for on-site work in the construction industry and 160,000 for off-site activities supplying the materials and services for the building operations. Any increase in this level of school construction would, of course, raise employment commensurately.

2/ The annual employment estimate of construction workers is based on 50 times the 1959 average employment in contract construction work of 35.8 hours a week. For other types of employment, 2,000 hours were considered a year's employment.

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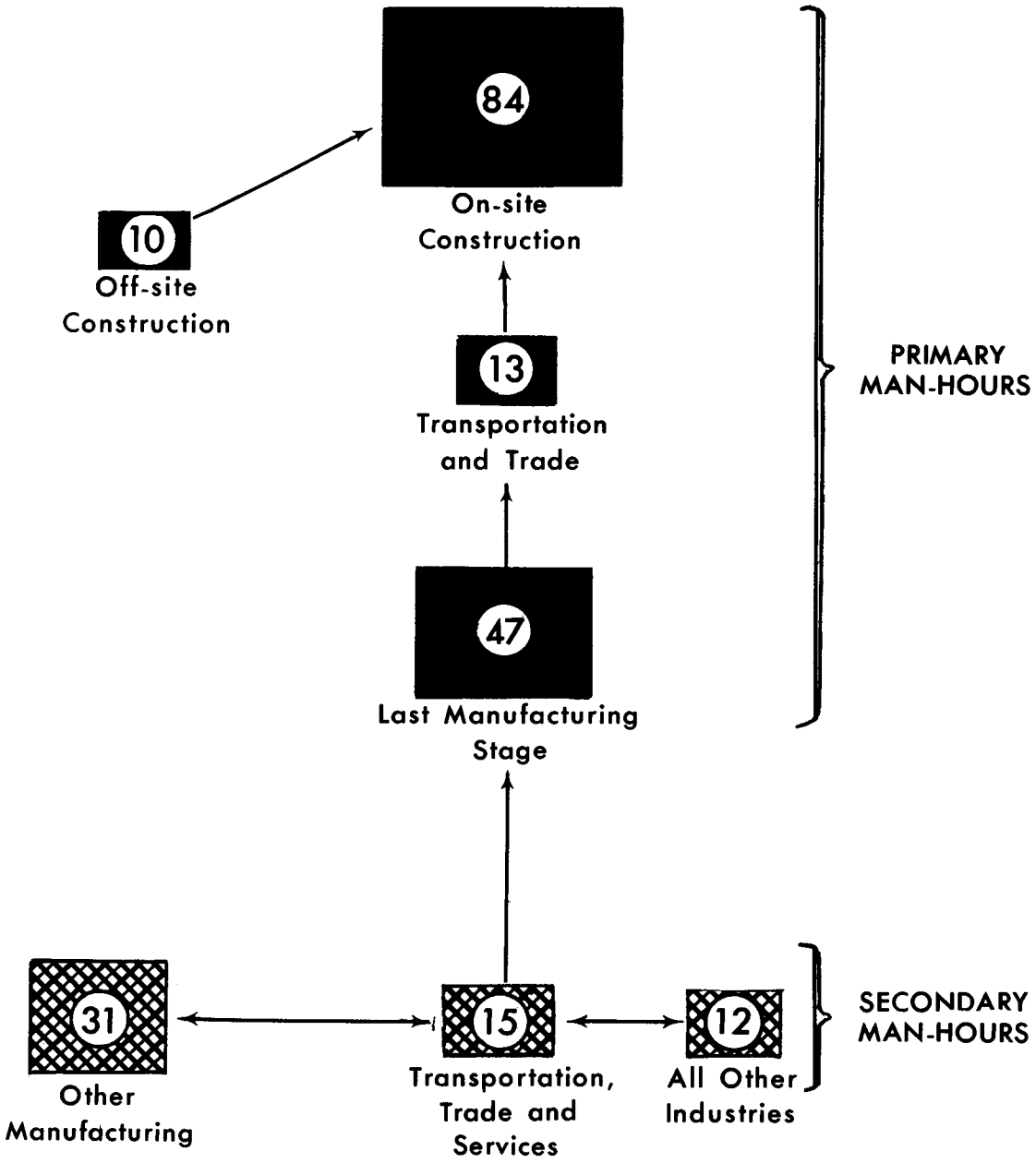
Chart 1. Distribution of Man-Hours for Each $1,000 of School Construction Contract, 1959



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The survey disclosed that, although more than half of the projects within the scope of the study had on-site labor requirements ranging from 75 to 95 man-hours per $1,000 of contract, there was substantial variation among individual installations. Some of the variation reflected differences in type and size of schools and differences between metropolitan and nonmetropolitan areas, and geographic location. The variation in unit manpower requirements associated with these characteristics plus others involving specific construction features (see table 2) are discussed in more detail in a later section of this report. Man-hour requirements per $1,000 of construction contract for secondary schools (83 hours) were 4 less than the average for elementary schools. The average requirements for metropolitan locations (83 hours) were similarly lower than for nonmetropolitan areas (87). Schools constructed in the northeastern part of the country averaged 76 man-hours compared with 99 in the South. Large projects typically required fewer man-hours per $1,000 of contract than small ones.

These observed variations in turn reflected basic underlying factors affecting manpower requirements such as--

1. Extent of use of mechanical equipment including cranes, elevators, and conveyors;
2. Amount of prefabricated components used in construction; and
3. The proportion of skilled as compared to unskilled labor employed.

Differences in group averages cited may reflect varying combinations of these factors. For example, some of the lower unit man-hours observed for metropolitan area schools might be attributed to the fact that the structures were of sufficient size to enable the contractor to take advantage of the building equipment frequently available in large cities. In addition, projects in metropolitan areas generally had access to a more highly skilled labor force. In some individual projects, the particular combinations of these factors caused wide variation in man-hour requirements.

High man-hour requirements tended to be associated with lower average wage rates. The proportion of total contract represented by on-site wages (wages per hour times hours) was fairly constant among various school projects, about 26 percent.

Materials costs, including supplies and depreciation of equipment, averaged about 56 percent of the construction contract, or about $555 per $1,000. (See chart 2 and table 14.) Variations from this proportion were relatively small. In nearly 70 percent of the projects studied, materials costs accounted for 52 to 62 percent of the contract. Of the proportion ascribed to materials, a little more than $100, or 18 percent of the $555 was allocated to the transportation, warehousing, and trade industries. The remaining $455 represents the producers' value of the materials used, distributed among manufacturing, mining, services, and other industries. The residual 18 percent, while not studied, would have covered such items as overhead and administrative costs, taxes, and supplementary wage benefits.

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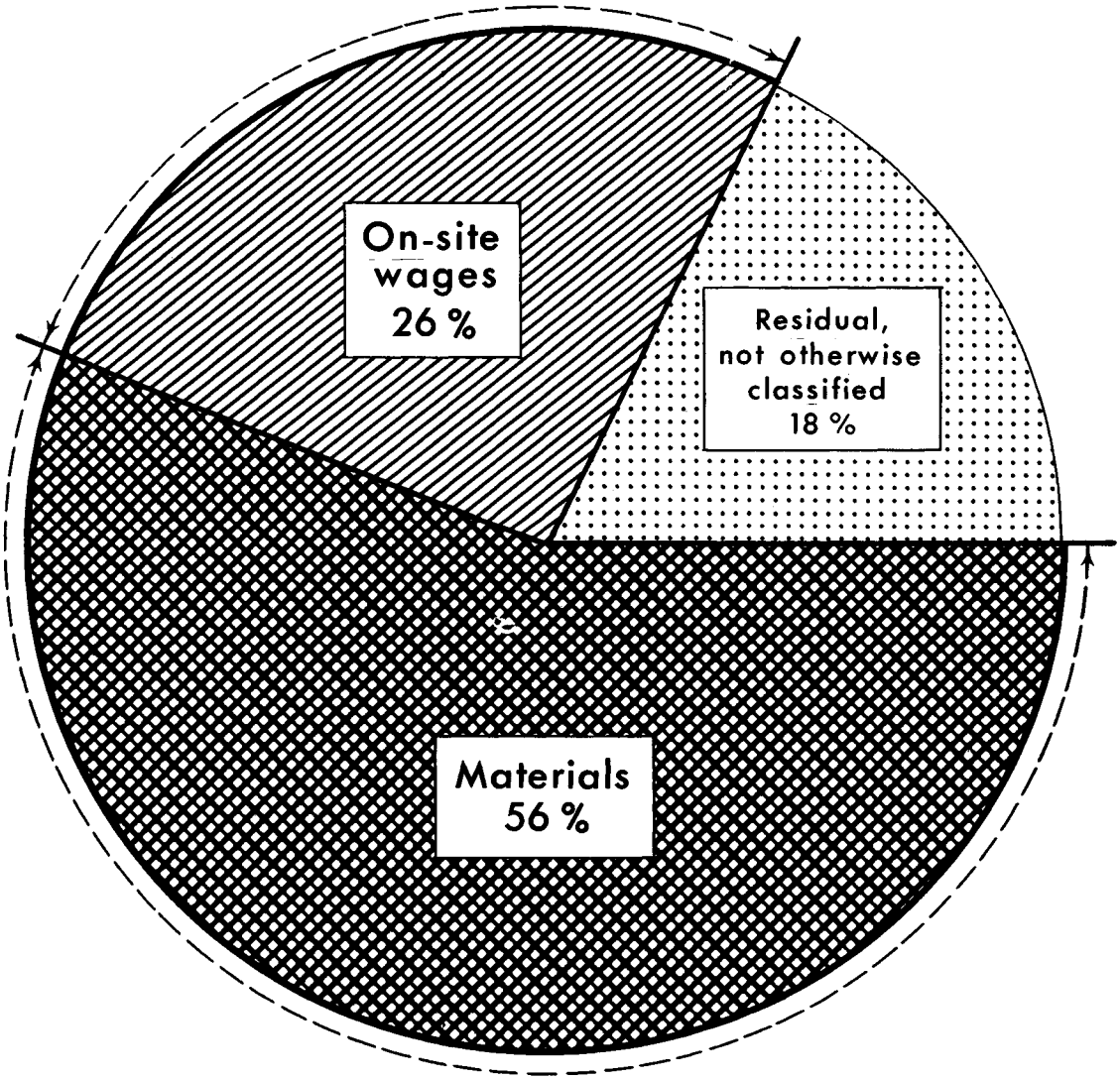
Chart 2. Percent Distribution of On-Site Wages and Materials Used for Each $1,000 of School Construction Contract, 1959



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The study of labor requirements eventually provided several types of information relating to the kinds of materials used, the types of employment generated, the timing of employment, and the share of total employment used by the various special-trades contractors. These are discussed in detail in later sections of the report.

School Characteristics

The size and cost of the schools studied averaged as follows:

	Average
Floor space	51.4 thousand square feet
Cost per square foot	$14.16
Number of classrooms	21
Cost per classroom	$35,000
School construction cost ...	$730,000

The size and cost of individual schools, of course, varied considerably by type of school, location, and type of construction. (See table 1.)

If elementary schools are considered separately from secondary schools, it becomes apparent that the latter are more costly, have more rooms, and cost more per room, reflecting additional facilities required for higher levels of education.

	Average cost per--			Average number of classrooms
	School	Square foot	Classroom	
Elementary ...	$370,000	$13.26	$24,800	15
Secondary	1,433,000	14.67	44,300	32

Schools constructed in metropolitan areas--about 55 percent of those studied--were generally larger and more expensive in total cost, cost per square foot, and per classroom than those built in nonmetropolitan areas.

Despite certain differences noted in the characteristics of the schools, the great majority had many similar features. About 80 percent of the schools were one-story structures, without basements. Exterior walls were generally of masonry and the floors were poured concrete covered with some type of soft tile, usually asphalt.

Differences in construction were noted in the type of framing, and the construction of the roof deck. About 40 percent of the schools had steel frames; 15 percent, all located in the West, had wooden frames. The remainder were almost equally divided between reinforced concrete and load-bearing masonry structures.

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The major regional difference was reflected in the more frequent use of wood products in the West and a correspondingly smaller use of clay products. Other regional differences were minor or restricted to specific localities, for example, relatively greater use of stone in quarry areas.

Most of the schools (83 percent) had cafeterias with cooking facilities. Auditoriums and gymnasiums were generally found only in secondary schools; other schools generally had a multipurpose room that served for assemblies as well as other purposes.

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Labor Requirements in the Past

It would be of considerable interest to compare labor requirements for current school construction with requirements for past periods. Unfortunately, only a limited amount of information is available and it cannot readily be used for comparison with current data. The two major problems are the change in cost (price) of construction and changes in physical specifications.

Changes in costs of materials and of labor, and of the relative proportions of each, affect the total price of construction. Adequate price indexes are not available for adjusting the dollar values of school construction costs in two time periods. However, a very rough adjustment for price change indicates that total man-hours per $1,000 (in constant prices) of school construction have declined by approximately one-third in the past 20 years, 3/ with a greater decline occurring for on-site employment than for off-site employment. Part of this difference, possibly all of it, merely reflected the transfer of work from on-site to off-site operations as a result of greater use of prefabricated units and changes in type of physical structure.

The decline in total labor requirements reflects not only increased efficiency but also changes in physical specification. Very few details of construction for the schools surveyed 20 years ago are available. However, schools built at that time were generally multistoried in contrast to the current single-storied structures; internal finishing was usually plaster in contrast to current painted cinder block. Methods of lighting, heating, and ventilation have improved, requiring different materials and different techniques of installation. The use of prefabricated components has already been mentioned. (Changes for specific kinds of materials are shown in the section on Material Requirements.)

3/ Based on unpublished data for public works projects built in the late 1930's.

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On-Site Man-Hour Requirements

Man-hour requirements at the construction site averaged 84 per $1,000 of construction contract, with more than half of the individual projects ranging between 75 and 95 hours. However, the overall range was much wider, reflecting special circumstances associated with the projects which tended to increase or decrease unit labor requirements. Apart from the variation in labor requirements exhibited by a ranking of individual projects, the survey also disclosed the existence of marked differences in group averages when the data were analyzed by various criteria such as type of school, size, location, or characteristics of construction. (See table 2.) It should be noted that man-hour requirements per dollar frequently do not parallel requirements per square foot. Differences in design, materials, and relative costs will affect the comparisons, especially between regions.

Large projects, secondary schools, and those built in metropolitan areas and in the northeastern part of the country tended to show lower man-hour requirements per $1,000 of contract for site labor.

Underlying much of the variation in labor requirements of individual projects and group averages are the three major factors discussed below. Although it seemed impractical to attempt to measure precisely the impact of any of these factors on manpower requirements, their influence was clearly apparent in many of the projects or groups which required fewer man-hours than others. These factors are:

1. Use of equipment such as cranes, elevators, and conveyors. It was frequently observed that the large projects and those built in metropolitan areas made greater use of mechanical equipment. In general, these projects tended to show lower unit man-hour requirements. Small projects, or those some distance from available equipment, were able to take advantage of these devices. The degree of mechanization varied, also, by region.

2. Amount of prefabricated components used in construction. An examination of the data for individual projects shows that the amount of prefabricated components used is one of the more important factors affecting man-hour requirements. Prefabrication is used at various stages in construction. Some projects used prefabricated concrete units in the construction of the frame, others used prefabricated wall panels, and many used prefabricated units in the interior finish such as in window and door frames, tack and chalk boards, and wardrobes.

Although on-site labor is reduced through this practice, it is possible that much of the difference in man-hour requirements between projects with a high degree of prefabrication and other projects may merely be due to transfer from the site to more remote shops and factories.

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3. Employment of larger proportion of skilled rather than unskilled labor. In general, low man-hour requirements on a project were frequently associated with greater than average use of skilled craftsmen. In most categories shown in table 3, lower proportions of laborers and helpers were related to lower man-hour requirements per $1,000 of contract.

Regional Group Comparisons

The distribution of projects by on-site man-hour requirements varied by region. (See table 4.) The great majority of projects in the Northeast required fewer than the 84 man-hours required nationally on the average. The relatively low average in that region, 76 man-hours per $1,000, is believed to reflect the greater use of equipment, prefabrication, and skilled craftsmen. (See chart 3.) The same factors were also noted for projects constructed in the West, where 70 percent of the schools required fewer than 84 man-hours per $1,000 of contract and the regional average was 81.

More than 80 percent of the school projects in the South fell in the upper range of man-hour requirements and, in general, reflected more frequent use of laborers and helpers. The average project in the South required 99 man-hours per $1,000 of contract.

Data from the North Central region projects lacked the concentration noted in other regions and man-hour requirements for individual projects extended over a wide range. The average for this region, 83 man-hours per $1,000, was close to the national average.

Other Group Comparisons

Elementary schools required more on-site man-hours for each $1,000 of contract than secondary schools, 87 compared with 83. This relationship, however, was not consistent in the different regions and may be a reflection of other factors, such as the size of project or differences in design.

About the same differential was noted in unit man-hour requirements between schools constructed in nonmetropolitan areas and those in metropolitan areas. The fewer hours required for projects in the metropolitan areas, except in the West, are probably attributable to the fact that most of them are larger and more expensive per square foot, thus making it feasible for builders to take advantage of the economies in labor time offered by the use of more heavy equipment available in most metropolitan areas, as well as prefabricated components and highly skilled labor forces. The differences in the labor requirements between these two groups were most noticeable in the South and North Central regions.

In general, the smaller projects required more on-site man-hours per $1,000 of contract, but the differences in averages were usually small. The variation in man-hour requirements of individual projects, especially within

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regions, would indicate that, in the absence of procedures feasible with large projects to reduce manpower requirements, other factors reflecting local conditions are more important than project size in determining man-hour requirements per dollar of contract.

The type of framing used in the projects had no consistent effect on the labor requirements. On the average, concrete framed schools had the higher on-site man-hour requirements, but this was not necessarily true when data were compared on a regional basis.

Multistoried schools required slightly fewer man-hours per $1,000 of contract than the more common one-story buildings, except in the West. The multistoried buildings were usually secondary schools, larger on the average, and frequently located in metropolitan areas. As such, man-hour requirements were more likely to reflect these other characteristics all of which were generally lower than the national average.

No consistent differences in unit man-hour requirements were apparent between schools with or without basements. The exterior finish of the school also did not appear to be an important factor affecting the man-hour requirements of school construction.

On an overall national basis, there was an inverse correlation between cost per square foot and man-hour requirements. In part, this reflected the influence of construction in the South, where high manpower requirements were associated with low cost per square foot of school construction. However, man-hour requirements per square foot were higher on the more expensive projects, which frequently included more elaborate facilities.

Requirements by Occupation

The employment of different types of skilled workers on the construction site varied because of several factors. Among these factors were the types of construction and materials used, the extent to which laborers were used, and the number of different craft unions in the area.

Carpenters are the most commonly employed skilled craftsmen in school construction. (See table 5.) At the time of the study, they accounted for 18.7 percent of total on-site man-hours. Many of the duties they now perform are tasks which have replaced their former work. Installation of floor tile, metal forms, and other jobs not associated with lumber are frequently performed by carpenters. Carpenters were, therefore, found on the payrolls of many different types of special trade contractors.

Plumbers and bricklayers, the next most frequently employed skilled workers, each represented slightly less than a tenth of total employment. Electricians, ranking fourth, accounted for just over 7 percent.

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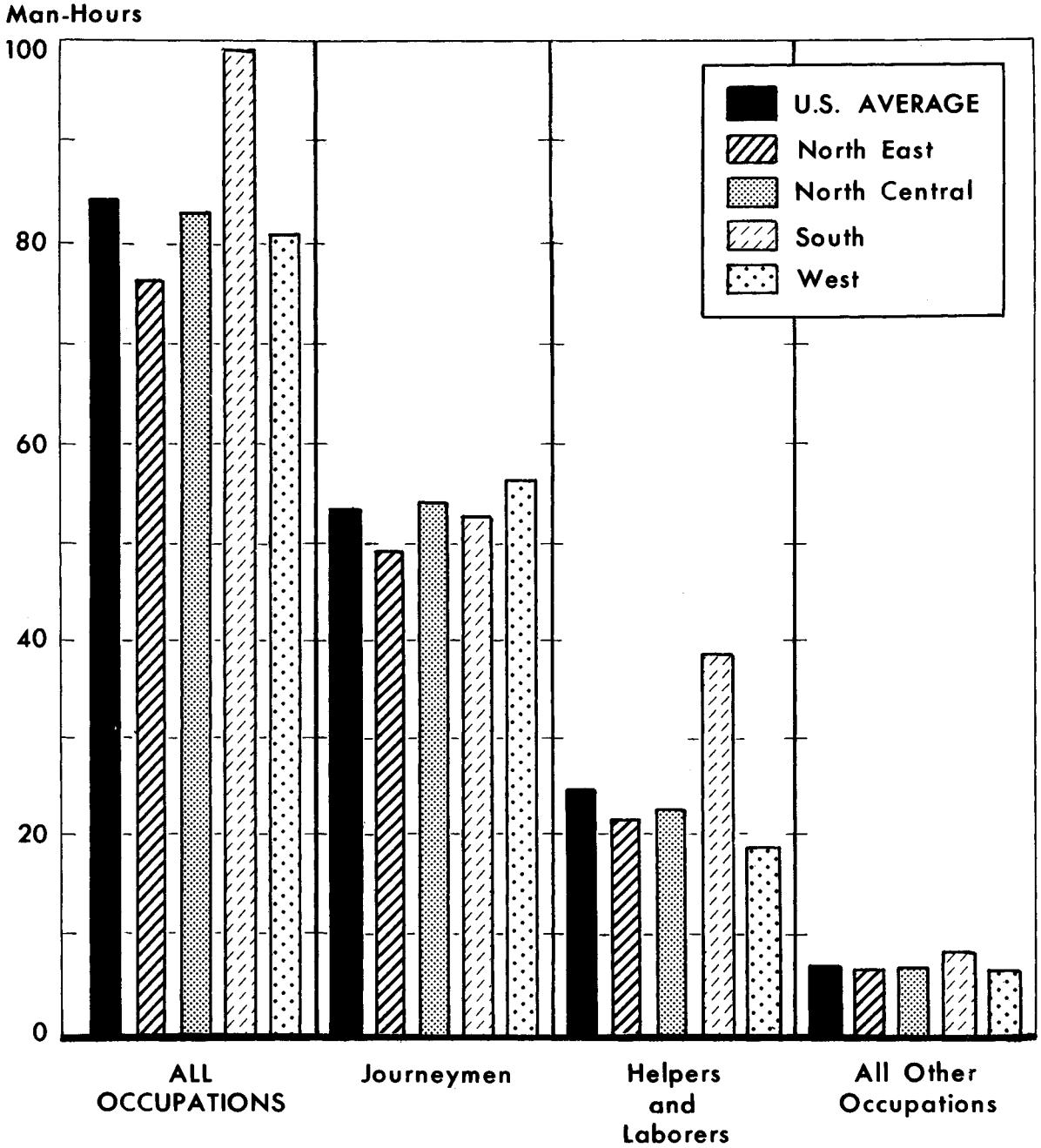
Chart 3. On-Site Man-Hour Requirements for Each $1,000 of School Construction Contract

By Skill Level and Region



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Laborers, the largest single occupational classification, performed many different types of work and were reported on the payrolls of almost every type of contractor. They accounted for nearly one-fourth of total on-site man-hours; helpers and tenders accounted for a twentieth.

The use of laborers and workers in other occupations varied considerably by area and region. In the South, laborers, helpers, and tenders accounted for almost two-fifths of total man-hours, whereas in the West, they represented less than one-fourth.

The greater than average use of lumber products on the West Coast brought carpenter employment there to more than one-fourth of total on-site man-hours, the largest proportion of all regions, and the smallest proportion of employment of bricklayers. Conversely, the North Central region used the highest proportions of bricklayers and plumbers and the lowest share of carpenters. The occupational distribution in the Northeast was very similar to that in the North Central except for a lower proportion of laborers.

The employment of operating engineers was relatively high in both the West and Northeast and was indicative of the use of laborsaving equipment. In both the South and North Central regions, where total man-hour requirements were higher, the employment of operating engineers was lower than in the West and Northeast.

Apprentices, employed under formal training programs, accounted for 3.7 percent of total man-hours. Use of apprentices was greatest in the West and South and lowest in the Northeast. When only skilled trades were considered, apprentices represented 5.8 percent. (See table 6.)

General and Special Trade Contractors Shares

Employees of general contractors accounted for nearly half (47.4 percent) of the total man-hours required on the construction site, the proportion ranging from a high of 52.1 percent in the North Central region to a low of 43.5 percent in the Northeast. (See table 8.) They frequently did most of the concrete and carpentry work and subcontracted other operations.

In addition to the general or prime contractor, the average school required 18 subcontractors. The number of contractors used varied by size of the project and also by area. (See tables 7 and 8.) Fewer subcontractors were used in the South and a greater number were used in the Northeast. Subcontracting was also more common in metropolitan areas.

Plumbing and heating contractors were the largest employers among the subcontractors, and in many areas, frequently held separate prime contracts. They accounted for over 14 percent of the total man-hours and were the major subcontractor in each region. Electrical contractors were responsible for 7.5 percent of the on-site man-hours. This proportion did not vary greatly by region.

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Masonry contractors averaged about the same proportion of man-hours nationally (7.2 percent) but exhibited much greater regional variation. They represented over 10 percent of the employment in the Northeast and South. However, in the North Central region, they represented only 2.1 percent of employment, most masonry work being done by the general contractor. In the West, the low proportion of masonry contractors' employment, 4.2 percent, was due to the infrequent use of bricks in construction. Painting contractors, comprising 3.5 percent nationally, varied little among the regions. Plastering contractors with a national average of 3.2 percent, had a larger proportion of the work in the West, 4.8 percent, as a result of the frequent use of stucco exteriors.

Other special trade contractors each generally represented about 3 percent or less of total employment.

The Cost of Direct Wages

Wage payments to on-site labor represented a little more than one-fourth of the total contract amount, reflecting the combined effect of man-hour requirements and wage rates. Although both man-hour requirements and wage rates varied considerably among individual projects, the total proportion paid to on-site labor remained rather constant. In general, on an individual project basis, higher wage rates were associated with lower man-hour requirements. This is reflected in the regional averages.

	Average hourly earnings	Percent of contract paid in wages
United States	$3.07	25.7
Northeast	3.32	24.0
North Central	3.27	25.4
South	2.62	26.9
West	3.27	26.0

Similar comparisons were made for contracts in metropolitan and nonmetropolitan areas, by types of framing, and by types of schools. (See table 9.) Although the average wages and man-hour requirements varied, the proportion wages represented of the total contract value remained close to a fourth.

A few individual school projects differed substantially in the ratio of wages to total construction contract. In most cases, these projects involved special conditions such as a large proportion of prefabricated parts, special

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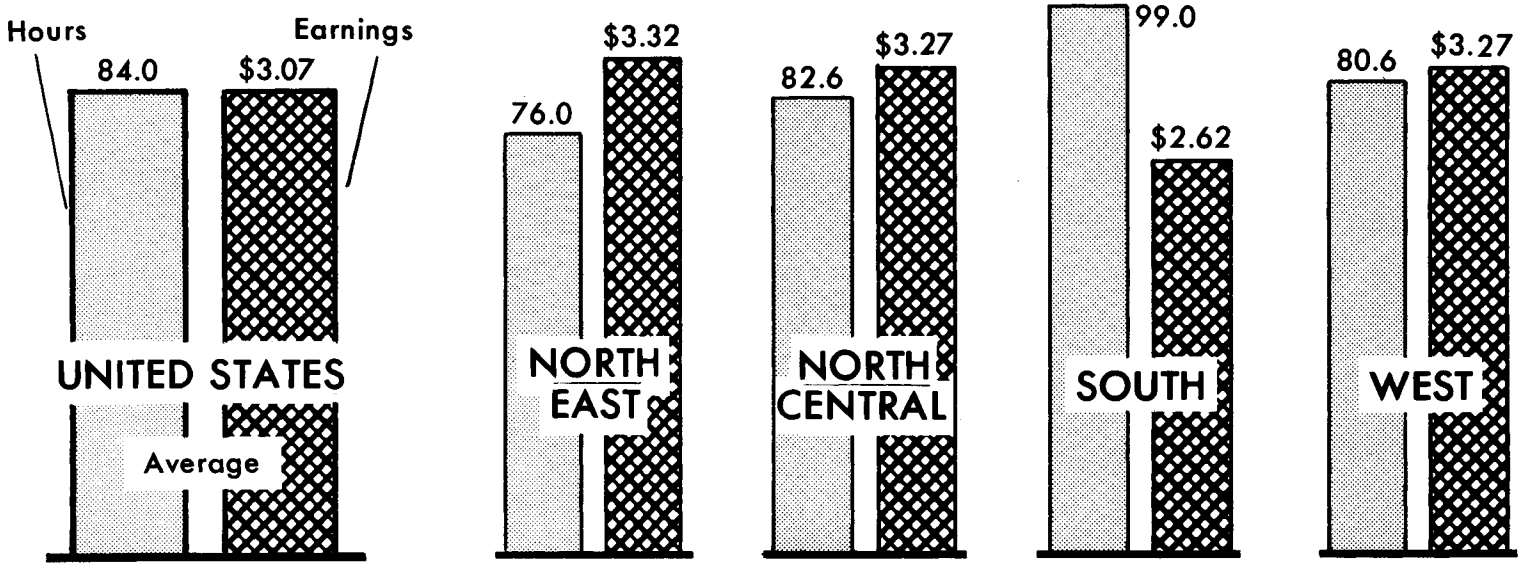
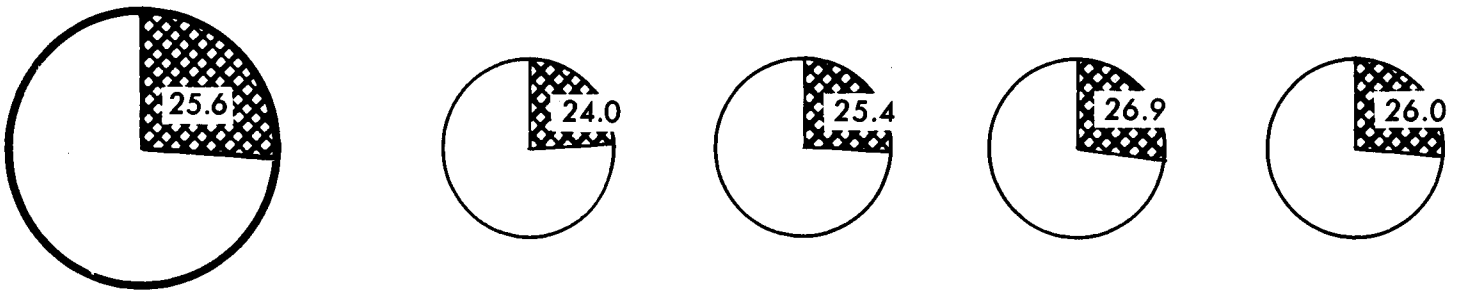
Chart 4. On-Site Man-Hours for Each $1,000 of School Construction Contract Multiplied by Average Hourly Earnings



...Result in Wages Which Are a Relatively Constant Proportion of the Contract Dollar



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site problems, or unusual labor arrangements, such as travel time included at regular hourly rates. The range of wages as a percent of contract for which a distribution of school projects could be made was as follows:

Percent wages were of contract	Percent of schools studied
Under 20.0	7.5
20.1 - 22.5	24.2
22.6 - 25.0	15.6
25.1 - 27.5	18.1
27.6 - 30.0	18.1
30.1 - 32.5	9.0
32.6 and over	7.5

Overtime work on schools was rare. Only 1 percent of the total hours reported was at overtime rates. The proportion of time at overtime rates was almost the same in each region, ranging from 0.8 percent in the Northeast to 1.1 percent in the North Central and West.

Occupational Shares

Carpenters, receiving 4.6 cents, were paid the biggest share of the construction contract dollar. Laborers received 4.3 cents. Other occupations each receiving more than 3 cents of the construction dollar were bricklayers, plumbers, and electricians.

Occupational shares of the contract dollar vary by region, reflecting the relative skills, numbers, and wage rates of the workers, as well as the differences in construction methods. In the West, the wide use of lumber products increased the share received by carpenters to 6 percent and reduced the share received by bricklayers. In the North Central region, both bricklayers and plumbers were paid a bigger share of the contract dollar than carpenters. Laborers in the South were paid 5.6 cents of the contract dollar, whereas in the West, they received only 3.2 cents.

The proportion each craft gets of the contract dollar depends also on the division of tasks among the several labor unions. These agreements vary by area and depend frequently on the quantity of construction activity. In large metropolitan areas, a number of special trade unions sometimes develop. In smaller communities, several kinds of skilled work are frequently performed by the same workers. For example, ceiling and floor tiles may be installed by special tradesmen in some areas, but in others are frequently installed by carpenters.

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Off-Site Employment

For each man-hour of employment performed on the construction site, an additional 1.5 man-hours of work are required to produce and distribute the necessary construction materials, supplies, and equipment used in construction. School construction projects, thus, gave rise to 128 man-hours of such employment per $1,000 of contract, compared with 84 hours on-site. (See table 10.)

The off-site employment is generated in many places, but can be classified in the following categories:

1. Construction industry--off site: administrative, estimating, and warehousing functions.

2. Manufacturing activities producing materials, ingredients, and equipment.

3. Transportation, warehousing, and distribution of construction materials, ingredients, and equipment.

4. All other industries which are directly or indirectly affected by the production of materials and ingredients. Various interindustry transactions eventually affect all additional industries such as agriculture, forestry, and mining.

There are, of course, other people affected which this study did not attempt to cover. Some of these are mentioned on page 2, in the introductory section. Of those omitted, the most numerically important groups who would be directly affected by a school construction program are employees in architectural firms, utility companies, and local government. A large area of employment also excluded from the calculations of man-hour effects, as mentioned earlier, is that created by the respending and investing of wages and profits arising in various areas of economic activity within the scope of this study.

Although the ratio of on-site to off-site employment requirements is commonly used in analyzing employment requirements in the construction industry, another type of distinction based upon the economic relations of the labor-generating areas is also useful. Therefore, in this study, employment requirements have also been divided into primary and secondary man-hour needs. As shown in the succeeding tabulation and chart 1, the primary man-hour requirements, estimated at 154, arise in the activities at the site and those rigidly related to the volume of construction activity. Included in these, in addition to site employment, are off-site construction employment, employees of manufacturing industries represented at the "last stage of manufacturing" for materials prior to shipment to the site, as well as those in transportation, trade, and service organizations dealing in materials used at the site.

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Secondary man-hour requirements have been defined as including those associated with all other requirements indirectly related to the needs at the site. Such employment, totaling 58 hours or 27 percent of total man-hour requirements, spreads to all parts of the economy as the impact of primary activity is reflected in the demand for basic materials and related transportation, trade, and services. 4/ The following tabulation shows man-hours of employment associated with $1,000 of school construction.

	Total	Primary activities	Secondary activities
Total	212	154	58
On-site:			
Construction	84	84	--
Off-site	128	70	58
Construction	10	10	--
Manufacturing	78	47	31
Transportation	8	4	4
Trade and service	20	9	11
Other	12	--	12

Some business employment is represented in both the primary and secondary man-hour needs since some commodities or services are used in support of either site activity or manufacturers producing items for site activity. For example, the sand and gravel industry furnished sand and gravel directly to the construction industry and also to the ready-mix concrete industry which sells to the construction industry. Metal producers may sell directly to the construction industry--in which case they engage in primary activity or they may sell to metal fabricators which produce other construction materials--in the latter instance, the metal sales would be included under secondary activity.

Builders' Off-site Employment

An exact study of the off-site employment of the contractors was not attempted, since it was almost impossible to relate accurately such employment with the projects being studied. Builders' off-site employment was not only concerned with the project studied but was also occupied with work involving other current or future projects of the builders.

4/ Secondary man-hours were estimated on the basis of a study made by the Bureau of 1947 interindustry relationships. See W. Duane Evans and Marvin Hoffenberg, Interindustry Relations Study for 1947, Review of Economics and Statistics, Vol. XXXIV (1952), Harvard University Press. For methods employed, see appendix A.

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The estimate of 10 man-hours of such work for each $1,000 of contract is based on the difference between construction worker employment and total employment in the contract construction industry. 5/ This estimate also includes self-employed craftsmen who may have worked at the site.

Combining this employment with on-site employment results in an estimate of 94 hours of employment in the construction industry for each $1,000 of school construction.

Employment in Transportation, Trade, and Service

The distribution of construction materials from the producing industries requires the employment of workers in the transportation, warehousing, and trade industries. The estimate of 13 hours of primary employment per $1,000 of school contract is based on the difference between producer's value and delivered value of the materials used at the site. This estimate covers only the distribution of the materials from the producers to the construction site and does not include the distribution, etc. of materials among industries prior to the shipment of the completed products.

"Last Manufacturing Stage" Employment

The sector of the economy most affected by school construction, other than the construction industry, is manufacturing. An estimated 47 man-hours were required for each $1,000 of total contract for the production of the construction materials used in the building of schools. This estimate, however, includes only the employment required in the last manufacturing process of the materials. 6/ The employment generated by this activity is distributed in many industries which are directly affected by activity in the construction industry. For example, it includes sawmills cutting rough lumber for forms and establishments making millwork items from lumber, but does not include the employment in sawmills producing lumber for millwork products. The latter is included in the estimate of secondary employment discussed below.

Employment in Secondary Activities

In addition to the 47 man-hours previously noted for primary employment for each $1,000 of school construction contract in the factories making construction materials, an additional 31 hours were required in secondary manufacturing activities.

5/ Administrative, engineering, estimating, and clerical workers accounted for about 14 percent of total employment in the construction industry. About one-fourth of this employment was involved at the site.

6/ Included in the bill of materials were the supplies and the expended value of the equipment used by construction contractors.

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The transportation industries required 4 hours of employment to transport the materials to and from the industries indirectly affected.

Trade and service industries as a group required 11 hours of employment for each $1,000 of school construction to meet the needs of secondary business activity.

Other business activities, primarily agriculture, forestry, and mining, accounted for the remaining 12 hours of secondary manpower requirements.

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Construction Time

The average construction period for all schools studied was slightly in excess of 1 year. (See table 11.) Construction time for individual projects, however, varied considerably. Significant differences were noted not only by size of project but also by region.

The construction time span ranged from several months for the smallest projects to almost 2 years for some of the largest ones. Nearly all of the schools costing more than $1 million took more than 1 year to complete.

Regional differences appeared to reflect climatic conditions. Schools in the Northeast averaged 68 weeks of construction time. Schools in the North Central also generally required longer than average construction time. In the South, where construction is usually a year-round industry, the average school construction time was a few weeks shorter.

Occupational Employment by Construction Periods

In order to measure the distribution of employment, the construction time for each school was divided into 10 equal periods. This permitted the combination of projects of various sizes to obtain typical employment patterns. (See table 12.)

Generally, employment started slowly and built up to a peak in the sixth period, then dropped off sharply in the last two periods. (See chart 5.) Nearly 70 percent of the on-site employment occurred in the fourth through the eighth periods. Employment in the last period fell to less than 3 percent of the total employment.

The first workmen to benefit from a building program after the contracts have been made are the operating engineers, truckdrivers, carpenters, and laborers. Peak employment for other skills, follow in succeeding waves--cement finishers, structural-iron workers, plumbers, bricklayers, roofers, sheet metal workers, plasterers, and finally, glaziers, tile setters, and painters. When the construction time is divided into 10 equal periods, most of the special trades have one period of peak employment in which at least 20 percent of their work is performed. Many of the occupations reach their peak in the fifth or sixth period.

Carpenters and laborers were employed almost constantly and their share of the employment remained comparatively the same during all periods of construction. Other trades which were employed in about the same degree during most of the periods were cement finishers, electricians, plumbers, and truckdrivers.

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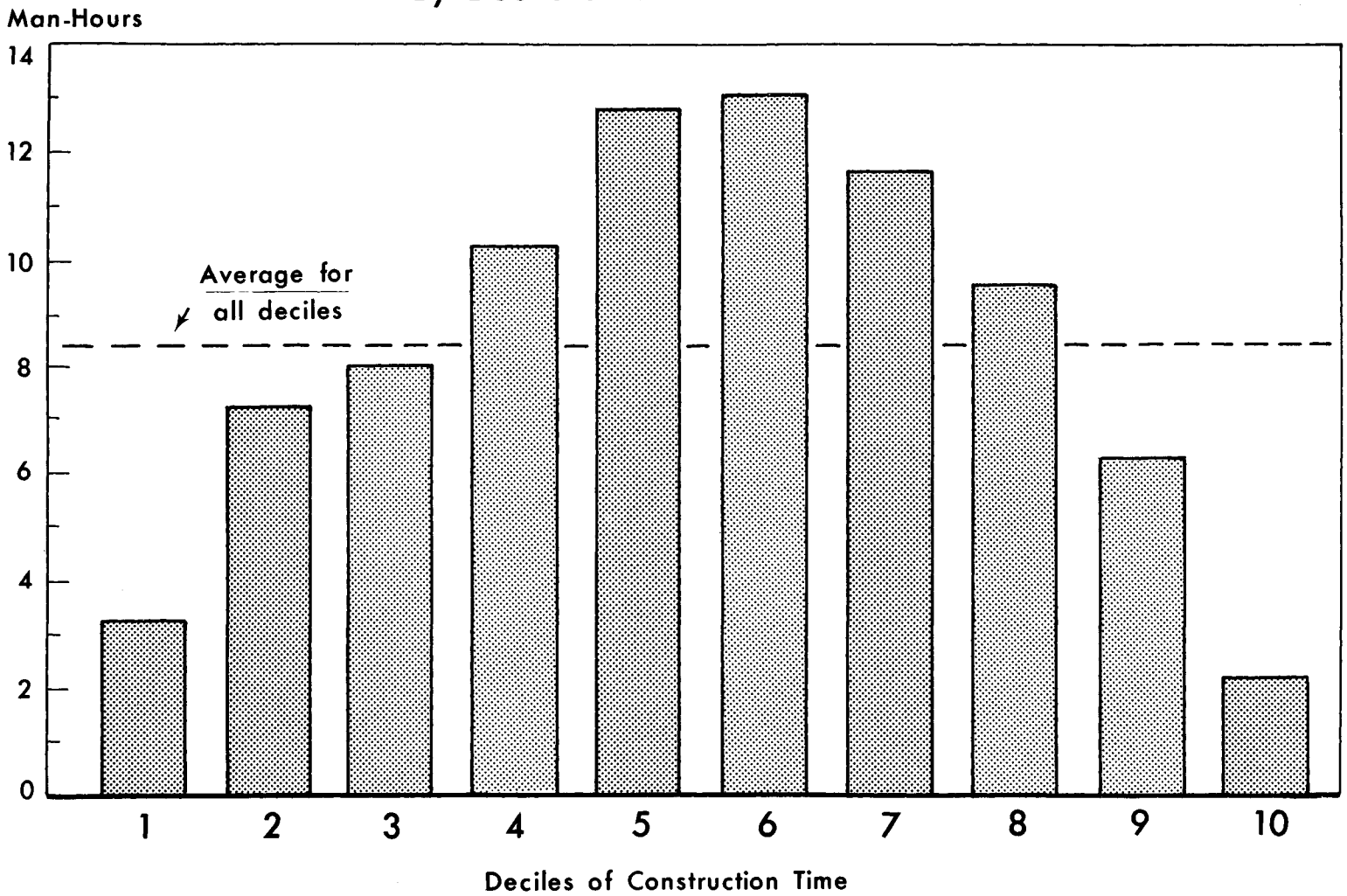
Chart 5. On-Site Man-Hours of Construction Labor for Each $1,000 of School Construction Contract By Decile of Construction Time



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Contractor Employment by Construction Period

The pattern of contractor employment, particularly where special-trade contractors were used for specific features of construction, followed a logical path of development. As might be expected, the major part of the work of site and excavation contractors was completed in the first third of total construction time, whereas the finishing work, such as painting and plastering, was concentrated in the latter part of the construction cycle.

Other contractors performed in normal sequence with most activities at peak in the fourth to seventh periods. Although general and plumbing and heating contractors also exhibited patterns of peak activity (the fifth and sixth, respectively), they were represented in all periods at a more uniform level than the others. (See table 13.)

Wages were expended at about the same rate that man-hours were used, indicating that the average skill requirements remained almost constant during the construction period.

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Materials Used

Costs of materials, shown for significant products in table 14, represented 55.5 percent of the total construction contracts. Variations from this average were very small, not only between regions but also within regions and between elementary and secondary schools. Nearly 70 percent of the school projects studied had materials costs ranging from 52 to 62 percent of their total construction contracts. 7/

One characteristic, size of project, did appear to be related to variation in the proportion of total cost assigned to materials. In general, there was an inverse relation between the size of project and the proportion that materials represented of the total contract cost. There were indications, also, that overhead, planning, and other off-site activities not covered in this survey were proportionately higher on more costly projects.

Cost of project	Materials as percent of contract cost
Under $200,000	59.3
$200,000-$400,000	57.7
$400,000-$1,000,000	55.8
$1,000,000-$2,000,000	55.6
$2,000,000 and over	53.9

Secondary schools, which were generally in the higher cost brackets, had materials costs amounting to 55.1 percent of contracts. For elementary schools, such costs averaged 56.4 percent. The larger schools frequently had auditoriums and gymnasiums which added to project costs but did not always add proportionately to materials costs.

Among the major materials used, the general grouping "metal products (excluding plumbing and heating items)" represented 16 percent of the total contract construction costs. 8/ Within this group, about one-third of the value comprised structural and reinforcing steel. Fabricated sheet-metal products and metal windows and doors were other important items within this group.

7/ Materials costs included an estimate for the rental or depreciation charge for major construction equipment used on the job. In total, such costs were a small proportion of costs.

8/ Each "percent of construction contract" represents almost $14 million of annual expenditures for construction materials at the current annual rate of school construction (e.g., $224 million of metal products is represented by the 16 percent).

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Stone, clay, and glass products, second in general importance, accounted for 13.8 percent of total costs. More than half of this was spent on cement, concrete, and concrete products. In recent years, ready-mix concrete has become a major item (approaching 4 percent of total costs). Its growing importance has been reflected in reduced use of brick and other clay products, which accounted for only 2.3 percent of contract costs.

Electrical products totaled 5.8 percent of the contracts, one-third being for lighting fixtures. Heating and ventilating equipment, including air conditioning equipment, amounted to 5.1 percent and plumbing products to 3.4 percent, about one-third of which was for plumbing fixtures.

Regional Differences in Materials Consumption

The largest difference in material uses between regions was in lumber products. The Western region, the only area where lumber continued to appear in large quantities in schools, used considerably less brick and stone. In the other regions, lumber was used primarily for millwork items, which accounted for about half or more of the expenditures for lumber products. Even much of the form lumber used for concrete work has been replaced by cardboard or reusable metal forms.

Use of rough and dressed lumber amounted to 3.9 percent of the total contract value in the West, more than twice the proportion used in any of the other regions.

In general, the great majority of materials classifications showed only minor differences between regions and many of these differences were probably due to problems of classification.

Changes in Materials

A comparison of construction costs at the time of the present study and that of a study made about 20 years ago shows that the proportion materials represented of total construction cost has changed very little between the two periods, increasing only from 52 to 55 percent. This relative overall stability, if considered alone, however, would mask a considerable change in construction methods and use of materials.

The use of lumber and brick has diminished sharply, whereas that of metal, concrete, and glass has increased. The proportion electrical wiring and fixtures represent of total material costs has more than doubled; in contrast, the use of marble, granite, and stone has almost disappeared, except in limited local areas.

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Many of the changed proportions indicated in the text tabulation below reflect differential price movements; others reflect a change in product form or amounts used; some are a combination of both factors. Millwork continues to be an important item whereas forest products, as a whole, have lost about half of their share of the construction dollar despite exhibiting the sharpest price rise of all building material items.

The position of stone, clay, and glass products, which as a group has been relatively steady as a proportion of materials costs over the past two decades, reflects substantial changes among its component products. A sharp contraction in the use of marble and other stones has already been noted. In addition, a substantial rise in the importance of ready-mix and precast concrete has also taken place in school and other construction. This is indicated not only by the diminished use of brick and stone, but also by the sharp decline in separate purchases of cement, sand, and gravel.

The tabulation below shows the percent selected materials represented of total material costs for the two periods of time. As stated previously, these comparisons include the combined effect of differential price movements and changes in the relative amounts of materials used for construction.

Material group	Current study	20 years ago
Iron and steel products	38.5	33.6
Heating and ventilating	8.8	12.2
Plumbing fixtures and supplies	6.6	5.5
Structural steel	5.3	5.4
Reinforcing steel	5.7	3.3
Metal doors	4.4	2.7
Stone, clay, and glass products	26.5	26.4
Cement and concrete products	12.4	6.2
Brick	3.0	10.2
Forest products	8.9	15.9
Lumber and timber	3.5	8.5
Planning mill products	5.3	7.4
Electrical products	10.5	5.1
Roofing materials	1.7	2.8
Paints	1.1	1.1

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Table 1. Number and Cost of Surveyed School Construction Projects, by Selected Characteristics and Region, 1959

Characteristic	United States			Northeast			North Central			South			West		
	Number	Cost per-- Square foot	Cost per-- Classroom (thousands)	Number	Cost per-- Square foot	Cost per-- Classroom (thousands)	Number	Cost per-- Square foot	Cost per-- Classroom (thousands)	Number	Cost per-- Square foot	Cost per-- Classroom (thousands)	Number	Cost per-- Square foot	Cost per-- Classroom (thousands)
All schools	128	$14.16	$35.0	22	$16.99	$42.7	26	$13.67	$35.1	41	$12.11	$26.1	39	$14.25	$38.4
Elementary	85	$13.26	$24.8	13	$17.02	$32.4	18	$14.27	$27.1	29	$10.67	$19.1	25	$13.40	$26.3
Secondary	43	14.67	44.3	9	16.97	50.2	8	13.35	42.3	12	13.49	36.4	14	14.61	46.8
In a metropolitan area	70	14.68	37.5	10	17.58	47.1	13	14.15	38.6	22	12.73	29.3	25	14.86	38.9
Not in a metropolitan area	58	13.11	30.5	12	16.01	36.6	13	12.74	29.4	19	10.67	20.2	14	12.97	37.3
Construction cost group (in thousands):															
$200 and under	22	11.57	19.9	1	(1/)	(1/)	5	12.76	23.0	9	9.97	17.2	7	13.01	23.3
$201-$300	16	10.60	20.0	1	(1/)	(1/)	4	12.46	25.6	7	9.13	15.5	4	11.62	25.6
$301-$400	24	12.15	23.2	4	15.02	29.4	4	13.77	28.4	10	11.02	20.4	6	11.66	22.1
$401-$500	15	12.08	23.6	1	(1/)	(1/)	3	13.56	32.1	5	9.96	17.4	6	13.52	27.3
$501-$1,000	24	14.77	30.2	7	17.19	33.1	5	14.31	29.1	5	12.40	24.4	7	14.86	33.7
$1,001-$2,000	17	13.89	41.7	5	15.45	40.9	3	13.01	43.3	4	13.85	42.3	5	13.14	40.8
$2,001 and over	10	16.48	56.3	3	18.88	61.3	2	(1/)	(1/)	1	(1/)	(1/)	4	15.86	56.8
Type of framing:															
Steel	51	14.77	38.7	14	16.98	45.4	12	13.12	34.7	17	12.41	27.7	8	15.84	49.5
Concrete	29	13.65	32.5	1	(1/)	(1/)	6	14.80	42.5	14	12.60	25.8	8	13.07	32.1
Load-bearing masonry	28	12.81	27.1	7	16.54	29.6	8	13.79	27.7	10	10.14	22.6	3	11.42	29.1
Wood	20	14.24	36.6	--	--	--	--	--	--	--	--	--	20	14.25	36.6
1 story	101	13.13	29.1	13	15.72	35.9	20	13.75	31.9	33	10.97	21.4	35	13.63	32.7
2 or 3 stories	27	15.53	45.3	9	17.74	47.5	6	13.61	38.5	8	14.25	38.5	4	15.72	60.0
Full or partial basement	27	15.81	45.0	12	17.90	47.2	9	14.43	40.3	4	12.65	36.4	2	(1/)	(1/)
No basement	101	13.42	31.3	10	15.20	35.1	17	13.09	31.7	37	12.01	24.8	37	14.20	36.5
Exterior:															
Masonry	105	14.09	34.5	21	17.01	43.2	26	13.67	35.1	36	12.31	26.7	22	13.37	35.6
Curtain wall	11	14.84	35.2	1	(1/)	(1/)	--	--	--	5	10.64	22.0	5	17.25	46.3
Other	12	14.15	39.3	--	--	--	--	--	--	--	--	--	12	14.15	39.3

1/ Insufficient data to warrant presentation.

NOTE: Construction work spanned the period 1958-60 but the major portion was done in 1959.

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Table 2. On-site Man-hour Requirements for School Construction Projects, by Selected Characteristics and Region, 1959

Characteristic	United States			Northeast			North Central			South			West		
	Man-hours per--			Man-hours per--			Man-hours per--			Man-hours per--			Man-hours per--		
	$1,000 of cost	1,000 square feet	Class-room	$1,000 of cost	1,000 square feet	Class-room	$1,000 of cost	1,000 square feet	Class-room	$1,000 of cost	1,000 square feet	Class-room	$1,000 of cost	1,000 square feet	Class-room
All schools	84.0	1,189	2,938	76.0	1,291	3,249	82.6	1,129	2,902	99.0	1,199	2,587	80.6	1,149	3,099
Elementary	86.7	1,150	2,153	83.3	1,417	2,697	78.9	1,126	2,136	105.1	1,122	2,006	75.6	1,013	1,986
Secondary	82.6	1,212	3,656	72.6	1,233	3,646	84.7	1,131	3,586	94.3	1,272	3,427	82.6	1,206	3,864
In a metropolitan area	82.6	1,212	3,092	74.4	1,307	3,499	77.9	1,102	3,007	94.9	1,208	2,778	82.1	1,220	3,197
Not in a metropolitan area	87.2	1,144	2,656	79.0	1,266	2,894	92.9	1,184	2,727	110.3	1,177	2,224	77.1	1,001	2,874
Construction cost group (in thousands):															
$200 and under	90.0	1,041	1,787	(1/)	(1/)	(1/)	98.4	1,256	2,260	96.1	958	1,650	77.7	1,012	1,812
$201-$300	92.0	974	1,842	(1/)	(1/)	(1/)	90.8	1,131	2,322	98.6	901	1,526	79.0	918	2,024
$301-$400	95.6	1,161	2,214	84.2	1,265	2,476	78.9	1,087	2,238	116.7	1,286	2,380	80.5	939	1,780
$401-$500	85.8	1,037	2,029	(1/)	(1/)	(1/)	93.3	1,264	2,991	96.7	963	1,678	75.4	1,019	2,059
$501-$1,000	81.2	1,199	2,449	79.1	1,359	2,619	76.7	1,097	2,231	103.1	1,278	2,512	70.6	1,048	2,376
$1,001-$2,000	82.2	1,142	3,427	74.5	1,151	3,047	83.7	1,089	3,623	92.6	1,282	3,914	79.2	1,040	3,233
$2,001 and over	81.7	1,347	4,604	73.6	1,389	4,515	(1/)	(1/)	(1/)	(1/)	(1/)	(1/)	86.6	1,374	4,916
Type of framing:															
Steel	83.5	1,233	3,230	74.0	1,256	3,354	87.5	1,148	3,033	96.3	1,195	2,670	84.2	1,335	4,172
Concrete	88.6	1,209	2,876	(1/)	(1/)	(1/)	72.5	1,073	3,081	101.5	1,278	2,621	79.5	1,038	2,548
Load-bearing masonry	81.6	1,046	2,212	74.7	1,235	2,208	84.0	1,158	2,328	100.2	1,016	2,270	68.6	783	1,999
Wood	80.5	1,146	2,949	--	--	--	--	--	--	--	--	--	80.5	1,146	2,949
1 story	85.0	1,116	2,474	78.4	1,232	2,811	83.8	1,152	2,670	102.5	1,124	2,191	77.5	1,056	2,536
2 or 3 stories	82.8	1,287	3,750	74.8	1,326	3,551	81.6	1,111	3,140	93.9	1,338	3,612	87.2	1,371	5,229
Full or partial basement	82.5	1,304	3,707	78.2	1,399	3,690	80.7	1,164	3,254	108.6	1,374	3,950	(1/)	(1/)	(1/)
No basement	84.8	1,138	2,653	71.0	1,079	2,490	84.3	1,103	2,668	97.1	1,166	2,405	80.5	1,143	2,941
Exterior:															
Masonry	83.2	1,172	2,870	76.0	1,293	3,283	82.6	1,129	2,902	98.3	1,211	2,629	76.1	1,018	2,705
Curtain wall	92.9	1,379	3,272	73.7	1,167	1,917	--	--	--	104.2	1,109	2,293	89.9	1,552	4,165
Other	82.1	1,163	3,230	--	--	--	--	--	--	--	--	--	82.1	1,163	3,230

1/ Insufficient data to warrant presentation.

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Table 3. On-site Man-hour Requirements per $1,000 of School Construction Contract, by Proportion of Lower skilled Labor Employed 1/ and Region, 1959

Percent groups of lower skilled workers	United States	Northeast	North Central	South	West
All groups	84	76	83	99	81
20.0 and under	80	72	80	--	82
20.1 - 25.0	75	68	67	--	82
25.1 - 30.0	85	87	94	86	79
30.1 - 35.0	80	70	95	91	70
35.1 - 40.0	92	--	89	94	--
40.1 - 45.0	110	--	--	113	91
45.1 and over	111	--	116	110	--

1/ For purposes of this comparison, laborers, helpers, and tenders were considered lower skilled.

Table 4. Percent Distribution of School Construction Projects, by Number of On-site Man-hours Required for Each $1,000 of Construction Contract, by Region, 1959

Percent group	United States	Northeast	North Central	South	West
Average man-hours	84.0	76.0	82.6	99.0	80.6
Under 60.0	5.5	4.6	7.7	--	10.3
60.0 - 69.9	12.5	22.7	11.5	--	20.5
70.0 - 79.9	21.8	31.7	23.1	14.6	23.1
80.0 - 89.9	21.1	9.1	19.2	17.1	33.2
90.0 - 99.9	15.6	22.7	11.5	21.9	7.7
100.0 - 109.9	9.4	4.6	11.5	17.1	2.6
110.0 - 119.9	6.3	4.6	7.7	12.2	--
120.0 - 129.9	3.1	--	3.9	7.3	--
130.0 and over	4.7	--	3.9	9.8	2.6

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Table 5. On-site Man-hour Requirements per $1,000 of School Construction Contract, by Occupation and Region, 1959

Occupation 1/	United States		Northeast		North Central		South		West	
	Man-hours worked	Percent	Man-hours worked	Percent	Man-hours worked	Percent	Man-hours worked	Percent	Man-hours worked	Percent
All occupations	84.0	100.0	76.0	100.0	82.6	100.0	99.0	100.0	80.6	100.0
General supervisors	2.8	3.3	2.7	3.5	2.9	3.5	3.6	3.6	2.3	2.8
Professional, technical, and clerical	.5	.6	.5	.6	.8	1.0	.6	.6	.4	.5
Bricklayers	7.8	9.3	8.6	11.3	10.6	12.8	9.7	9.8	4.2	5.2
Carpenters	15.7	18.7	11.9	15.7	11.7	14.2	14.9	15.1	21.4	26.5
Cement finishers	1.5	1.8	1.2	1.6	1.2	1.5	1.8	1.8	1.8	2.2
Electricians	6.0	7.1	5.6	7.3	6.4	7.7	5.6	5.7	6.3	7.8
Glaziers	.6	.8	.5	.7	.6	.7	.9	.9	.6	.7
Lathers	1.2	1.4	1.5	2.0	1.0	1.2	.8	.8	1.2	1.5
Operating engineers	1.6	1.9	1.7	2.3	1.0	1.2	1.6	1.7	1.9	2.3
Ornamental-iron workers	.9	1.1	1.3	1.7	1.1	1.3	.9	.9	.5	.6
Painters	2.8	3.3	2.7	3.6	2.3	2.8	2.7	2.8	3.0	3.8
Plasterers	1.1	1.3	.7	.9	1.0	1.2	.9	.9	1.5	1.9
Plumbers	7.9	9.4	7.3	9.6	9.1	11.0	7.8	7.8	7.9	9.8
Roofers	1.2	1.5	1.1	1.5	1.6	1.9	1.3	1.3	1.1	1.4
Sheet-metal workers	2.5	2.9	1.8	2.4	2.9	3.5	1.5	1.5	3.4	4.2
Structural-iron workers	1.4	1.7	1.5	1.9	2.5	3.0	1.3	1.3	.9	1.1
Terrazzo workers and tile setters	.8	.9	1.0	1.3	.8	1.0	.9	1.0	.5	.6
Truckdrivers	.7	.8	.6	.8	.5	.6	.7	.7	.8	1.0
Laborers	20.1	24.0	16.5	21.8	20.0	24.3	32.8	33.1	14.3	17.7
Helpers and tenders	4.3	5.1	4.6	6.0	2.4	2.9	5.6	5.6	4.2	5.3
Watchmen	.5	.6	.8	1.1	.2	.3	.8	.9	.1	.1
Other	2.1	2.6	1.8	2.4	2.1	2.5	2.3	2.3	2.4	2.9

1/ Working foremen and apprentices are included with journeymen.

NOTE: Because of rounding, sums of individual items may not add to totals.

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Table 6. Percent of Apprentices Employed on School Construction Projects, by Occupation and by Region, 1959

Occupation	United States	Northeast	North Central	South	West
All workers	3.7	1.8	3.0	4.3	5.7
Skilled trades only	5.8	2.8	4.4	7.7	7.9
Bricklayers	3.8	1.9	4.6	3.9	5.9
Carpenters	3.9	2.0	2.1	3.0	6.6
Cement finishers	.4	.2	.2	.1	.9
Electricians	15.0	7.5	10.1	27.8	14.5
Glaziers	3.9	.1	1.7	6.0	5.6
Lathers	3.9	.6	.9	10.9	5.3
Operating engineers	(1/)	--	--	--	(1/)
Ornamental-iron workers	2.3	--	1.9	5.7	3.5
Painters	3.8	1.4	.7	5.6	6.5
Plasterers	2.6	1.1	.6	3.0	4.3
Plumbers	9.7	5.6	6.3	14.7	12.0
Roofers	8.1	3.1	14.0	2.3	12.3
Sheet-metal workers	8.0	2.4	4.2	13.7	11.4
Structural-iron workers	2.2	1.0	1.4	2.7	4.9
Terrazzo workers and tile setters	4.2	4.4	1.5	1.2	13.4

1/ Less than 0.05 percent.

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Table 7. Average Number of Contractors per School Construction Project, by Cost Group and Region, 1959

Cost group (in thousands)	United States	Northeast	North Central	South	West
All groups	19	25	18	15	21
$200 and under	12	(1/)	9	10	15
$201-$300	12	(1/)	15	11	12
$301-$400	18	21	22	14	20
$401-$500	16	(1/)	15	13	19
$501-$1,000	22	25	19	19	23
$1,001-$2,000	29	28	30	32	26
$2,001 and over	33	32	(1/)	(1/)	37

1/ Insufficient data to warrant presentation.

Table 8. Percent of Total On-site Man-hour Requirements for School Construction, by Type of Contractor and Region, 1959 1/

Type of contractor	United States	Northeast	North Central	South	West
All types	100.0	100.0	100.0	100.0	100.0
General	47.4	43.5	52.1	48.5	46.5
Electrical	7.5	7.6	7.8	5.9	8.8
Masonry	7.2	10.8	2.1	10.5	4.2
Painting	3.5	4.7	3.5	2.6	3.8
Plastering and lathing	3.2	.5	2.3	3.3	4.8
Plumbing and heating	14.2	10.9	18.4	13.5	14.9
Roofing and sheet metal	2.4	2.2	3.1	2.7	2.1
Site preparation and excavation .	2.4	4.9	1.5	1.2	2.5
Structural and ornamental metal .	3.2	2.8	3.3	3.4	3.1
Tile and terrazzo work	2.0	2.8	.7	2.5	1.5
All other types	7.1	9.2	5.3	6.0	7.7

1/ Based on data from federally aided school projects only.

NOTE: Because of rounding, sums of individual items may not add to 100.

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Table 9. Average On-site Hourly Earnings on School Construction Projects, by Selected Characteristic and Region, 1959 1/

Characteristic	United States		Northeast		North Central		South		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 schools	$3.07	25.7	$3.32	24.0	$3.27	25.4	$2.62	26.9	$3.27	26.0
Elementary	$ 2.80	25.3	$3.12	25.7	$3.02	24.2	$2.25	25.3	$3.26	25.4
Secondary	3.28	26.1	3.48	22.9	3.45	26.2	3.06	28.5	3.28	26.3
In metropolitan area	3.21	25.8	(2/)	(2/)	3.48	24.7	2.80	27.8	3.39	26.3
Not in metropolitan area ..	2.87	25.6	3.13	25.5	2.72	27.7	2.24	24.7	3.14	25.7
Construction cost group (in thousands):										
$200 and under	2.69	26.2	(2/)	(2/)	(2/)	(2/)	2.69	27.3	(2/)	(2/)
$201-$300	2.54	26.1	--	--	(2/)	(2/)	2.29	25.9	2.81	24.3
$301-$400	2.74	26.5	(2/)	(2/)	(2/)	(2/)	2.26	25.7	3.33	27.5
$401-$500	2.85	27.0	--	--	(2/)	(2/)	2.31	24.2	3.26	26.8
$501-$1,000	2.95	23.4	3.15	25.3	(2/)	(2/)	(2/)	(2/)	3.33	23.4
$1,001-$2,000	3.31	28.2	(2/)	(2/)	(2/)	(2/)	3.19	29.6	(2/)	(2/)
$2,001 and over	3.37	24.3	(2/)	(2/)	(2/)	(2/)	--	--	(2/)	(2/)
Type of framing:										
Steel	3.07	25.6	3.38	23.5	(2/)	(2/)	2.79	27.5	3.17	26.0
Concrete	2.84	24.9	--	--	3.36	25.0	2.24	26.0	2.99	22.8
Load bearing masonry	3.01	25.0	3.15	25.3	2.96	27.8	2.48	24.9	(2/)	(2/)
Wood	3.37	27.3	--	--	--	--	--	--	3.36	27.3

1/ Based on federally aided projects only.
2/ Insufficient data to warrant presentation.

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Table 10. Total Man-hour Requirements per $1,000 of School Construction Contract, by Selected Industry Classifications, 1959

Industry	Total	Primary 1/	Secondary 2/
Total	212	154	58
Construction	94	94	--
On-site	84	84	--
Off-site	10	10	--
Manufacturing	78	47	31
Nonmetallic minerals and products (excludes petroleum and coal)	15	13	2
Fabricated metal products	11	11	1
Iron and steel	10	1	9
Logging, sawmills, and wood products	7	5	2
Insulated wire and cable and electrical fixtures	4	4	1
Cutlery, tools, valves, and other hardware	3	2	2
Plumbing fixtures and heating equipment	3	3	(3/)
Iron and steel forgings and castings	3	2	1
Transportation	8	4	4
Railroads, trucking, and water transportation (exclude overseas)	8	4	4
Trade and services	20	9	11
Trade	13	8	5
Business services	4	1	3
Other	12	--	12

1/ Employment in the production (last manufacturing process) and distribution of the construction materials used.

2/ Employment in the industries serving the industries primarily affected and represents employment in all sectors of the economy.

3/ Less than 0.5 man-hour.

NOTE: Because of rounding, sums of individual items may not equal totals.

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Table 11. Average Number of Weeks Required for Construction of Schools, by Cost Group and Region, 1959

Cost group (in thousands)	United States	Northeast	North Central	South	West
All groups	53	68	55	47	51
$100 and under	31	--	41	25	(1/)
$101-$200	37	(1/)	50	37	29
$201-$300	43	(1/)	49	37	40
$301-$400	47	47	44	50	43
$401-$500	50	(1/)	59	43	51
$501-$1,000	56	60	61	53	51
$1,001-$2,000	76	83	73	76	72
$2,001 and over	84	98	(1/)	(1/)	86

1/ Insufficient data to warrant presentation.

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Table 12. Percent of On-site Employment for School Construction in Each Tenth of Total Construction Time, by Occupation, 1959 1/

Occupation	1st tenth	2d tenth	3d tenth	4th tenth	5th tenth	6th tenth	7th tenth	8th tenth	9th tenth	Last tenth
All occupations	3.9	8.5	9.5	12.2	15.2	15.5	13.9	11.3	7.4	2.6
General supervisors	9.4	11.7	11.1	11.9	12.0	11.7	10.3	9.9	7.6	4.5
Professional, technical, and clerical	10.8	17.1	14.2	13.1	11.5	11.0	8.3	7.3	3.9	2.9
Bricklayers	1.5	6.0	10.5	19.8	26.0	20.4	11.1	3.5	1.1	.1
Carpenters	4.0	9.3	9.3	11.4	13.0	14.6	14.5	13.2	8.3	2.4
Cement finishers	.8	8.4	14.4	15.0	13.9	15.2	12.6	11.2	7.5	.9
Electricians	.6	4.2	7.2	11.1	15.2	16.3	14.9	14.0	12.2	4.2
Glaziers	--	--	.5	2.0	12.5	24.7	23.7	21.2	11.9	3.7
Lathers	1.2	5.1	3.8	10.4	16.3	26.8	19.7	14.8	1.9	.1
Operating engineers	22.2	18.9	10.7	8.4	7.9	7.3	7.2	8.0	7.5	2.0
Ornamental-iron workers	.4	.6	3.6	10.5	19.2	24.5	22.2	9.8	6.2	3.0
Painters	(2/)	(2/)	.2	1.0	3.4	11.5	19.1	29.6	26.7	8.5
Plasterers	--	--	.4	4.2	11.5	23.8	29.0	25.5	5.4	.1
Plumbers	2.3	9.8	12.9	14.1	15.9	15.2	11.9	9.7	6.0	2.1
Roofers	(2/)	.9	1.3	11.8	25.7	25.6	22.8	7.4	3.6	.7
Sheet-metal workers	.3	1.0	1.9	7.1	13.7	19.8	22.8	18.0	11.8	3.7
Structural-iron workers	.7	7.3	19.2	31.3	18.0	11.3	7.6	3.0	1.4	.3
Terrazzo workers and tile setters	--	--	.1	.2	3.8	25.7	38.0	23.6	7.9	.6
Truckdrivers	13.2	13.5	6.0	7.2	7.8	7.4	11.7	14.5	12.6	5.9
Laborers	6.2	12.7	12.2	12.3	15.8	13.1	10.7	8.3	5.9	2.9
Helpers and tenders	1.1	2.9	5.9	12.5	16.6	21.2	21.3	13.7	4.3	.4
Watchmen	2.7	8.6	10.6	13.9	13.7	13.5	11.8	13.0	10.1	2.2
Other	5.9	11.4	10.1	8.0	8.9	10.2	11.5	14.8	14.0	5.2

1/ Based on data from federally aided schools only.
2/ Less than 0.05 percent.

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Table 13. Percent of On-site Man-hour Requirements for School Construction in Each Tenth of Total Construction Time, by Type of Contractor, 1959 1/

Type of contractor	1st tenth	2d tenth	3d tenth	4th tenth	5th tenth	6th tenth	7th tenth	8th tenth	9th tenth	Last tenth
All employment	3.9	8.5	9.5	12.2	15.2	15.5	13.9	11.3	7.4	2.6
General	5.2	11.0	11.3	13.6	15.0	14.8	11.9	8.9	6.0	2.4
Plumbing and heating	2.7	9.6	12.0	12.9	15.0	15.2	12.9	10.6	6.7	2.3
Electrical	.7	4.8	7.5	11.5	15.9	16.3	14.4	13.4	11.4	4.0
Masonry	1.7	6.3	9.7	20.0	33.5	18.9	7.7	1.9	.4	(2/)
Painting	--	(2/)	.3	.9	3.5	10.5	17.7	30.6	28.5	8.0
Plastering and lathing	--	(2/)	.4	3.9	10.7	26.8	29.9	23.4	4.7	(2/)
Structural and ornamental metal	.8	6.9	14.0	23.6	15.6	13.5	14.9	5.5	3.6	1.5
Roofing and sheet metal	.1	.4	1.6	8.7	23.1	22.5	25.4	12.2	4.8	1.1
Site preparation and excavation	26.5	21.6	12.4	6.8	2.7	6.2	3.4	8.9	8.0	3.4
Tile and terrazzo work	--	--	.1	.4	4.3	24.9	39.3	24.4	6.0	.6
All other types	2.7	5.5	5.5	5.3	10.4	13.0	17.6	20.7	14.2	5.1

1/ Based on data from federally aided projects only.
2/ Less than 0.05 percent.

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Table 14. Total Cost of Material Components for Each $1,000 of School Construction Contract, by Region, 1959

Selected products and product groups	United States	Northeast	North Central	South	West
All products	$554.60	$521.90	$574.70	$577.80	$550.90
Stone, clay, and glass products	$138.10	$132.00	$161.60	$150.40	$119.80
Cement, concrete, and gypsum products	76.40	72.60	84.30	84.50	68.60
Ready-mix concrete	38.80	37.80	34.80	41.00	40.20
Concrete block	13.20	16.20	17.10	15.70	6.40
Precast concrete products	7.40	(1/)	15.50	8.80	6.40
Gypsum products	6.80	7.60	6.80	8.40	5.10
Cement	6.10	4.70	4.60	6.00	8.30
Concrete pipe	3.20	3.90	4.30	3.70	1.50
Structural clay products	23.30	22.70	32.00	29.80	13.70
Brick and structural tile	15.50	15.25	24.70	19.00	7.60
Ceramic tile	6.60	5.60	6.40	9.80	5.10
Other stone, clay, and glass products	38.40	36.70	45.30	36.10	37.50
Fibre glass products	13.00	11.80	16.90	9.60	14.10
Window glass	6.30	6.00	7.30	6.40	6.00
Asphalt tile	5.20	3.00	6.30	6.20	5.60
Sand and gravel	3.80	2.90	5.10	3.40	4.00
Cut stone	3.30	5.40	4.30	2.50	1.70
Metal products (except plumbing and heating)	161.00	154.50	155.20	177.10	156.70
Fabricated structural metal products	117.70	120.20	112.30	135.10	105.20
Structural steel	29.60	27.80	35.80	30.10	27.00
Reinforcing bars and joists	23.40	26.50	21.60	25.40	20.50
Fabricated sheet-metal	20.70	17.10	17.10	21.60	25.10
Metal windows	16.10	17.10	10.70	25.30	11.40
Ornamental metal	11.40	12.90	9.00	15.70	8.20
Metal doors	8.40	14.10	9.00	7.20	4.40

See footnote at end of table.

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Table 14. Total Cost of Material Components for Each $1,000 of School Construction Contract, by Region, 1959--Continued

Selected products and product groups	United States	Northeast	North Central	South	West
Metal products (except plumbing and heating)--Con.					
Other fabricated metal products	$17.60	$13.70	$18.40	$16.20	$21.30
Builders' hardware	12.00	9.40	11.60	11.10	14.90
Other metal products	25.70	20.60	24.50	25.80	30.20
Copper products	10.70	7.80	12.40	12.20	10.90
Partitions, lockers, and shelves	7.80	10.20	3.90	9.90	6.40
Galvanized sheet-metal	5.60	2.10	7.00	2.50	9.90
Plumbing products	34.20	31.50	36.90	33.30	35.50
Steel and galvanized pipe	10.90	10.20	10.60	10.30	12.00
Plumbing fixtures	10.40	7.70	10.50	10.90	12.00
Cast-iron pipe	8.30	7.30	12.00	7.60	7.60
Heating and ventilating equipment	51.00	51.10	59.20	54.80	43.30
Radiators, convectors, and boilers	14.40	12.60	20.20	18.40	9.30
Temperature controls	12.80	12.70	16.80	12.30	10.90
Unit heaters and ventilators	12.10	11.70	14.70	12.60	10.60
Blowers, exhaust and ventilating fans	4.60	7.00	2.10	5.10	3.60
Warm air furnaces	3.20	3.60	2.60	4.20	2.50
Electrical equipment, fixtures, and wire	58.10	53.60	65.60	57.20	58.10
Lighting fixtures	19.20	15.90	20.90	22.30	18.30
Noncurrent carrying wiring devices	14.90	14.90	17.60	13.40	14.50
Switchboards and panelboards	6.50	6.20	9.00	5.50	6.00
Wire and cable	6.10	6.20	5.40	7.60	5.40
Program equipment	3.30	2.90	2.60	2.70	4.60
Lumber and lumber products	47.90	36.10	43.60	29.50	74.20
Millwork	23.00	22.20	21.50	19.00	27.50
Rough and dressed lumber	19.50	9.10	17.40	6.60	38.90
Flooring	3.00	3.10	4.10	2.80	2.50

See footnote at end of table.

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Table 14. Total Cost of Material Components for Each $1,000 of School Construction Contract, by Region, 1959--Continued

Selected products and product groups	United States	Northeast	North Central	South	West
Petroleum products	$11.20	$7.90	$9.30	$11.50	$14.70
Asphalt and tar pitches	4.00	3.30	4.10	4.50	4.20
Asphalt paving	3.00	1.40	(1/)	3.20	5.50
Asphalt felts	3.00	2.40	2.70	2.40	4.20
Fixed school equipment	16.10	19.90	13.20	18.30	13.00
Chalkboards and tackboards	4.10	3.90	3.70	4.70	4.00
Kitchen equipment	5.30	8.40	3.40	5.80	3.60
Paints and other chemical compounds	7.80	7.40	7.90	9.10	7.20
Paints	4.20	4.30	3.40	4.40	4.70
All other	29.10	27.80	22.20	36.50	28.40
Construction equipment	13.90	(1/)	(1/)	(1/)	(1/)
Insulating board	4.20	2.70	4.30	8.00	2.50

1/ Insufficient data to warrant presentation.

NOTE: Group totals include products not shown separately.

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APPENDIX A. Scope and Method of Survey

This study, which was designed to develop man-hour requirements associated with the construction of public elementary and secondary schools, utilized project data obtained from or relating to activity at the construction site, as well as information based on secondary data such as the Census of Manufactures.

Characteristics of the Universe and Selection of the Sample

A complete list of all schools started during the 1-year period selected for study was not available. It was, therefore, necessary to use several sources to obtain what is considered to be a representative, if not exhaustive, list of school projects from which to draw the sample of projects for survey purposes. Initially, the listing of schools consisted of two universes, one comprising schools constructed with Federal financial assistance and the other representing schools not so assisted. It was later established from the information derived from these two sources that in the analysis of the data continued separation of these groups of schools was not warranted. Furthermore, the combining of the samples, culminating in 128 projects, created a larger and more representative sample from which to measure various regional and other special characteristics.

Information on schools built without Federal assistance was gathered by field agents of the Bureau directly from public officials and private contractors involved in the construction activities, whereas that for federally aided projects was developed from data filed by the contractors with the Housing and Home Finance Agency.

Schools not Federally Aided. The sample of schools constructed without Federal assistance was selected from a list of about 1,500 new public schools started during the 12 months ending June 1959. These were stratified by four geographical regions (Northeast, South, North Central, and West) and by total construction contract cost. 9/ They were further sorted by type of school--elementary or secondary--and whether located in a metropolitan or nonmetropolitan area.

9/ The States included in each of the regions were as follows: 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.

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A sample of about 70 such school projects was determined to be adequate for this portion of the study. These projects, selected at random from the above groupings, were then tested to make sure that other characteristics for which information was desired were properly represented.

Federally Aided School Sample. A listing of approximately 200 federally aided schools completed during the year ending June 1959 was compiled from HHFA records. These projects were sorted into groups similar to those for schools built without Federal aid and a sample of about 70 schools was also chosen. This sample was also selected at random from the groups and tested to assure proper representation of other characteristics. Any obvious imbalance was corrected by project substitution.

Tests of the data originating from the field collections for the nonfederally aided schools and the HHFA sample indicated that any differences in results with regard to the construction-site labor requirements were small and did not warrant the continued separation of the data as though independent universes were involved. The combined sample, amounting to 128 projects, reflected some deletions during the course of the study. The sample was thus about 1 in 14 of the known universe.

Man-Hour Estimates. The customary presentation of employment data for construction projects includes estimates for on-site and off-site employment. Such a presentation is followed by this study. In addition, however, there is an economic distinction which can be made in analyzing the man-hour requirements for construction. The basic grouping in this instance would be the primary and secondary labor effects of construction expenditures, with the primary sector including the on-site employment plus the off-site employment directly related to activity at the site.

Primary man-hour requirements, for purposes of this report, include, in addition to all on-site labor, the construction contractors' office employment, the labor required in those manufacturing industries which fabricate the construction materials used on the site--that is, the "last stage of manufacturing" companies, plus all trade, distribution, and services involved in placing the construction materials at the site. Secondary employment includes all other labor requirements necessary to produce and transport the raw materials, and semifinished products to the factories which finally produce the items used at the site.

With respect to the derivation of man-hour requirements, data for on-site hours were generally collected from payroll data. All other labor requirements discussed below, whether considered primary or secondary, were established by use of secondary data.

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Collection of On-Site Man-Hour Data

Although the nature of the construction labor and materials requirements data sought was similar for both the nonfederally aided and HHFA school projects, the sources for the data differed, as indicated previously. In the case of the non-HHFA schools, those financed entirely by the various levels of local governments, data were obtained by field representatives from school boards, architects, contractors, and other direct participants in these projects. For the HHFA school projects, data were made available from HHFA files. Access to these files made possible the collection of some additional detail for the federally aided projects. This included information on wage relationships, timing of construction operations, and requirements by type of contractor.

Federal legislation which set up the program for granting Federal assistance for the construction of schools in federally impacted areas (the School Survey and Construction Act of 1950), requires each prime contractor and subcontractor on a federally aided school project to submit to the HHFA, the administering agency, a copy of each weekly payroll showing (with other information) the daily and weekly hours worked, the gross weekly earnings and the occupation of each mechanic and laborer on the particular project. Through the cooperation of HHFA, copies of the payrolls for the federally aided school projects in the sample were obtained from the regional HHFA offices, along with lists of the contractors on the jobs. These payrolls provided the data for on-site man-hour requirements, as well as wages for all hourly rated workers on the projects. In a few cases, the requested payroll files were not available or were inadequate as data sources. For these situations, alternate projects were substituted.

In the nonfederally aided schools, the data for on-site labor requirements were generally derived from payroll or labor cost records, or daily work force reports. Only summary man-hour results, by occupation, were required. For a small number of contractors, whose records could not be used to isolate the data for specific school projects, estimated hours and materials costs were used.

Estimating Off-Site Man-Hour Data

The procedures used in estimating the employment generated by new school construction did not include all such employment. The technique used covers only the employment generated by direct purchases of materials and supplies and implicit in the depreciation of construction equipment. The following areas of employment related to generation of construction activity were not covered: (1) Architectural, surveying, estimating, and other planning employment; (2) employment generated by purchases of movable school equipment; (3) the "multiplier" effect of the respending of wages and profits; and (4) the construction and equipment of new production facilities, if needed to supply construction materials.

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From contractors and subcontractors cooperating in the school construction study, a price list was obtained of the value of each type of material used in schools. These material listings were classified into categories consistent with 5-digit Census of Manufactures product groups. For each of these product groups, the average amount used per $1,000 of contract construction was determined. Once the average use was calculated, each figure was reduced by a ratio representing the difference between valuation by the purchaser and valuation by the producer. 10/ Since all data reported by the contractors were in purchasers' value, the reduction to producers' value made it consistent with data published on these various components. These figures on average dollar value, stated in producer's value of each construction material per $1,000 of contract value were necessary for each of the succeeding steps.

Primary Distribution Industries Employment

The man-hours in the distribution industries (trade, transportation, warehousing, freight forwarding, etc.) at primary level with respect to construction activity were determined by using the value represented by the difference between producer and purchaser value for each construction material. This difference was summed and allotted to each of the distribution sectors by a ratio representing the total portion of construction activity attributable to each of these sectors in relation to their total activity. 11/ After allotting the value, the man-hours for each distribution sector were determined by multiplying the value allotted to this sector by the man-hours needed to produce $1,000 of product in the distribution sectors.

Primary Manufacturing Employment

Primary employment in manufacturing was considered to be that required to produce the items in the construction bill of materials in their final stage of fabrication. In this stage, the man-hours resulting from school construction were found by using the average dollar value of each construction component and applying this to a ratio of man-hours to $1,000 of production. 12/ Whenever the average dollar value of construction components used was stated in prices different from the year of the man-hour ratios, an adjustment was made for subsequent price and productivity changes in the man-hour ratios.

10/ The ratio used for this reduction was the purchaser to producer ratio for these components in new school construction, as reported in the 1947 Interindustry Input-Output Analysis.

11/ In such areas as retail trade, it was necessary to make a product-by-product evaluation, as many of the construction items are bought directly from wholesalers or manufacturers.

12/ This ratio was established by using 1958 Census of Manufactures specialization tables for plants with 90 percent or greater specialization.

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Secondary Employment in All Industries

Secondary employment is the production and employment necessary from intermediate industries to produce an item in its final form, i.e., the coke, iron ore, coal, etc., necessary to produce structural steel shapes. It also includes all related service and transportation necessary between origin of raw materials and intermediate manufacturing processes.

To calculate all of the man-hours back of each construction product, it was necessary to determine the contribution from each of the sectors of the economy to the construction bill of materials. To obtain these contributions from each sector, an interindustry inverse matrix was used. The matrix was calculated by the Bureau of Labor Statistics for the United States economy in 1947. 13/ Since this matrix is stated in 1947 prices, all prices of the construction components were deflated to 1947 and then grouped into industry classifications which were consistent with the interindustry study's 57-sector aggregation. This gave the amount of construction goods stated in 1947 prices, for each interindustry sector. Each of these figures was in turn multiplied by the corresponding coefficients of the inverse matrix. This procedure gave the contribution necessary from each of the sectors to produce the specified construction item used. 14/ These products which were stated in 1947 prices were then inflated to 1958 prices (the year consistent with the bill of materials).

The sector contributions to each of the separate construction items were totaled to obtain the total contributions from each sector of the economy to the construction bill of materials. To translate the dollars of product contributed by each sector into the employment required by this sector, a ratio of man-hours to $1,000 of production was used. These ratios were developed for each of the 57 interindustry sectors. 15/

From each stage (primary distribution, primary manufacturing and secondary), a man-hour figure per $1,000 of school construction contract was obtained When these were summed with the direct or on-site man-hours, the total employment effect, within the definition used by the study, was determined. For school construction, it was necessary to adjust the primary and secondary employment estimates to reflect the shifts in productivity between 1958 and 1959.

13/ For a further description, see W. Duane Evans and Marvin Hoffenberg, the Interindustry Relations Study for 1947, Review of Economics and Statistics, Vol. XXXIV (1952), Harvard University Press.

14/ The product obtained by the inverse matrix contained duplications from fictitious transfers in of secondary products. The unit man-hour ratios, therefore, had to contain this same double counting or the product had to be reduced by the amount of double counting. In this case, the products were reduced by ratios developed by Sidney Jaffe in unpublished documents.

15/ Both the price and unit man-hour ratios were actually calculated on a 450-order aggregation and summed to the 57-order aggregation.

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APPENDIX B. Data Collection Schedule

BLS No. 2652(a)

U. S. DEPARTMENT OF LABOR
Bureau of Labor Statistics
Washington 25, D. C.

Budget Bureau 44-5926
Approval Expires 12/31/60

LABOR REQUIREMENTS FOR SCHOOL CONSTRUCTION

The data submitted on this schedule will be seen only by sworn employees of the Bureau of Labor Statistics. The data will not be released in any form which permits identification with any specific company.

I Identification of Project (Please check all previous entries and correct those in error)

A. Name of School _____

Type: Elementary ☐ Secondary (Including Jr. High) ☐

B. Location: City _____ County _____ State _____

C. Construction Started: _____ (date) Completed: (actual or estimated) _____ (date)

D. Agency Awarding Contract: Name _____

Address _____

E. Total Amount of Construction Contracts on this Project: $ _____

1. Does amount include any Federal-aid funds? Yes ☐ No ☐

F. General or Principal Prime Contractor: Name _____
(Strike out one)

Address _____

G. Architect: Name _____

Address _____
(street) (city)

II Characteristics

A. Number of Stories of main part of structure (above grade) _____

1. Basement: Full ☐ Partial ☐ None ☐

B. Square Feet of floor area (gross) _____

C. Frame: Steel ☐ Reinforced Concrete ☐ Load-bearing Masonry ☐

Other (specify) _____

D. Principal Materials Used for:

1. Exterior Walls. Masonry ☐ Curtain Wall ☐ Other (specify) _____

2. Floors. Specify base and covering _____

3. Roof. Specify deck and covering _____

E. Number of Classrooms: General _____

Special: Shops _____ Laboratories _____

Other _____ Specify _____

F. Special Purpose Rooms: (check) Cafeteria ☐ Auditorium ☐ All Purpose Room ☐

Kitchen ☐ Gymnasium ☐ Health Unit ☐ Administration Offices ☐

Library ☐ Others (specify) _____

G. Data Furnished by: _____ (name) _____ (position)

H. Agent _____ (name) _____ (date)

Code Box (Leave Blank)

Region	Serial	Met.	Type	Amount	Code	Floor Area	Code	No. of Classrms.	Code	Weight	Stories	Bsmt.	Frame	Exter.	Appr.	Source	Progrm.		
1	2-3	4	5	6-9	10	11-13	14	15-16	17	18-19	20	21	22-23	24	25	26	27	28	

(Use reverse side for notes)

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2652(b)

III Construction Contracts Project No. [ ]

A. Enter data for general or principal prime contract as reported in 1-F, and for every subcontract thereto. Repeat procedure for additional prime construction contracts, if any.

Contractor's name	Contractor's address	Operations performed	Approx. value of contract	Includes (check)		Construction dates (estimate or actual)	
				Material	Labor	Starting	Completion
General or principal prime contract							
Subcontracts of above							

B. Check any of the following operations included in contracts described above:

1. Site preparation ☐ 2. Paving ☐ 3. Landscaping ☐

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2652(c)

IV Labor and Materials Requirements Project No. [ ]

Prime	Sub	Sub-sub	Type of work
29	30–31	32	33–35

A. Name of (sub) contractor for whom data are reported _____

B. Operations performed by this (sub) contractor _____

C. 1. Work started _____ (date) 2. Completed (actual or estimated) _____ (date)

D. Labor required for this (sub) contract, by occupation

1. Period covered by data reported below: From _____ (date) To _____ (date)

2. Number of man-hours/days on this (sub) contract in period covered:

Occupations	Skill unspecified		Journeymen		Apprentices	
	Code 36–38	man-hours/days 39–43	Code 36–38	man-hours/days 39–43	Code 36–38	man-hours/days 39–43
Asbestos workers	001		301		601	
Bricklayers, stone masons	002		302		602	
Carpenters	003		303		603	
Cement finishers	004		304		604	
Electricians	005		305		605	
Glaziers	006		306		606	
Lathers	007		307		607	
Operating engineers	008		308		608	
Ornamental iron workers	009		309		609	
Painters	010		310		610	
Plasterers	011		311		611	
Plumbers and pipe fitters	012		312		612	
Rodmen	013		313		613	
Roofers	014		314		614	
Sheet metal workers	015		315		615	
Structural iron workers	016		316		616	
Terrazzo workers	017		317		617	
Tile setters	018		318		618	
Other building trades (specify)	019		319		619	
_____						
_____						
Superintendents and general formen	130		X	XXX	X	XXX
Professional and technical employees	131		X	XXX	X	XXX
Helpers and tenders (all trades)	500		X	XXX	X	XXX
Clerical employees	032		X	XXX	X	XXX
Truckdrivers	734		X	XXX	X	XXX
Laborers	835		X	XXX	X	XXX
Custodial workers	933		X	XXX	X	XXX
All others	039		X	XXX	X	XXX

3. If above data are for man-days worked, estimate average number of hours worked per man-day during the reported period [ ].

4. Source of above data: Payrolls [ ] Daily work force reports [ ]
Welfare or insurance reports [ ] Other [ ] _____ (specify)

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2652(d)

Project No. [ ]

E. Name of (Sub) contractor _____

F. Address of (Sub) contractor _____

G. Materials required for this (sub) contract

1. Period covered by data reported below: From _____ (date) To _____ (date)

2. Quantities and costs of materials, supplies, and school equipment required by the (sub) contract:

Item	Quantity	Unit of measure	Approx. cost

3. Source of above data: Material "take-off" sheets ☐ Cost accounting records ☐ Materials invoices ☐ Ledger ☐
Other ☐ _____ (specify)

4. Rental cost of construction machinery and equipment, or equivalent value $_____.
(Enter actual rental cost, amount of depreciation charged to this contract, or estimated amount reasonably chargeable to this contract.)

H. Data furnished by _____ (name) _____ (position)

I. Agent _____ (name) _____ (date)

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