

## CHAPTER III.—GENERAL SURVEY OF THE CONSTRUCTION INDUSTRY

Although the basic statistics of the construction industry presented in this report were collected in connection with the Fifteenth Decennial Census and were based upon business operations for the year 1929, they may be considered to give an approximate horizontal cross section of the industry at any period of normal activity. This assertion is based upon the fact that the year 1929 was an average year in this industry, standing neither at the height of the construction boom, which was reached between 1926 and 1928 in different parts of the country, nor at the depth of the depression on either side. The level of construction activity in the United States during 1929 was very close to that of 1925 and may, therefore, be taken to represent the activity of an average construction year.

Since changes take place very slowly in the fundamental relationships in an established industry such as this, the analytical presentation of facts revealed by statistics relating to an average or typical year, may be taken to apply with equal accuracy to any normal construction year within a reasonable period of time. As a matter of fact, the principal utility of the results of this first census of the construction industry lies in this field, because there are no comparable figures for previous years, nor, as yet, for later years, which might serve as a basis for determining trends which depend entirely upon the time factor.

In the following pages, accordingly, some of the most significant relationships which obtain in the construction industry at a period of normal activity are brought out, with the idea that these examples may suggest to the reader the direct application of these statistics in the solution of his own problems. For the contractor the points of interest are manifold, because the aspects of his own position in the industrial world are many. He is, of course, first of all a constructor, but in a minor degree he is also an estimator, a bidder, a financier of construction projects, an employer of labor, and a purchaser of materials. Every one of these aspects of his activity are covered in the reports of the census of the construction industry for each State and for all cities of over 100,000 population. Much material is also included in these reports which may be used to great advantage by the manufacturer or distributor of construction materials and by those interested in the many problems affecting construction labor.

### OVERLAPPING CLASSIFICATIONS

In connection with the following discussion certain limitations of these statistics, already pointed out in the first chapter, should be remembered.

In the tables for the United States in this volume, as well as in those for the individual States, the allocation of construction business to any designated area is determined by the post office address of the reporting establishment. Consequently, these figures can

not be taken to signify the amount of construction which was done in the designated area during the year. They represent simply the value of construction business of establishments which had their business offices in that locality during 1929. In Tables XXVI and XXVII of this chapter, however, and in Tables 3 and 4 of Chapter V of the United States summary and in each State report, is shown the actual location of the construction executed by reporting establishments in the home city, in the home State, and elsewhere.

Just as there is an unavoidable overlapping of reported construction business among the States, so is there a certain degree of overlapping among the specified classifications assigned to individual establishments. This is due to the necessity of classifying each schedule in one and only one group, although the reporting establishment may have engaged in more than one type of construction work. This was necessary because the detail was reported for each establishment as an operating unit, and was not shown separately for each of the various classes of construction work done. Thus, an establishment which engaged in building as well as bridge construction was classified in one group or the other according to the greater value reported for that type of work. As already explained in Chapter I, however, it seems likely that in the long run the additions to and subtractions from a given group will tend to balance one another. Nevertheless, it should be remembered that the figures for any given classification of establishments represent a summary of data for establishments engaged primarily but not solely in that line of work.

There is only one exception to this rule. It was found that a number of establishments in the building group were engaged exclusively in a certain type of building. In order to make a special analysis of these groups an individual code was given to each with the result that the building group in the tabulations is subdivided into the following classes: Building not specialized, commercial building only, manufacturing building only, and residential building only. The last three of these are the only rigidly exclusive classes of establishments in the tabulations, but even they have their limitations in that they do not include all reported construction of the designated type, a considerable amount of such work being included in the reports of the first group of building contractors who did not make a specialty of any one type.

### TOTAL CONSTRUCTION DURING 1929

The data presented in detail in the principal tabulations of the census publications on the construction industry are derived primarily from the reports of establishments which had a business of \$25,000 or more during 1929. General information is also given for establishments which reported less than that

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amount of business during the year, notably in Table VII of this chapter, in Table XXX of Chapter IV, and in Tables 12 and 13 of Chapter V of this report.

The utility of this line of demarcation, which was set up in the construction industry for census purposes, has been called in question on various occasions. It has been claimed by some that the minimum business of \$25,000, for which complete reports were required for this census, was too high, especially for the subcontractor group, and by others that complete reports should have been required of all contractors regardless of the size of business.

From the point of view of numbers only, these objections were justified, since the count of establishments from which reports were received shows that 21 per cent of the total number had a business of more than \$25,000, while 79 per cent had a smaller business. But it is not so much the number of establishments from which reports were received as the aggregate volume of business which they reported which should be taken as the standard of judgment in this case. From this standpoint, then, the contractors with the larger business, although they represented only a little more than one-fifth of the total in point of numbers, reported 86 per cent of the total construction business of all establishments, leaving only 14 per cent of that business to the credit of four-fifths of the total number.

It is true, also, that only 16 per cent of all reporting subcontractors had more than a \$25,000 business during the year, but these few reported 74 per cent of the total business of the entire group. These figures seem to justify the original opinion of those who selected the \$25,000 minimum as a basis for reports for this census, since, with the assistance of estimates for the group of smaller establishments, approximately the same totals have been obtained, at an incalculable saving in time, labor, and expense which would have been involved in auditing and tabulating five times as many individual reports.

Thus, there are presented in the published reports of the construction census two groups of statistics, the first relating to establishments which had a business of more than \$25,000 during the year, based upon individual detailed reports, and the second relating to establishments which had a smaller business, for which estimates have been made upon the basis of comprehensive sampling found in the more or less complete reports of an average of about 20 per cent of all such active reporting establishments throughout the United States. A general summary of these two sets of figures is presented in Table VII, and the totals for the respective States are also shown in Table XXX of Chapter IV.

TABLE VII.—VALUE OF CONSTRUCTION BUSINESS, PRINCIPAL ITEMS OF EXPENDITURE, AND WORK DONE, INCLUDING ESTIMATES FOR ESTABLISHMENTS REPORTING A BUSINESS OF LESS THAN \$25,000

ITEM	All reporting establishments		Establishments which had a business of—			
	Amount	Per cent of total business	Over \$25,000 during 1929		Less than \$25,000 during 1929	
			Amount	Per cent of total business	Amount <sup>1</sup>	Per cent of total business
Number of establishments reporting.....	144,396	-----	30,597	-----	113,799	-----
Value of all construction business handled.....	\$7,285,720,244	100.0	\$6,250,266,665	100.0	\$1,035,453,579	100.0
Value of business under general contract or directly for owner.....	5,778,453,565	79.3	4,911,765,910	78.6	866,687,655	83.7
Value of business under subcontract.....	1,507,266,679	20.7	1,338,500,755	21.4	168,765,924	16.3
Principal items of expenditure.....	5,753,468,523	79.0	4,978,631,383	79.7	774,837,140	74.8
Subcontract work let.....	1,507,266,679	20.7	1,455,494,000	23.3	51,772,679	5.0
Wages paid.....	1,798,698,266	24.3	1,487,541,001	23.5	301,066,365	29.1
Cost of materials.....	2,477,593,588	34.0	2,055,595,482	32.9	421,998,106	40.8
Value of work done by own force <sup>2</sup> .....	5,778,453,565	79.3	4,794,772,665	76.7	983,680,900	95.0

<sup>1</sup> Values estimated from sampling of reports of an average of about 20 per cent of active reporting establishments.

<sup>2</sup> Obtained by subtracting the value of subcontract work let from the value of all construction business handled.

During the year 1929, 144,396 reporting construction establishments of all sizes throughout the United States handled an aggregate business valued at more than \$7,285,000,000. (Table VII). Of this total, something over \$1,507,000,000 represented the duplication involved in the reports of contractors who worked under subcontract for others, while the remaining \$5,778,000,000 was the measure of the actual net value of construction work done, indicated in the various tabulations as the value of business handled under general contract or directly for the owner, or

as the value of work done by the reporting contractor's own construction forces.

Against the total value of all construction business handled by all reporting establishments, the cost of the three principal items of expenditure, subcontract work let, wages paid, and cost of materials, amounted to \$5,753,000,000, or 79 per cent of the value of business, leaving only 21 per cent for all other expenses (presented in detail in Tables IX and X of this chapter, in Table XXXI of Chapter IV, and in standard Table 8 of all census reports of the construction industry) and profit.

About 21 per cent of the total business of all reporting establishments was sublet to others, leaving a balance of almost 79 per cent, or \$5,778,000,000, as the value of work done by reporting establishments themselves. The combined cost of wages and materials entering into the actual construction work was \$4,246,000,000, 42 per cent of this amount going to labor and 58 per cent for materials.

CONSTRUCTION AND ITS COST

According to the general method of doing business there are three principal groups or classifications of

reporting construction establishments: Operative builders, general contractors, and subcontractors. The census meaning of each term has been adequately explained in Chapter I. Of the 30,597 construction establishments which had a business of at least \$25,000 during 1929, 750 were classed as operative builders, 14,766 as general contractors, and 15,081 as subcontractors. For purposes of general comparison, the figures for these major groups are especially significant. In Table VIII are shown the relationships which obtain among the principal items reported on the schedule for these respective groups and for all classes of establishments combined.

TABLE VIII.—VALUE OF CONSTRUCTION BUSINESS, PRINCIPAL ITEMS OF EXPENDITURE, AND WORK DONE BY PRINCIPAL GROUPS OF ESTABLISHMENTS

ITEM	VALUE (IN \$1,000) OF PRINCIPAL ITEMS REPORTED BY—				PER CENT OF ALL CLASSES			PER CENT OF TOTAL BUSINESS			
	All classes of establishments	Operative builders	General contractors	Subcontractors	Operative builders	General contractors	Subcontractors	All classes of establishments	Operative builders	General contractors	Subcontractors
Number of establishments reporting.....	30,597	750	14,766	15,081	2.5	48.3	49.2				
Value of all construction business handled.....	\$6,250,267	\$163,524	\$4,217,367	\$1,879,376	2.5	67.5	30.0	100.0	100.0	100.0	100.0
Value of business under general contract or directly for owner.....	4,911,766	153,519	4,171,886	586,861	3.1	84.9	11.9	78.6	100.0	98.9	31.2
Value of business under subcontract.....	1,338,501	5	45,480	1,293,015	( <sup>1</sup> )	3.4	96.6	21.4	( <sup>1</sup> )	1.1	68.8
Principal items of expenditure.....	4,978,631	138,890	3,393,677	1,446,064	2.8	68.2	20.0	79.7	90.5	80.5	76.0
Subcontract work let.....	1,455,494	103,142	1,290,373	61,474	7.1	88.7	4.2	23.3	67.2	30.6	3.3
Wages paid.....	1,467,542	13,146	914,112	540,284	.9	62.3	36.8	23.5	8.6	21.7	28.7
Cost of materials.....	2,055,595	22,602	1,188,687	844,306	1.1	57.8	41.1	32.9	14.7	28.2	44.9
Value of work done by own force <sup>2</sup> .....	4,794,773	50,382	2,926,489	1,817,902	1.1	61.0	37.9	76.7	32.8	60.4	96.7

<sup>1</sup> Less than one-tenth of 1 per cent.

<sup>2</sup> Obtained by subtracting the value of subcontract work let from the value of all construction business handled.

All classes of establishments which had a business of over \$25,000 reported a volume of construction business for the entire United States aggregating \$6,250,267,000 during 1929. Of this enormous business \$4,370,891,000 was handled by general contractors and operative builders combined, and \$1,879,376,000 by subcontractors. Of the aggregate business, \$4,911,766,000 was reported as handled under general contract or directly for the owner, and \$1,338,501,000 under subcontract. It is important to have in mind the exact distinction between these two pairs of confusingly similar terms. The first two relate to the classes of establishments by which the business was reported, shown in parallel columns in the table, while the second pair indicate the method of handling that business, as shown in the third and fourth lines.

The value of construction business handled under general contract or directly for the owner represents approximately the actual amount of construction work, since business handled under subcontract presupposes the intervention of the general contractor in the transaction. It is sufficiently accurate for general purposes to use this approximation for the United States, or even for individual States and the three

major groups of contractors, but for individual classes of contractors the only accurate method of determining the actual amount of construction work done is to deduct the value of subcontract work let from the total value of construction business consisting of all business handled under general contract or directly for the owner, as well as under subcontract by establishments of that class. The difference between the two results for the larger establishments of the United States as a whole may be seen by comparing the third and last items in the first column of Table VIII, while in Table VII in which estimates for the establishments of the smaller business group are included, the exact balance of these two items is shown. In order to keep all figures upon a comparable basis, the method of subtracting the value of subcontract work let from total business is used throughout the reports for the construction industry.

The figures cited above show that the business of general contractors was \$540,875,000 less than the value of business reported as done under general contract or directly for the owner, which indicates that subcontractors engaged in specialized lines of work did about that amount of business directly for owners,

over and above any amount which general contractors may have done under subcontract. The figures in the third and fourth lines of the table show that this was actually the case, and that subcontractors did \$586,361,000 worth of business directly for owners, whereas general contractors and operative builders together did a business under subcontract valued at only \$45,485,000.

**Distribution of the construction dollar.**—The reduction of such large amounts to a percentage basis is the simplest method of making them understandable. In the analysis of construction statistics this method has upon numerous occasions been referred to as the "distribution of the construction dollar" which still further simplifies the idea. Thus, referring to the percentage figures in Table VIII it may be observed that, of each dollar which changed hands in connection with all classes of construction business, 2½ cents went to the operative builder, 67½ cents to the general contractor and 30 cents to the subcontractor. Of each dollar expended by owners, however, the operative builder received 3 cents, the general contractor 85 cents and the subcontractor 12 cents, whereas, of each dollar expended by original contractors for subcontract work 3 cents was paid to general contractors and 97 cents to specialized subcontractors, with a negligible amount paid to operative builders.

From another angle the figures in the second percentage section of the table show that of the dollar used to pay for all construction business 79 cents went for business handled under general contract or directly for the owner, while 21 cents was paid by the original contractor for subcontract work let to other contractors. On the average, this is very close to the aggregate amount for this group, which appears in the figures for the item "Subcontract work let" lower down in the table, for which 23 cents is shown as the part of each dollar paid by all classes of establishments for this item. The actual difference of \$116,993,000 between the value of subcontract work let and the value of business handled under subcontract by all classes of reporting establishments of the larger business group, indicates that this amount of subcontract work was done for them by contractors whose business was less than \$25,000 during the year. In passing, it should be mentioned that all contractors of the smaller business group had an estimated aggregate business in excess of a billion dollars, as shown in Table VII of this chapter, and in Table XXX of Chapter IV, the amount just mentioned being only a small part of that total.

Table XXX of Chapter IV presents, for the respective States, a further analysis of the principal items for all classes of establishments which had more than a \$25,000 business during 1929, together with the number of reporting establishments which had less than that amount of business, and estimates of the approximate amount of their aggregate business. In the last

column of the table, the 1930 population figures are also shown for each area to facilitate the working of per capita figures if such are desired.

**Principal items of expenditure.**—In making an analysis of the aggregate construction business reported by numerous individual members of the construction industry, it was necessary to treat this "value of subcontract work let" as one of the principal items of expenditure which, in a certain sense, it actually is. But, from another point of view, it is primarily a deduction from the total business for which the general contractor holds the contract, leaving a certain remaining amount of work to be done by the forces of the original contracting establishment. As indicated above, this remainder, designated in the last line of the table as the "value of work done by own force," is the amount which is used throughout these reports to represent the value of actual construction work done. In speaking of "business" the aggregate turnover of all individual reporting establishments is meant, whereas "construction work done" stands for the value of actual, tangible construction.

The principal items of expenditure listed in this table shared in the construction dollar in the following proportions: Subcontract work let, 23 cents, wages paid, 24 cents, and cost of materials delivered on the job, 33 cents. The balance of 20 cents remained to cover all other items of expenditure and profits. In the last three columns of the table comparable ratios are shown for the three principal groups of establishments. In these it is interesting to note that the operative builder paid two-thirds of his dollar for subcontract work let, whereas the general contractor paid a little less than one-third, and the subcontractor only 3 cents. These figures also show that relatively more was paid by each group for materials than for wages. A further analysis of all expenditures of these three groups of establishments is presented in Table IX.

**Distribution of all expenditures.**—This table shows that for all classes of reporting establishments total expenditures for the conduct of a construction business during 1929 amounted to 94.3 per cent of total receipts. This leaves an average margin of profit on the year's business of less than 6 per cent. In the individual reports which went to make up this average there were some which showed a larger margin of profit, while others showed less, and still others reported an actual loss of occasionally as much as 10 per cent and sometimes even more. The latter condition was found most frequently in the case of establishments equipped with heavy construction machinery and an engineering and office force sufficient to handle an annual business many times as large as that which they actually had in 1929. In such a situation, the overhead and depreciation could easily throw such an establishment "into the red."

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TABLE IX.—PRINCIPAL AND OTHER EXPENDITURES BY GROUPS OF ESTABLISHMENTS

ITEM	ESTIMATED TOTAL FOR ALL ESTABLISHMENTS		ESTABLISHMENTS REPORTING EXPENDITURES							
			All classes		Operative builders		General contractors		Subcontractors	
			Amount <sup>1</sup>	Per cent of total expenditures	Amount	Per cent of total expenditures	Amount	Per cent of total expenditures	Amount	Per cent of total expenditures
Number of establishments reporting.....	30,597		26,671		594		12,566		13,521	
Value of construction business.....	\$6,250,266,665		\$5,649,822,607		\$130,802,297		\$3,703,514,888		\$1,715,505,422	
Total expenditures, value.....	5,845,175,404	100.0	5,233,254,060	100.0	128,431,851	100.0	3,501,047,552	100.0	1,603,774,557	100.0
Per cent of construction business.....	93.5		94.3		98.2		94.5		93.5	
<b>Principal items of expenditure.....</b>	<b>\$4,978,631,383</b>	<b>85.2</b>	<b>\$4,457,426,987</b>	<b>85.2</b>	<b>\$117,874,775</b>	<b>91.8</b>	<b>\$3,014,717,572</b>	<b>86.1</b>	<b>\$1,324,834,640</b>	<b>82.6</b>
Subcontract work let.....	1,455,494,000	24.9	1,312,113,000	25.1	88,924,000	49.2	1,164,167,000	33.2	59,022,000	3.7
Wages paid.....	1,467,641,901	25.1	1,310,634,188	25.0	10,804,349	8.5	803,886,336	23.0	496,883,503	30.9
Cost of materials.....	2,055,595,482	35.2	1,834,670,799	35.1	18,086,428	14.1	1,046,664,230	29.9	769,929,137	48.0
<b>Other items of expenditure.....</b>	<b>866,544,021</b>	<b>14.8</b>	<b>775,827,073</b>	<b>14.8</b>	<b>10,557,176</b>	<b>8.2</b>	<b>486,329,980</b>	<b>13.9</b>	<b>278,939,917</b>	<b>17.4</b>
Total salaries.....	348,600,743	6.0	312,106,853	6.0	3,695,960	2.9	184,965,337	5.3	123,445,056	7.7
Proprietors and firm members.....	35,933,857	.6	32,172,000	.6	343,369	.3	13,481,435	.4	18,347,202	1.1
Salaries employees.....	312,666,886	5.3	279,934,347	5.3	3,352,591	2.6	171,483,902	4.9	105,097,854	6.6
Rent for equipment.....	25,380,060	.4	22,723,065	.4	22,253	(.?)	17,951,998	.5	4,748,814	.3
Rent for offices, warehouses, etc.....	26,992,692	.5	24,166,879	.5	286,234	.2	11,406,949	.3	12,473,696	.8
Interest.....	30,962,278	.5	27,720,890	.5	2,945,157	2.3	18,297,878	.5	6,477,855	.4
Contract bond premiums.....	20,674,435	.4	18,510,065	.4	51,311	(.?)	16,811,075	.5	1,647,679	.1
Compensation and liability insurance premiums.....	54,023,037	.9	48,367,462	.9	445,787	.3	33,759,264	1.0	14,162,411	.9
All other overhead (including depreciation on equipment).....	359,910,776	6.2	322,232,359	6.2	3,110,474	2.4	203,137,470	5.8	115,984,406	7.2

<sup>1</sup> A considerable number of establishments failed to report a complete distribution of their minor expenditures, but the 3 principal items were reported by all establishments. The figures for the other items in this column have been estimated upon the assumption that the relative distribution for minor items was the same as for the combined total for the 3 major items.

<sup>2</sup> Less than one-tenth of 1 per cent.

Among the major groups of establishments, the figures for operative builders show an indicated profit of less than 2 per cent. This ratio, however, does not truly represent the situation of the operative builder. As a general rule, he was not in the construction business to make a profit, and the contract value which he put upon his buildings was approximately what it actually cost him to build them. He had, as it were, two edges to his sword, and the one which cut profits out of the sale or actual operation of his buildings was the sharper of the two. If the volume of construction reported by operative builders had represented a larger proportion of the total reported by all classes of establishments, it might seriously have affected the ratios among items into which it enters, but, since it constitutes less than 3 per cent of all business, the effect is negligible.

General contractors as a class showed total expenditures amounting to 94.5 per cent of the year's business and subcontractors, 93.5 per cent. The slight difference in indicated profits for these two groups may be accounted for by the fact that general contractors sublet a considerable part of their work, on which an additional margin of profit was naturally exacted by the subcontractor.

The three principal items of expenditure consumed 85 cents of every dollar spent by all classes of establishments for construction costs, subdivided as follows: Subcontract work let, 25 cents; wages paid, 25 cents; and cost of materials, 35 cents. Operative

builders paid out 92 cents of each dollar for these items, 69 cents for subcontract work let, 9 cents for wages, and 14 cents for materials. For general contractors the parallel distribution of a total of 86 cents was, subcontract work let, 33 cents; wages paid, 23 cents; and cost of materials, 30 cents; while for subcontractors 83 cents was distributed as follows: Subcontract work let, 4 cents; wages paid, 31 cents; and cost of materials, 48 cents.

For all classes of establishments "other items of expenditure" consumed about 15 cents of each dollar, for operative builders, 8 cents; for general contractors, 14 cents; and for subcontractors, 17 cents. The chief saving of operative builders appears in the salary and overhead items for each of which they paid out less than 3 cents, whereas general contractors paid between 5 and 6 cents and subcontractors more than 7 cents for each of these items. Operative builders also paid comparatively little for rental of equipment and contract bond premiums. The interest item for this class, on the other hand, is conspicuously high in this comparison, which indicates that operative builders as a class were financially less independent than either of the other groups.

It is interesting to note the slight variation from the average for the United States which is shown for the respective geographic divisions in the distribution of costs between the two major expenditure groups designated as principal and other items of expenditure. (Table X.) The greatest proportional expenditure



generalization. The distribution of expenditures is affected by many factors, of which local topography, location with regard to markets, relative weight in the total business of various kinds of construction requiring heavy equipment, and the personal factor of efficiency in management, are but a few. It is, therefore, extremely dangerous to make any generalizations from these figures without a careful analysis of all the component factors.

In the East South Central division the smallest proportion of the total was expended for the three principal cost items. This was one of the three divisions which showed the smallest proportion of subcontract work let. Wages were also comparatively low, but the cost of materials, amounting to 40.8 per cent, was higher than in any other division except the West South Central. Among the other items of expenditure for this division the ratio for overhead was well above the average and the item of rent for offices, warehouses, etc., was relatively higher than in any other division.

Other interesting comparisons among expenditures may be found by further study of the data presented in these analytical tables. A summary of expenditures is also presented for the respective States in Table XXXI of Chapter IV.

**Relative cost of labor and materials.**—Two items of great interest to all who are engaged in construction work are labor and materials. Together with capital, these two constitute a triangle of prime essentials without any one of which little could be accomplished. The mere fact of engaging in any line of activity, presupposes the possession of, or means of obtaining the necessary capital to finance the venture. Therefore, when the business is once under way, the actual and relative costs of labor and materials may seem to command the greater amount of interest on the part of those who require them.

In the story of construction during 1929, these two factors have already been seen in various perspectives. In comparison with the total value of all construction business for the country as a whole, wages appeared as 24 per cent and the cost of materials as 33 per cent of the total, in Table VIII of this chapter and in Table XXX of Chapter IV. In comparison with total expenditures, they were seen to constitute about 25 and 35 per cent, respectively, of all reported expenditures, in Tables IX and X. Now, at still closer range, they are to be considered, in combination, in their relationship with the actual value of construction work done and, individually, in their direct relationship to one another in Table XI.

TABLE XI.—COST OF LABOR AND MATERIALS BY GROUPS OF ESTABLISHMENTS AND BY GEOGRAPHIC DIVISIONS

CLASSIFICATION AND LOCATION OF OFFICES OF REPORTING ESTABLISHMENTS	Establishments reporting	Value of construction work by own forces <sup>1</sup>	COST OF WAGES AND MATERIALS					
			Combined total		Wages paid		Cost of materials	
			Amount	Per cent of work done	Amount	Per cent of total	Amount	Per cent of total
All classes of establishments.....	80, 597	\$4, 794, 772, 865	\$3, 523, 137, 383	73. 5	\$1, 467, 641, 901	41. 7	\$2, 055, 595, 482	58. 3
Operative builders.....	750	50, 381, 880	35, 748, 085	71. 0	13, 145, 859	36. 8	22, 602, 226	63. 2
General contractors.....	14, 795	2, 929, 483, 643	2, 102, 799, 569	71. 9	914, 112, 368	43. 5	1, 188, 687, 201	56. 5
Subcontractors.....	15, 081	1, 817, 902, 136	1, 384, 689, 720	76. 2	540, 283, 674	39. 0	844, 306, 055	61. 0
<b>All classes by geographic divisions:</b>								
New England.....	2, 780	370, 101, 822	275, 026, 159	74. 3	130, 049, 907	47. 5	144, 376, 252	52. 5
Middle Atlantic.....	8, 546	1, 608, 972, 272	1, 178, 298, 658	73. 2	519, 448, 095	44. 1	658, 850, 593	55. 9
East North Central.....	7, 934	1, 224, 663, 063	917, 444, 553	74. 9	374, 710, 637	40. 8	542, 727, 910	59. 2
West North Central.....	2, 480	367, 544, 399	265, 057, 143	72. 1	104, 914, 237	39. 6	160, 142, 908	60. 4
South Atlantic.....	2, 184	338, 238, 201	247, 793, 741	73. 3	95, 665, 443	38. 6	152, 128, 298	61. 4
East South Central.....	936	137, 100, 184	97, 606, 978	71. 2	35, 473, 044	36. 3	62, 133, 884	63. 7
West South Central.....	1, 009	256, 849, 528	188, 187, 555	73. 3	69, 822, 701	37. 1	118, 364, 854	62. 0
Mountain.....	709	74, 203, 022	50, 465, 399	68. 0	21, 246, 932	42. 1	29, 218, 467	57. 9
Pacific.....	3, 409	417, 009, 274	303, 257, 197	72. 7	115, 604, 305	38. 1	187, 652, 892	61. 9

<sup>1</sup> Obtained by subtracting the value of subcontract work let from all construction business handled. See Table 1, Chapter V.

The value of construction work done by all classes of reporting establishments which had a business of over \$25,000 during 1929, amounted to an aggregate of more than four and three-quarters billions, the labor and materials for this volume of work costing more than three and a half billions, or 73.5 per cent. For the operative builders' group this ratio stood lower at 71 per cent; for general contractors it was somewhat higher, although still below the average for the United States, 71.9 per cent; while for subcontractors these

two items of cost constituted 76.2 per cent of the actual value of work done. Among the respective geographic divisions, labor and materials for all classes of establishments cost least in the Mountain and most in the East North Central division.

The combined cost of labor and materials entering into all construction work done by all the larger reporting establishments in the United States was divided in the following ratios: Wages paid, 41.7 per cent, and cost of materials, 58.3 per cent. For operative build-

ers as a group proportionally less was spent for labor and more for materials, the ratios being 36.8 per cent and 63.2 per cent, respectively; among general contractors wages consumed a higher proportion of the total, 43.5 per cent, and the cost of materials correspondingly less, 56.5 per cent; while the distribution for subcontractors took an intermediate position between the two.

These comparative figures must not be taken to indicate that operative builders and subcontractors paid a lower rate of wages than general contractors. As a matter of fact, for the respective groups the very reverse is shown by the estimated average annual wage per workman employed. In comparison with the estimated annual wages paid by all establishments amounting to \$1,771, general contractors paid \$1,617, operative builders, \$1,772, and subcontractors, \$2,109. In view of these figures, then, the ratios in Table XI merely indicate that proportionally fewer men were employed by the two groups which paid the higher wages, while general contractors employed many more men although at a lower average annual wage. The percentage figures in Table XVI bear out this point and those in Table XVII indicate a slightly more seasonal trend of employment by general contractors. This latter fact may also help to explain the lower average annual wages per workman paid by general contractors, although the hourly wage rates for many classes of workmen they employ are among the highest paid for construction labor.

In the various geographic divisions, labor consumed a proportion of the combined cost of both labor and materials higher than the average for the United States, in the New England, Middle Atlantic, and Mountain divisions in the order named, while in all other divisions materials cost more than the average for the entire

country. In New England the cost of labor and materials was more nearly balanced than in any other division, the percentage being 47.5 and 52.5, respectively. The component figures for the respective States are presented in a similar comparison in Table XXXII of Chapter IV.

### CONSTRUCTION MATERIALS

**Distribution of all materials.**—As already shown in Table VII, the estimated total cost, delivered on the job, of all materials used in construction was about \$2,500,000,000, or almost 43 per cent of the total value of all construction work during 1929. Of the total cost of all materials, more than \$2,000,000,000 was reported by the larger construction establishments as their share in the year's purchases. (Table XII.) Upon the basis of this expenditure it may be said that establishments which had a business of more than \$25,000 during the year consumed 83 per cent of all construction materials used by the contractor group of that industry. This single ratio furnishes the manufacturer or distributor of construction materials a milepost which states clearly that along this way lies 83 per cent of his business.

A national distributor may also observe in the second column of this table that 32 per cent of all construction materials was consumed in the Middle Atlantic division and 26 per cent in the East North Central division, indicating that more than 50 per cent of his sales effort should be concentrated in those States. A similar proportional distribution for individual States and cities of over 100,000 population, or for any listed class of materials, may be derived from an analysis of the census reports on the construction industry.

TABLE XII.—TOTAL COST OF MATERIALS AND COST OF CEMENT AND LUMBER, INCLUDING ESTIMATES FOR ESTABLISHMENTS REPORTING A BUSINESS OF LESS THAN \$25,000<sup>1</sup>

LOCATION OF OFFICES OF REPORTING ESTABLISHMENTS	TOTAL COST OF MATERIALS				ESTIMATED TOTAL COST OF CEMENT USED BY ALL ESTABLISHMENTS		ESTIMATED TOTAL COST OF LUMBER USED BY ALL ESTABLISHMENTS	
	Estimated for all establishments		Reported by larger establishments	Estimated for smaller establishments	Amount	Per cent of United States total	Amount	Per cent of United States total
	Amount	Per cent of United States total						
United States.....	\$2,477,593,588	100.0	\$2,055,695,482	\$421,998,106	\$221,592,123	100.0	\$183,895,520	100.0
<b>Geographic divisions:</b>								
New England.....	174,015,598	7.0	144,376,252	29,639,346	11,030,270	5.4	18,621,231	10.1
Middle Atlantic.....	704,107,568	32.1	658,850,563	135,257,005	56,902,945	25.7	47,025,971	25.0
East North Central.....	654,145,826	26.4	542,727,016	111,417,910	57,023,949	25.7	46,431,022	25.2
West North Central.....	193,019,026	7.8	160,142,906	32,876,120	24,096,566	10.9	14,478,489	7.9
South Atlantic.....	183,359,080	7.4	152,128,295	31,230,782	18,687,412	8.4	13,913,878	7.6
East South Central.....	74,888,834	3.0	62,133,334	12,755,500	7,841,039	3.5	5,011,083	2.7
West South Central.....	142,694,255	5.8	118,364,854	24,299,404	15,765,751	7.1	10,368,006	5.6
Mountain.....	35,216,796	1.4	29,218,467	5,998,329	3,099,525	1.4	3,749,373	2.0
Pacific.....	226,176,602	9.1	187,652,892	38,523,710	20,839,660	11.9	23,695,867	12.9

<sup>1</sup> Based upon reports of establishments which did a business of over \$25,000 with estimated amounts for smaller establishments. See Table VII.



**Distribution of cement and lumber.**—An illustration of the use of these statistics in ascertaining the distribution of a particular material is also presented in Table XII in the figures for cement and lumber, two of the most widely sold and used of all construction materials. For the purpose of making these figures comparable with the total cost of all materials in the first section of that table, the cost of each of these materials used by all classes of establishments has been estimated, upon the basis of its relative value in the reported total, to cover its utilization or consumption by nonreporting as well as reporting establishments of both the larger and the smaller business groups. These estimates indicate that more than \$221,000,000 was the cost to all classes of contractors of cement used in all kinds of construction work, while lumber cost approximately \$184,000,000, cement comprising nearly 9 per cent and lumber more than 7 per cent of the total bill for materials.

A little more than half the total cost of both cement and lumber for the entire United States was reported by establishments located in the Middle Atlantic and East North Central divisions. Establishments in the Pacific and West North Central divisions also reported the consumption of 11.9 per cent and 10.9 per cent of

all cement, respectively, while the Pacific and New England divisions reported the use of a considerable proportion of total lumber. Similar ratios for all States and principal cities may be derived for any material listed in the construction reports. Since they represent in the aggregate a distribution of more than \$2,000,000,000 expended for construction materials, these figures furnish a comparatively dependable standard for the measurement of the relative and local distribution of construction materials.

**Cost of materials.**—The relative cost of each material, together with the value of each material per \$1,000 construction work done, furnishes a convenient basis for estimating the cost of various materials entering into construction work. A summary of such figures for the United States is presented in Table XIII. The 30,597 establishments of the larger business group reported the expenditure of more than \$2,000,000,000 for materials, with an itemized distribution among the principal materials, or groups of materials, of more than \$1,570,000,000. The cost of the 22 principal items enumerated in the list in Table XIII represented more than 90 per cent of the distributed total.

TABLE XIII.—COST OF MATERIALS IN DETAIL

ITEM	COST OF MATERIALS REPORTED BY				
	All classes of establishments			General contractors <sup>2</sup>	Subcontractors
	Amount	Per cent distribution	Per \$1,000 construction work done <sup>1</sup>		
Number of establishments reporting.....	30,597			15,516	15,081
Value of construction business handled.....	\$6,250,286,665			\$4,370,890,529	\$1,879,376,136
Value of subcontract work let.....	1,455,494,000			1,394,020,000	61,474,000
Value of work done by own force.....	4,794,772,665		\$428.72	2,976,870,529	1,817,902,136
Total cost of all materials.....	2,055,595,482			1,211,239,427	844,306,056
All materials distributed by kind.....	1,572,964,879	100.0		873,637,174	699,327,705
Sand, gravel, crushed stone, slag, cinders.....	164,323,947	10.4	44.79	150,007,079	14,316,868
Brick (face, common, fire, paving, etc.).....	65,058,116	4.1	17.73	62,039,724	13,018,392
Cut stone, granite and marble.....	43,809,635	2.8	11.94	21,713,696	22,095,939
Cement.....	140,833,536	8.9	38.34	127,994,366	12,839,170
Plaster, etc.....	14,969,326	1.0	4.08	6,206,863	8,762,463
Structural steel.....	128,053,585	8.1	34.90	64,872,760	63,180,795
Reinforcing steel.....	47,126,319	3.0	12.84	43,071,287	4,055,032
Metal doors, windows, and trim.....	17,508,830	1.1	4.77	6,324,506	11,184,324
Lumber, rough and finished.....	116,750,865	7.4	31.82	107,049,006	9,701,859
Millwork.....	47,008,170	3.0	12.81	43,892,678	3,115,492
Hardware, rough and finished.....	18,112,097	1.2	4.93	16,703,871	1,408,226
Paints, varnishes, glass.....	33,614,058	2.1	9.18	6,994,135	26,619,923
Roofing and sheet metal.....	66,035,925	3.6	15.27	6,933,787	49,102,138
Heating and ventilating equipment and supplies.....	125,122,220	8.0	34.10	10,636,162	114,486,058
Plumbing and gas-fitting equipment and supplies.....	130,987,637	8.3	35.70	10,796,385	120,191,252
Electrical appliances and supplies.....	99,455,264	6.3	27.11	16,035,909	83,419,355
Elevators, dumb-waiters, and equipment.....	51,552,310	3.3	14.05	1,798,368	49,753,942
Pipe: Drain tile, vitrified, concrete, segment-tile, corrugated.....	20,344,184	1.3	5.54	18,900,010	1,444,174
Pipe: Cast-iron, sheet and tube steel, etc.....	33,214,729	2.1	9.05	25,099,118	8,115,611
Bituminous paving materials, tar, asphalt, and oil.....	25,202,335	1.6	6.87	23,609,185	1,593,150
Machinery.....	18,766,994	1.2	5.11	18,410,661	356,933
Metal products, n. e. s. (including metal furniture).....	19,451,852	1.2	5.30	4,110,867	15,340,985
All other materials.....	165,812,945	9.9	42.47	90,437,231	65,375,714

<sup>1</sup> The value of construction work done is obtained from figures presented in Table VII, by subtracting the value of subcontract work let from the total value of construction business.  
<sup>2</sup> Includes operative builders.

The preponderance of concrete and steel construction in the year's work is indicated by the materials' bill for sand and other aggregates, cement, and structural and reinforcing steel. The combined cost of these four materials was approximately 30 per cent of the total cost of all materials. Lumber and mill-work together took more than 10 per cent, and brick and stone combined about 7 per cent. More than a quarter of the total cost of materials was spent for modern construction facilities for health and efficiency, as follows: Plumbing and gas-fitting equipment, 8.3 per cent; heating and ventilating equipment, 8 per cent; electrical appliances and supplies (including electric refrigerators), 6.3 per cent; and elevators, dumb-waiters, and equipment, 3.3 per cent. The data presented in this table are shown in complete detail for the United States and the respective geographic divisions in Tables 9, 10, and 11, of Chapter V of this report, and for the State and cities of over 100,000 population in each of the individual State reports.

A cross comparison of the proportion of each material which was consumed by general contractors and subcontractors is presented in the last two columns of the table. For example, about 91 per cent of sand, cement, and reinforcing steel and other aggregates, was reported by general contractors; structural steel was about evenly divided between the two; while almost 92 per cent of both heating and ventilating equipment and plumbing and gas-fitting equipment was installed by subcontractors. In most cases, elevator installation was done by subcontractors, usually elevator manufacturers, under the general policy of selling their product installed. On the other hand, 98 per cent of the essential machinery equipment of structures was installed by general contractors. An analysis of the machinery item reported in Table 11 of Chapter V of this report, shows that about half the total amount was installed in central station, light and power plants and the greater part of the remainder in buildings.

In the third column of this table, the cost of each material per \$1,000 construction work done furnishes a basis for estimates of the relative value of any material entering into a hypothetical composite structure consisting of all construction in the United States during the year. The figures in this table, of course, represent the average ratios for a composite structure consisting of all types of construction throughout the United States during 1929. For a particular type of construction, in any State or city of over 100,000 pop-

ulation, a table similar to this can be set up from basic figures presented in Tables 1 and 11 in the published census reports of the construction industry for each State. Typical examples of such analyses are presented in Tables XIV and XV of this chapter.

In connection with the use of materials figures for any designated class of establishments, it seems necessary to again stress the fact that these figures relate to the entire construction activity of establishments engaged primarily but not exclusively (except in the case of commercial, manufacturing, and residential building classifications) in the line of work described by the classification. A contractor engaged primarily in building might also do a considerable amount of highway work, and the materials reported by him would accordingly include those used in both kinds of work.

**Cost to individual classes of establishments.**—Moreover, the cost of materials reported by any given individual classification of establishments, such as "building," "highway," etc., do not include materials which were furnished and installed for them by other contractors to whom special parts of their construction business were sublet, although those materials are included in the totals for all classes of establishments and in the various classifications with which these other contractors are classed. This point is illustrated by the distribution of materials furnished and used by establishments engaged primarily in building, presented in Table XIV. It may be seen that this class of establishments reported the expenditure for heating, plumbing, electrical, and elevator materials and equipment of only about 5 per cent of the total cost of all their materials, whereas the proportion expended for these items by all classes of contractors was more than 25 per cent, as shown in Table XIII. The bulk of heating, plumbing, electrical, and elevator work must be done on buildings and, since building work was only about two-thirds of all construction, the relative importance of these items among materials used on buildings would accordingly be even greater than in the aggregate distribution of materials used on all types of construction. The direct implication of this comparison is that these four types of work were, as a rule, sublet by general building contractors to specialized subcontractors (the materials used by the latter being allocated to their own special classification), the total value of all work sublet being shown in the third figure in each amount column in Tables XIV and XV.

# CONSTRUCTION—UNITED STATES SUMMARY

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TABLE XIV.—COST OF MATERIALS IN DETAIL FOR ESTABLISHMENTS ENGAGED PRIMARILY IN BUILDING

ITEM	ALL CLASSES OF BUILDING <sup>1</sup>			COMMERCIAL BUILDING ONLY			RESIDENTIAL BUILDING ONLY		
	Amount	Per cent distribution	Per \$1,000 construction work done by own force	Amount	Per cent distribution	Per \$1,000 construction work done by own force	Amount	Per cent distribution	Per \$1,000 construction work done by own force
Number of establishments reporting.....	10,131			599			2,455		
Value of construction business handled.....	\$2,622,046,898			\$132,627,030			\$245,650,776		
Value of subcontract work let.....	1,124,702,000			67,126,000			105,974,000		
Value of work done by own force.....	1,497,344,898			65,501,030			139,676,776		
Total cost of materials.....	652,160,912		\$435.55	26,283,592		\$386.00	64,865,354		\$464.40
All materials distributed by kind.....	438,496,051	100.0		17,320,729	100.0		43,566,501	100.0	
Sand, gravel, crushed stone, slag, cinders.....	37,524,832	8.6	37.27	1,847,765	10.7	41.18	1,670,506	3.8	17.81
Brick (face, common, fire, paving, etc.).....	48,413,897	9.9	43.12	1,775,166	10.2	39.50	2,850,517	6.5	30.39
Tile (fireproofing).....	7,061,355	1.6	7.01	208,698	1.2	4.65	240,968	.6	2.57
Tile, facing, terra cotta, floor, and wall.....	7,509,787	1.7	7.46	406,291	2.3	9.06	719,508	1.7	7.67
Concrete and cinder block.....	6,289,229	1.4	6.25	268,322	1.5	5.98	753,485	1.7	8.03
Cut stone, granite and marble.....	15,791,997	3.6	15.68	490,571	2.8	10.93	506,265	1.3	6.04
Cement.....	41,997,862	9.6	41.72	2,188,461	12.6	48.77	1,557,787	3.6	16.01
Lime.....	5,783,365	.8	3.47	141,067	.8	3.14	340,388	.8	3.63
Plaster, etc.....	3,489,200	.8	5.71	176,504	1.0	3.93	754,704	1.7	8.04
Structural steel.....	27,894,384	6.4	27.71	710,336	4.1	15.83	489,348	1.1	5.22
Reinforcing steel.....	19,391,069	4.4	19.20	1,244,899	7.2	27.74	261,274	.6	2.79
Cast iron, miscellaneous, excluding pipe.....	2,318,630	.5	2.30	51,842	.3	1.15	59,466	.1	.68
Metal doors, windows, and trim.....	5,041,737	1.4	5.90	189,543	1.1	4.22	284,087	.7	3.05
Metal and wire lath and furring.....	2,136,730	.5	2.11	62,595	.4	1.39	160,864	.4	1.82
Ornamental metal work.....	2,088,852	.7	2.97	102,367	.6	2.28	170,865	.4	1.92
Lumber, rough and finished.....	81,790,677	18.6	81.21	3,440,606	19.9	76.68	10,063,033	36.8	171.12
Laths, shingles, and shakes (wood).....	2,667,068	.6	2.65	81,176	.5	1.81	762,218	1.7	8.13
Millwork.....	41,132,380	9.4	40.85	990,634	5.7	22.08	7,461,496	17.1	79.54
Composition board.....	3,464,924	.8	3.44	51,975	.3	1.16	468,325	1.1	4.99
Waterproofing materials.....	1,137,430	.3	1.13	56,260	.3	1.25	88,638	.2	.94
Hardware, rough and finished.....	12,666,913	3.0	12.88	568,497	3.3	12.67	1,788,089	4.1	19.06
Paints, varnishes, glass.....	5,967,368	1.4	5.93	212,712	1.2	4.74	908,130	2.1	9.68
Roofing and sheet metal.....	6,207,265	1.4	6.17	289,902	1.7	6.46	833,321	1.9	8.88
Finished flooring (other than cement, wood, or tile).....	3,181,171	.7	3.10	63,187	.4	1.41	489,962	1.1	5.22
Screens, shades, awnings, etc.....	918,575	.2	.91	19,506	.1	.44	296,482	.7	3.16
Heating and ventilating equipment and supplies.....	7,306,108	1.7	7.35	212,415	1.2	4.73	846,676	1.9	9.02
Plumbing and gas-fitting equipment and supplies.....	8,137,088	1.9	8.08	261,942	1.5	5.84	1,403,199	3.4	15.00
Electrical appliances and supplies.....	4,992,289	1.1	4.96	179,605	1.0	4.00	625,391	1.4	6.66
Elevators, dumb-waiters, and equipment.....	1,617,721	.4	1.61	262,906	1.5	5.86	21,810	.1	.23
Pipe: Drain tile, vitrified, concrete, segment-tile, corrugated.....	968,104	.2	.96	18,539	.1	.41	77,871	.2	.83
Pipe: Cast-iron, sheet and tube steel, etc.....	6,619,167	1.5	6.58	55,443	.3	1.24	28,357	.1	.30
Ready-mixed concrete.....	1,169,071	.3	1.16	193,045	1.1	4.30	4,655	.01	.05
Machinery.....	7,990,935	1.7	7.34	320,435	1.8	7.14	9,631	.02	.10
Metal products, n. e. s. (including metal furniture).....	2,299,784	.5	2.28	34,481	.2	.77	9,631	.02	.10
All other materials.....	9,068,178	2.1	9.01	143,036	.8	3.18	459,216	1.1	4.89

<sup>1</sup> Excludes operative materials.

\* Less than one-tenth of 1 per cent.

The actual and relative cost of each class of materials furnished and used by all classes of general building contractors and by two of the specialized building groups are presented in Table XIV. The relative cost of all materials, in proportion to the total value of work done, was considerably higher for residential than for commercial buildings, being \$464 and \$386, respectively, per \$1,000. The summary for the general building contractors group shows the use of at least some of all the principal items of materials, but the outstanding items making up about two-thirds of the total cost of all materials are: Lumber, 18.6 per cent; brick, 9.9 per cent; cement, 9.6 per cent; millwork, 9.4 per cent; sand, gravel and other aggregates, 8.6 per cent; structural steel, 6.4 per cent; and reinforcing steel, 4.4 per cent.

For commercial buildings exclusively, the ratios show some variation from the average for all types of

building. A preponderance of reinforced concrete and brick construction is indicated by the principal percentages for this class: Lumber, 19.9 per cent; cement, 12.6 per cent; sand, gravel and other aggregates, 10.7 per cent; brick, 10.2 per cent; reinforcing steel, 7.2 per cent; millwork, 5.7 per cent; and structural steel, 4.1 per cent. The relative cost of materials reported by general contractors engaged exclusively in residential building, on the other hand, shows a prevalence of frame construction, with lumber comprising 36.8 per cent of the total cost of all materials; millwork, 17.1 per cent; brick, 6.5 per cent; sand, etc., 3.8 per cent; and cement, 3.6 per cent. The higher percentage of total cost expended for heating, plumbing, and electrical equipment, reported by this class of contractors, indicates that more of this kind of work was done by general contractors on residential than on other types of building.

## CONSTRUCTION—UNITED STATES SUMMARY

TABLE XV.—COST OF MATERIALS IN DETAIL FOR ESTABLISHMENTS ENGAGED PRIMARILY IN HIGHWAY, STREET PAVING, AND BRIDGE AND CULVERT CONSTRUCTION

ITEM	HIGHWAY			STREET PAVING			BRIDGE AND CULVERT		
	Amount	Per cent distribution	Per \$1,000 construction work done by own force	Amount	Per cent distribution	Per \$1,000 construction work done by own force	Amount	Per cent distribution	Per \$1,000 construction work done by own force
Number of establishments reporting.....	1,614			984			476		
Value of construction business handled.....	\$443,064,426			\$282,759,559			\$137,206,366		
Value of subcontract work let.....	43,789,000			25,230,000			11,893,000		
Value of work done by own force.....	390,275,426			257,529,559			125,313,366		
Total cost of all materials.....	165,940,861		\$414.10	109,109,244		\$423.66	55,658,045		\$444.15
All materials distributed by kind.....	134,792,440	100.0		89,139,074	100.0		45,649,962	100.0	
Sand, gravel, crushed stone, slag, cinders.....	50,597,962	42.0	173.88	32,799,832	36.8	155.89	5,163,358	11.3	50.24
Brick (face, common, fire, paving, etc.).....	1,997,417	1.5	0.14	2,031,805	3.0	12.51	272,278	.6	2.05
Concrete and cinder block.....	1,311,225	1.0	4.03	720,422	.8	3.42	200,087	.5	2.04
Cut stone, granite and marble.....	1,057,036	.8	3.25	2,491,517	2.8	11.84	630,891	1.4	0.14
Riprap, rubble, etc.....	409,223	.3	1.26	537,366	.6	2.55	443,930	1.0	4.32
Cement.....	39,856,158	29.6	122.45	26,253,224	29.5	124.78	5,486,333	12.0	53.33
Structural steel.....	1,725,606	1.3	5.30	853,920	.4	1.68	18,709,532	41.2	182.91
Reinforcing steel.....	8,458,282	6.3	25.98	2,625,848	2.8	12.00	4,709,190	10.3	45.81
Cast iron, miscellaneous, excluding pipe.....	159,946	.1	.49	800,231	.4	1.71	69,035	.2	.07
Lumber, rough and finished.....	2,582,002	1.9	7.93	1,014,997	1.1	4.83	4,043,673	8.9	30.84
Hardware, rough and finished.....	556,345	.4	1.71	212,622	.2	1.01	400,020	1.0	4.48
Paints, varnishes, glass.....	56,028	(1)	.17	25,995	(1)	.12	246,480	.5	2.40
Pipe: Drain tile, vitrified, concrete, segment-tile, corrugated.....	2,780,076	2.1	8.54	2,101,600	2.4	9.90	184,752	.4	1.80
Pipe: Cast-iron, sheet and tube steel, etc.....	1,258,317	.9	3.87	977,317	1.1	4.64	204,143	.4	1.00
Wire cable, guards, and fencing.....	600,176	.4	1.84	53,688	.1	.25	290,769	.6	2.83
Bituminous paving materials, tar, asphalt, and oil.....	10,580,221	7.9	32.64	11,576,139	13.0	55.02	227,536	.5	2.21
Wood piling and timber.....	79,859	.1	.24	13,378	(1)	.06	773,281	1.7	7.62
Ready mixed concrete.....	345,048	.3	1.06	591,891	.7	2.81	36,100	.1	.35
All other materials.....	4,370,414	3.2	13.43	3,898,552	4.4	18.53	3,399,684	7.4	33.08

<sup>1</sup> Less than one-tenth of 1 per cent.

A similar analysis of the relative cost of materials reported by establishments engaged primarily in highway, street paving, or bridge and culvert construction is given in Table XV. The cost of all materials, in proportion to the total value of work done, was greatest in bridge and culvert work, and least on highways. Sand and other aggregates and cement represent about two-thirds of the cost of all materials used by general highway and street paving contractors, whereas these two items combined with structural and reinforcing steel make up three-fourths of the total cost of materials used by bridge and culvert contractors. Other interesting comparisons are revealed in these figures. For example, the relative cost of brick and cut stone used in street paving, probably for gutters and curbs, is much higher than that used on highway work. Highways, on the other hand, seem to have been more heavily reinforced than city streets, while bituminous paving materials were more generally used in the latter. The use of lumber in bridge and culvert construction greatly exceeded its use on highway and street work.

**Determining prospective demand.**—The figures presented in standard Table 10 in Chapter V of this report and in the published State reports of the construction industry were intended to serve as a guide in determining prospective demand for any of the principal construction materials or groups of materials. They not only furnish for each class of establishments a comparison between the cost of the designated material and

the total cost of all materials distributed by kind, but also give for the identical groups of establishments the total value of business handled and percentages for determining the approximate value of construction work in which the material was used. By applying the results of computations based upon these figures, to the known value of construction contracts awarded in any given locality for a certain type of construction, such as building, highway, street paving, etc., the material dealer can determine what part of the value of that contract he may expect to have expended for his product. Let us assume, for example, that a street-paving contract valued at \$500,000 has been awarded in a certain vicinity. The local dealer in cement, by consulting the section of Table 10 which relates to that material (see p. 63) will find that street paving business valued at \$235,000,000 is listed in the fifth column, and (in the footnote) that 91.1 per cent of that business which would amount to about \$214,000,000, was done by the reporting establishment's own forces. Among many kinds of materials valued at \$89,000,000, \$26,000,000 worth of cement was required for this work, representing about 12 per cent of the total value of the work done. The cement dealer may accordingly expect a demand for cement amounting to 12 per cent of the paving contract, or about \$60,000.

**Distortion of distribution ratios.**—Attention should be called to the fact that the figures relating to highly specialized materials have sometimes received apparent

over emphasis in the statistics for limited areas. This is due to the fact that a considerable number of large establishments whose construction operations extend throughout the United States, submitted combined reports for all offices in their entire nation-wide organization in lieu of separate reports for each local branch office. This fact has already been mentioned in the discussion of branch offices in Chapter II. The location in any city or State of the home office of an establishment specializing in a certain product, which submitted a combined report for the construction census covering its total business, tends to exaggerate the relative importance of that material in the distribution of the total value of all materials for the locality, in proportion to the relative amount of reported construction work which was done outside the home State.

Many of the organizations from which combined reports were received were manufacturers or fabricators of specialized products, such as structural steel for building and bridge work, heating and ventilating equipment, elevators, ornamental iron, and flooring other than cement, wood, or tile, which were sold and installed by their own local construction organizations in various States. The production of such materials is more or less definitely centralized in one or a few localities, and establishments installing each of these materials almost exclusively, reported a considerable amount of business outside the home State. (See Table 3 of Chapter V of this report.) Almost invariably, it has been found that the high proportion of specialized materials in localities in which they are manufactured indicates the presence there of at least some combined reports, or the existence of a comparable situation in the case of establishments which conducted their business in other States direct from the home office without maintaining branch offices in different sections of the country.

Statistics for all classes of establishments throughout the United States represent a general mean in which the irregularities shown for smaller areas or individual groups of establishments are minimized, but in the publications for the respective States and for geographic divisions in the United States summary presented in Chapter V of this report, the items of specialized materials which have appeared out of proportion in the local distribution shown in Tables 9, 10, and 11, have been designated by footnotes explaining the apparent inconsistency. In using these statistics, therefore, it is highly important that these danger signals be observed and duly considered.

The effect of this distortion upon the relationships among the general business items reported would not be as great as its effect upon the indicated importance of a highly specialized material in the local distribution of all materials. Nor would the distortion appear as great in the distribution of materials used by establishments engaged primarily in building construction, of which a considerable number also reported a large amount of work outside the home State, because the kinds of material used on this type of work are usually very much the same in any locality, although the proportions may vary to some extent on account of differences in building code, climate, custom, or prevailing type of structure in different communities.

### CONSTRUCTION LABOR

Each reporting establishment was requested to state the actual number of skilled and unskilled workmen on its pay rolls on the 15th day of each month, or nearest normal working day. Satisfactory information on this point was furnished by 27,102 of the 30,597 establishments which had a business of over \$25,000. In Tables XVII and XVIII of this chapter, in Table XXXIII of Chapter IV, and in Table 7 of Chapter V of this report and in each published State report on the construction industry, a summary of the reported employment figures is presented. Similarly, the inventory value of equipment owned at the end of the year was reported by only 26,718 establishments. These reported figures are shown in Table 6 of Chapter V.

**Estimates per workman employed.**—From time to time requests have been received for estimates, upon the basis of the number of workmen employed, of the value of various related factors entering into construction. For the purpose of making such a comparison it was necessary that all the figures involved should be upon the same basis. Actual reported total values of construction work done, wages paid, and cost of materials were available for all establishments reporting for the construction census, but it was necessary to project incomplete employment and equipment figures to the same level. These total estimates were made, in the first instance, upon the basis of the ratio of wages paid by establishments which reported the number of workmen employed to total wages paid by all establishments and, in the second, upon the basis of the ratio of construction business of establishments which reported equipment to total business of all establishments. These estimates, together with reported total figures for the other related items, are presented in Table XVI of this chapter.

## CONSTRUCTION—UNITED STATES SUMMARY

TABLE XVI.—NUMBER OF WORKMEN EMPLOYED THROUGHOUT THE YEAR AND VALUE OF WORK DONE, WAGES PAID, INVENTORY VALUE OF EQUIPMENT, AND COST OF MATERIALS PER WORKMAN EMPLOYED

CLASSIFICATION AND LOCATION OF OFFICES OF REPORTING ESTABLISHMENTS	ESTIMATED AVERAGE NUMBER OF WORKMEN EMPLOYED <sup>1</sup>		VALUE OF CONSTRUCTION WORK DONE		WAGES PAID FOR CONSTRUCTION LABOR		ESTIMATED TOTAL INVENTORY VALUE OF EQUIPMENT <sup>1</sup>		COST OF ALL CONSTRUCTION MATERIALS	
	Number	Per cent of all classes	Amount	Per workman employed	Amount	Per workman employed	Amount	Per workman employed	Amount	Per workman employed
All classes of establishments.....	828,772	100.0	\$4,794,772,665	\$5,785	\$1,467,541,901	\$1,771	\$449,118,718	\$542	\$2,055,595,482	\$2,480
Operative builders.....	7,418	.9	50,381,890	6,792	13,145,359	1,772	690,173	93	22,602,226	3,047
General contractors.....	565,179	68.2	2,926,488,643	5,178	914,112,368	1,617	360,031,291	637	1,188,087,201	2,103
Subcontractors.....	256,175	30.9	1,817,902,130	7,090	540,283,674	2,109	88,397,254	345	844,306,055	3,296
<i>All classes by geographic divisions:</i>										
New England.....	73,479	8.9	370,191,822	5,038	130,649,907	1,775	27,346,115	372	144,376,252	1,965
Middle Atlantic.....	250,447	30.2	1,605,972,272	6,424	519,448,095	2,074	140,132,178	500	668,850,593	2,631
East North Central.....	202,122	24.4	1,224,093,963	6,059	374,716,637	1,854	109,550,204	542	542,727,910	2,635
West North Central.....	72,716	8.8	367,544,399	5,055	104,914,237	1,443	43,870,604	603	160,142,900	2,202
South Atlantic.....	72,824	8.8	338,235,201	4,645	95,665,443	1,314	33,355,770	458	152,128,298	2,089
East South Central.....	29,355	3.5	137,100,184	4,670	35,473,644	1,208	10,346,151	557	62,133,334	2,117
West South Central.....	47,598	5.7	256,849,528	5,390	69,822,701	1,467	25,409,080	534	118,304,854	2,487
Mountain.....	13,169	1.6	74,203,022	5,635	21,240,952	1,613	10,679,295	911	29,218,487	2,219
Pacific.....	67,064	8.1	417,009,274	6,218	115,604,305	1,724	42,449,341	633	187,682,802	2,708

<sup>1</sup> See text for explanation of the derivation of these estimates.

In making use of these figures the reader is cautioned that they should be considered to provide only a very general basis of comparison and should not be taken as an accurate measure of any given item. In order that there may be no misunderstanding of the method by which the total employment figures were derived, the following statement of the process is submitted: From information contained in the individual construction reports, the approximate number of workmen employed throughout the year could only be obtained by dividing by 12, the sum of the number on pay roll on the 15th of each month. It is recognized that this figure may not represent the actual average number employed throughout the year, because the actual number of men employed at other periods may have been greater or less than the number on the mid-month pay roll. Nevertheless, the average obtained by this method may be assumed in most instances to be a close approximation of the actual number. By dividing the total wages paid throughout the year by this derived average number employed, the approximate average annual amount paid each workman was obtained. Assuming that the same average wage was paid by establishments which failed to report the number of workmen employed, total wages paid by all establishments divided by the average wage per workman furnished the estimated average number employed throughout the year. This total was then distributed among the respective items of any breakdown of employment data, in proportion to the original percentage distribution of actually reported figures.

For all establishments which had a business of over \$25,000 during the year, the estimated total number of workmen employed throughout the year was 828,772. Operative builders employed less than 1 per cent of the total number, general contractors,

68 per cent and subcontractors, 31 per cent. An equivalent of about 250,000 men were employed throughout the year in the Middle Atlantic division, and more than 200,000 in the East North Central division. The fewest men were employed by this group of establishments in the Mountain and East South Central divisions.

A line by line comparison of the figures for the principal groups of establishments and for the geographic divisions, reveals the varying relationships among the cost of labor, materials, and owned mechanical construction equipment for the respective groups. For example, the value of construction work done, wages and materials per workman employed are less for general contractors than the average for all classes of establishments, coupled with an inventory value of equipment which is higher than the average. Subcontractors, on the other hand, show the reverse relationship, with a comparatively higher relative value shown for work, wages, and materials and a lower value for equipment.

The average value of construction work done during 1929 per workman employed, for all classes of larger establishments throughout the United States was \$5,785; for operative builders, \$6,792; for general contractors, \$5,178; and for subcontractors, \$7,096. In no sense do these figures indicate the comparative efficiency of labor employed by the respective groups. They do indicate, however, that the work of general contractors consisted of an average of more moderately priced labor, utilizing materials of moderate cost, whereas the work of subcontractors represented the installation of more highly fabricated and higher priced materials by generally more highly skilled and highly paid labor.

**Seasonal trend of employment.**—During recent years, a consistent effort has been made by progres-

sive contractors in many sections of the country to minimize seasonal unemployment in the construction industry. The report and recommendations of a committee of the President's Conference on Unemployment, sets forth in detail the facts and remedies of "Seasonal Operation in the Construction Industries."<sup>1</sup> The following statement appears in the foreword to this report: "The committee states that bad weather is not the principal cause of seasonal idleness. Customs, which became fixed when builders had not yet learned to cope with adverse weather conditions, have not changed to meet improvements in building materials, the development of new equipment, and innovations in management methods. For most types of construction it is now possible to build the year round in all parts of the United States." Although the employment figures of the census of the construction industry show the persistence of a distinct seasonal trend in all lines of construction activity during 1929, it is undoubtedly true that much progress has been

made toward greater stability in employment from month to month in the construction industry.

The seasonal trend of employment in the construction industry, as reported by establishments which had a business of over \$25,000 during 1929, is shown by figures presented in Table XVII. The estimated total for all establishments indicates a maximum employment of approximately 1,031,604 men about the middle of August, with only 579,396, or 56 per cent of the maximum, employed in January. August was also the month of greatest employment by general contractors and January the month of least employment. For subcontractors, however, the months of maximum and minimum activity were September and February, respectively. Operative builders, on the other hand, employed most men in July and fewest in January. As shown by the percentages of maximum employment for the respective months, the work of general contractors was more seasonal than that of subcontractors whose activity continued more regularly throughout the year.

TABLE XVII.—WAGE EARNERS EMPLOYED EACH MONTH BY PRINCIPAL GROUPS OF ESTABLISHMENTS

ITEM	ESTIMATED TOTAL FOR ALL ESTABLISHMENTS		ESTABLISHMENTS REPORTING WAGE EARNERS							
			All classes		Operative builders		General contractors		Subcontractors	
	Number	Per cent of maximum	Number	Per cent of maximum	Number	Per cent of maximum	Number	Per cent of maximum	Number	Per cent of maximum
Number of establishments reporting.....	30, 597		27, 102		458		13, 036		13, 608	
Number of wage earners 1—										
January.....	579, 396	56. 2	530, 887	56. 2	4, 526	53. 2	329, 811	48. 0	196, 550	74. 6
February.....	579, 834	56. 2	531, 289	56. 2	4, 768	56. 0	331, 196	49. 1	195, 325	74. 2
March.....	647, 905	62. 8	593, 061	62. 8	0, 049	71. 0	377, 318	56. 0	210, 294	79. 9
April.....	766, 991	74. 3	702, 776	74. 3	7, 450	87. 5	465, 386	69. 0	229, 940	87. 3
May.....	802, 632	83. 6	790, 410	83. 6	8, 019	94. 2	541, 905	80. 4	240, 486	91. 3
June.....	935, 427	90. 7	857, 110	90. 7	8, 401	98. 7	598, 414	88. 8	250, 295	95. 0
July.....	997, 531	96. 7	914, 015	96. 7	8, 514	100. 0	647, 063	95. 0	258, 438	98. 1
August.....	1, 031, 604	100. 0	945, 235	100. 0	8, 456	99. 3	674, 149	100. 0	262, 030	99. 7
September.....	1, 006, 267	97. 5	922, 019	97. 5	7, 826	91. 9	650, 863	96. 5	263, 330	100. 0
October.....	968, 734	93. 9	887, 020	93. 9	6, 725	79. 0	623, 088	92. 4	257, 810	97. 9
November.....	861, 115	83. 5	789, 020	83. 5	5, 913	69. 5	544, 796	80. 8	238, 311	90. 6
December.....	707, 821	68. 6	648, 520	68. 6	4, 943	58. 1	430, 299	63. 8	213, 318	81. 0

<sup>1</sup> Number on pay roll on 15th of each month or nearest normal working-day. The estimated number of wage earners shown in the first column is based upon the ratio of wages paid by establishments reporting employment to wages paid by all establishments.

The seasonal trend of employment by reporting contractors in each State and geographic division is shown in Table XXXIII of Chapter IV. The highest degree of seasonal variation in employment during 1929 is shown for North Dakota, South Dakota, and Wyoming, where minimum employment in January and February was less than 20 per cent of the maximum, which means that only one out of five available construction workmen was employed. More than one but not more than two out of five workmen were employed at the period of least activity in the following States: Minnesota, Iowa, Nebraska, Kansas, West Virginia, Montana, Idaho, Colorado, Utah, and Nevada. In California, North Carolina, Texas, and Alabama, on the other hand, minimum employment was more than 70 per cent of the maximum.

**Length of working week.**—A considerable variety in the length of working day and week in the construction industry is shown by the summary of reports of 27,102 establishments presented in Table XVIII. These figures have been tabulated only for the two principal groups of establishments, general contractors (including operative builders) and subcontractors, since the detail involved in tabulating this information for individual classes of business was prohibitive. In Table 7 of Chapter V of this report, a summary of employment by months is given for this breakdown.

Of the varieties of working week enumerated in this tabulation, the 44-hour 5½-day week was reported by 11,562 establishments, or 32.1 per cent of the total number. This group of establishments employed an average of 243,566 men throughout the year and paid them average annual wages of \$1,886. The 40-hour

<sup>1</sup> Published by the McGraw-Hill Book Co., (Inc.), 1924.

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5-day week was second in importance with respect to the number of establishments and men affected, while the average annual wage was \$2,359. Although the shorter day was reported by a greater number of establishments, the 60-hour 6-day week affected a

larger number of men than the 48-hour 6-day week. Of these two groups, however, the one which worked the longer hours received less average pay for its labor, which suggests that this group consisted, for the most part, of common or unskilled laborers.

TABLE XVIII.—LENGTH OF WORKING WEEK, NUMBER OF WORKMEN AFFECTED AND AVERAGE ANNUAL WAGES PAID BY REPORTING ESTABLISHMENTS

LENGTH OF WORKING WEEK	ALL CLASSES OF ESTABLISHMENTS				GENERAL CONTRACTORS <sup>1</sup>				SUBCONTRACTORS			
	Establishments reporting	Estimate of workmen affected		Estimated average annual wage per workman	Establishments reporting	Estimate of workmen affected		Estimated average annual wage per workman	Establishments reporting	Estimate of workmen affected		Estimated average annual wage per workman
		Number <sup>2</sup>	Per cent of total			Number <sup>2</sup>	Per cent of total			Number <sup>2</sup>	Per cent of total	
Total.....	27, 102	759, 384	100. 0	\$1, 771	18, 494	524, 658	100. 0	\$1, 621	13, 608	234, 728	100. 0	\$2, 105
40-hour 5-day week.....	5, 116	130, 648	17. 2	2, 359	1, 673	58, 554	11. 2	2, 176	3, 443	72, 004	30. 7	2, 568
45-hour 5-day week.....	56	1, 041	. 2	1, 740	28	653	. 1	1, 383	28	388	. 2	2, 340
50-hour 5-day week.....	36	864	. 1	1, 272	25	729	. 1	1, 265	11	165	. 1	1, 304
All other 5-day week.....	107	1, 747	. 2	2, 040	34	588	. 1	1, 725	73	1, 159	. 5	2, 213
44-hour 5½-day week.....	11, 562	243, 566	32. 1	1, 886	4, 789	136, 760	26. 0	1, 756	6, 773	108, 806	45. 5	2, 053
49½-hour 5½-day week.....	380	7, 865	1. 0	1, 507	222	5, 626	1. 1	1, 600	168	2, 239	1. 0	1, 523
55-hour 5½-day week.....	628	20, 054	2. 6	1, 135	423	18, 052	3. 5	1, 102	105	2, 002	. 8	1, 435
All other 5½-day week.....	1, 475	35, 733	4. 7	1, 544	841	25, 002	4. 8	1, 477	694	10, 641	4. 5	1, 703
48-hour 6-day week.....	3, 084	100, 941	13. 3	1, 606	1, 890	87, 046	16. 6	1, 587	1, 144	13, 895	5. 9	1, 728
54-hour 6-day week.....	1, 419	55, 037	7. 2	1, 637	1, 022	46, 500	8. 9	1, 617	397	8, 597	3. 6	1, 741
60-hour 6-day week.....	1, 886	107, 065	14. 1	1, 309	1, 030	100, 580	19. 2	1, 312	322	6, 535	2. 8	1, 691
All other 6-day week.....	811	25, 630	3. 4	1, 479	489	20, 145	3. 8	1, 421	250	2, 807	1. 2	1, 923
All other not designated.....	342	15, 719	2. 1	1, 554	234	12, 912	2. 4	1, 474	108	2, 807	1. 2	1, 923
Not reported.....	350	13, 334	1. 8	1, 934	194	11, 419	2. 2	1, 900	156	1, 916	. 8	2, 085
Length of week reported.....	28, 410	780, 331	100. 0	5, 622	13, 068	500, 325	100. 0	5, 270	13, 344	230, 008	100. 0	6, 141
5-day week.....	5, 315	134, 330	18. 4	2, 343	1, 700	60, 524	12. 1	2, 152	3, 555	73, 806	32. 1	2, 500
5½-day week.....	13, 945	307, 218	42. 1	1, 788	6, 275	185, 530	37. 1	1, 647	7, 070	121, 638	52. 9	2, 052
6-day week.....	7, 150	288, 783	39. 5	1, 491	5, 031	254, 271	50. 8	1, 471	2, 110	34, 512	15. 0	1, 630
Length of day reported.....	24, 017	807, 171	100. 0	4, 861	11, 702	454, 500	100. 0	4, 673	12, 315	212, 671	100. 0	5, 225
8-hour day.....	19, 712	475, 155	71. 2	1, 967	8, 352	282, 360	62. 1	1, 701	11, 300	192, 795	90. 7	2, 260
9-hour day.....	1, 855	64, 003	9. 6	1, 622	1, 272	52, 779	11. 6	1, 602	583	11, 224	5. 3	1, 721
10-hour day.....	2, 450	128, 013	19. 2	1, 282	2, 078	119, 361	26. 3	1, 280	372	8, 652	4. 1	1, 304

<sup>1</sup> Includes operative builders.

<sup>2</sup> Obtained by dividing by 12 the sum of the reported number of workmen on the 15th day of each month or nearest normal working-day. See explanation in text on p. 36.

It is interesting to note that for both the 5 and 5½ day week, for all classes of establishments as well as for the two component groups, the men who worked the shorter day received the higher average annual wages. In the 6-day week group, however, there is a break in this regular trend, since the average wage of those reported as working the 9-hour day is slightly higher than that of those working the 8-hour day, while those reported as working the 10-hour day received the lowest relative wages as in the 5 and 5½ day groups. This difference amounts to only a few dollars per year, but the appearance of such a variation should be the result of discoverable causes.

An analysis of the reports for the Middle Atlantic division in which about a quarter of all contractors reporting the 54-hour 6-day week were located, reveals the extensive use of this length of working week among establishments engaged in construction work on highways, street paving, and other types of public work and utilities construction on which a large percentage of common labor is employed. The number of men employed on work of this nature is known to vary greatly from week to week, or even from day to day, according to the weather, or the need of speedily completing a job.

This combination of facts suggests that the number of workmen on the mid-month pay roll of establishments reporting this length of working week, probably did not accurately represent the average number employed throughout the month. If the figures for the 15th of each month are not an approximate average for the entire month, the average for the year is correspondingly inaccurate and the average annual wage for this group is inversely in error, i. e., if the number of men is too large the average wage is too small, or vice versa. The possibility of the occurrence of just such an error when an attempt is made to obtain the average wages per man by the use of the monthly employment figures in connection with the total annual wages paid, has been stressed in the reports of the construction industry wherever these figures have been discussed.

The figures in Table XVIII, however, while illustrating the importance of heeding this general warning, serve also to show that in grand totals and combinations of subordinate groups, the irregularities which appear in figures for the smaller groups balance out so that the figures for the cumulative groups show certain constant relationships. The average wages shown at the end of this table, for the respective groups by



number of working days per week and number of hours per day, clearly illustrates the point that men working the longer hours and the longer week earned smaller average annual wages.

These figures also show that the 5½-day week prevailed among reporting establishments of the construction industry during 1929. The greater frequency of the 5½-day week among subcontractors coupled with a fair representation among general contractors, accounted for this average. Although the greater number of general contractors also reported the 5½-day week in force, more than half the men employed by general contractors worked the 6-day week. More than 90 per cent of the workmen employed by subcontractors worked an 8-hour day, while only about 4 per cent worked 10 hours. Among the workmen employed by general contractors, on the other hand, 62 per cent worked an 8-hour day and 26 per cent a 10-hour day. To any person who is acquainted with the general conditions which determine hours and wages of construction labor, the deductions to be made from these comparisons are obvious.

**Other conditions affecting labor.**—A summary of general conditions affecting labor is presented in Table XIX and in detail by States in Table XXXIV of Chapter IV. This information relating to strikes and lockouts, accidents, and fatalities was not tabulated for the individual States except in this summary form. These are, therefore, the only tabulations of this kind in the reports of the construction industry. These figures are very general, since no attempt has been made to analyze them in detail. Their value will probably be found to be correspondingly limited in specific application to individual problems, but as an indicator of the importance of these factors in the construction industry during 1929 they may be of general interest.

**Strikes and lockouts.**—The occurrence of, or freedom from loss of time through strikes and lockouts during

the year was reported by 26,547 establishments of the larger group, 97.8 per cent of that number reporting no loss of time from these causes. Of the few who reported the occurrence of labor disputes resulting in loss of time, 38.3 per cent were in the Middle Atlantic division and 19.9 per cent in the East North Central division. Since more than half the reported number of workmen were employed by establishments located in these two divisions, such ratios are what might normally be expected. Despite the apparent frequency of labor disputes in these two divisions, in the Middle Atlantic division only 3 per cent of reporting establishments showed loss of time from these causes and in the East North Central division less than 2 per cent so reported, while in the West North Central division 4 per cent of the establishments reported loss of time. According to the reports of establishments in other sections of the country, the construction industry in the South Atlantic, East South Central, and Pacific divisions was comparatively free from labor disturbances during the year.

**Accidents.**—The occurrence of 79,239 accidents was reported by 25,422 establishments which answered this question, making an average of about three accidents for each reporting establishment. The greatest relative number of accidents was reported in the West South Central division, while the lowest accident rate was shown for the Pacific States.

**Fatalities.**—The number of fatalities in connection with construction work was reported by 27,265 establishments, of which a large percentage reported no fatalities at all. The actual number of fatalities reported was 2,406, or less than 9 for each 100 reporting establishments. The highest average number of fatalities was almost 10 for each 100 establishments reporting in the South Atlantic division and the lowest about 5½ for each 100 establishments in the Pacific division.

TABLE XIX.—LOSS OF TIME THROUGH STRIKES AND LOCKOUTS AND NUMBER OF ACCIDENTS AND FATALITIES

LOCATION OF OFFICES OF REPORTING ESTABLISHMENTS	LOSS OF TIME THROUGH STRIKES AND LOCKOUTS				ACCIDENTS			FATALITIES		
	Total number reporting	Some loss of time			Total number reporting	Number of accidents		Total number reporting	Number of fatalities	
		Number reporting	Per cent of—			Total	Average per 100 establishments		Total	Average per 100 establishments
			United States	Total						
United States.....	26,547	572	100.0	2.2	25,422	79,239	311.7	27,265	2,406	8.8
<b>Geographic divisions:</b>										
New England.....	2,480	69	12.1	2.8	2,394	7,380	308.3	2,540	223	8.8
Middle Atlantic.....	7,418	219	38.3	3.0	7,119	26,065	366.0	7,567	718	9.5
East North Central.....	6,853	114	19.9	1.7	6,617	19,782	299.0	7,034	654	9.3
West North Central.....	2,161	86	15.0	4.0	2,047	6,884	338.9	2,212	203	9.2
South Atlantic.....	1,925	18	3.1	.9	1,788	5,008	280.1	1,086	196	9.9
East South Central.....	811	3	.5	.4	799	1,479	185.1	851	67	7.9
West South Central.....	1,384	25	4.4	1.8	1,290	6,905	542.2	1,419	139	9.8
Mountain.....	623	10	2.8	2.6	597	1,070	180.2	843	39	6.1
Pacific.....	2,892	22	3.8	.8	2,771	4,680	167.1	3,013	167	5.5

## CONSTRUCTION EQUIPMENT

The end-of-the-year inventory value of equipment used in construction work was reported by 26,718 establishments which had a business of over \$25,000 during 1929. The value of equipment owned by establishments which did not report this item has been estimated as already explained in the discussion of Table XVI. These figures are presented for the principal groups of contractors and for all classes of establishments in the respective geographic divisions in Table XX, together with parallel columns for other items with which they form interesting comparisons.

Construction equipment valued at more than \$449,000,000 was reported by these establishments

whose actual work during the year amounted in the aggregate, to \$4,795,000,000. About 80 per cent of the reported value of all construction equipment was owned by general contractors, almost 20 per cent by subcontractors, and only two-tenths of 1 per cent by operative builders. An investment in working equipment of 9.4 per cent of the value of actual work done was reported by all classes of establishments. The corresponding investment of operative builders was 1.4 per cent, and that of subcontractors 4.9 per cent, while the inventory of construction equipment of general contractors was 12.3 per cent of the value of the year's work.

TABLE XX.—INVENTORY VALUE OF CONSTRUCTION EQUIPMENT OWNED IN COMPARISON WITH WORK DONE AND WAGES PAID

CLASSIFICATION AND LOCATION OF OFFICES OF REPORTING ESTABLISHMENTS	Establishments reporting	Value of construction work done by own forces <sup>1</sup>	Wages paid for construction labor	ESTIMATED INVENTORY VALUE OF CONSTRUCTION EQUIPMENT			
				Amount <sup>2</sup>	Per cent of—		
					All classes, total	Construction work done	Wages paid
All classes of establishments.....	30,597	\$4,794,772,065	\$1,467,541,901	\$449,118,718	100.0	9.4	30.6
Operative builders.....	760	50,331,888	13,145,859	630,173	.2	1.4	5.3
General contractors.....	14,706	2,926,488,643	914,112,368	360,031,201	80.2	12.3	39.4
Subcontractors.....	15,081	1,817,902,136	540,283,674	88,397,254	19.7	4.0	18.4
<i>All classes by geographic divisions:</i>							
New England.....	2,780	370,191,822	130,649,907	27,346,115	6.1	7.4	20.9
Middle Atlantic.....	8,540	1,608,072,272	619,448,095	140,132,178	31.2	8.7	27.0
East North Central.....	7,934	1,224,633,963	374,716,637	109,630,204	24.4	8.0	20.2
West North Central.....	2,490	367,544,399	104,914,237	43,870,604	9.8	11.0	41.8
South Atlantic.....	2,184	368,233,201	95,695,443	33,355,770	7.4	9.0	34.0
East South Central.....	936	137,100,184	35,473,644	16,346,151	3.6	11.0	46.1
West South Central.....	1,609	259,849,528	69,822,701	25,409,080	5.7	9.0	36.4
Mountain.....	709	74,293,022	21,246,932	10,679,295	2.4	14.4	50.3
Pacific.....	3,409	417,069,274	115,604,305	42,440,341	9.5	10.2	36.7

<sup>1</sup> Obtained by subtracting the value of subcontract work let from all construction business handled. See Table VII, p. 24.

<sup>2</sup> See text on p. 36, for explanation of these estimates.

More than half the total inventory value of equipment was reported by all classes of establishments in the Middle Atlantic and East North Central divisions, but the relative value of equipment to value of work done was lower in these two divisions than in any other except New England. In the Mountain division the inventory value of equipment, amounting to 14 per cent of the value of work done, indicates a possible lack of sufficient work to employ this equipment to capacity during the year, which was undoubtedly a contributing cause of the exceptionally high proportion of other overhead (including depreciation on equipment) shown for this division in Table X.

In comparison with wages paid for construction labor the inventory value of equipment owned by all classes of reporting establishments was less than one-third as great as wages paid. For general contractors this ratio was higher, 39.4 per cent, and for subcontractors lower, 16.4 per cent, than the average for all classes. Among the geographic divisions, the ratio of value of equipment to wages paid was highest in the Mountain division and lowest in New England. A summary of these figures, by States, is shown in Table XXXV of Chapter IV.

## CLASSIFICATION OF CONSTRUCTION BUSINESS

**Class of ownership of construction work.**—The total projected value of construction business classified by each designated class of ownership (private construction, quasi public or community construction, and public construction), or by each type of construction work, is presented in Tables XXI to XXV, inclusive. These projected figures were computed for the two principal groups of establishments, general contractors (including operative builders) and subcontractors, and the derived totals for these two groups were added to obtain the total for all classes of establishments. The basic figures for these computations are shown in Table 2 of Chapter V of this report. In each individual breakdown of the projected figures, the total value of all business reported for each of the contractor groups was prorated in the relative proportions shown by the distribution of the reported partial figures for that group.

There was not sufficient time to make these projections individually for each State. For this reason, the State figures presented in the corresponding analysis

in Tables XXXVI to XXXIX, inclusive, of Chapter IV, are those actually reported by all classes of establishments for each individual breakdown. For certain items in these two sets of figures the corresponding percentages do not agree exactly, although they are approximately the same. The cause of this apparent discrepancy may be explained by a comparison of the figures relating to privately owned construction in Table XXI of this chapter and in Table XXXVI of Chapter IV, which show the breakdown by class of ownership.

The figures for all classes of establishments in standard Table 2 of Chapter V of this report are the sum of reported figures for general contractors and subcontractors. By a comparison of the grand total and the total distributed by class of ownership reported by each of these component groups, it may be seen that almost 98 per cent of the total reported business of all general contractors (including operative builders) throughout the United States, was distributed according to class of ownership, while only a little more than 90 per cent of the total reported business of subcontractors was so distributed. For each of these two groups the respective percentages for the individual classes of ownership are identical with those shown in the fourth and seventh columns of Table XXI.

In the reported breakdown for all classes of establishments in the United States, private construction work represents 67.8 per cent of the distributed total, as shown in the analysis of reported figures in Table XXXVI of Chapter IV. But in these reported figures, as we have just seen in the figures for all classes of establishments, the general contractor group received greater weight than the subcontractor group in the proportion of about 98 to 90. When the distribution of the business of each of the two contractor groups was raised to the 100 per cent level, a greater adjustment had to be made in the figures for subcontractors because their reported distribution was less complete. Moreover, in the reported distribution of the business of subcontractors among the three classes of ownership, 82.7 per cent was privately owned. Therefore, in the 100 per cent projection, 82.7 per cent of the undis-

tributed amount was allocated to this item, which resulted in a corresponding increase in the value of private business handled by all classes of establishments and raised the adjusted percentage for this class of business to 68.2 per cent instead of 67.8 per cent, shown in the reported distribution. The percentages in the adjusted distribution for all classes of establishments are thus shown to be more accurate than those based upon the sum of actual reported figures for the general contractor and subcontractor groups.

The aggregate value of construction business handled by all classes of establishments which had a business of over \$25,000 during 1929, was subdivided according to class of ownership into the following proportional groups: Private construction, 68.2 per cent; quasi public or community construction, 5.7 per cent; and public construction, 26.1 per cent, as shown in Table XXI. The total business of general contractors and operative builders combined was distributed in somewhat similar proportions, but almost 83 per cent of the business of subcontractors was done for private owners, with only 6 per cent on quasi public or community work and 11 per cent on public construction.

If the approximate value of actual construction work by classes of ownership is desired, this may be obtained by applying these percentages to the last amount in the first column of Table VIII of this chapter, designated as "Value of work done by own force." By this method, the approximate value of construction work done by all classes of establishments of the larger business group according to class of ownership would be as follows: Private construction, \$3,270,035,000; quasi public or community construction, \$273,302,000; public construction, \$1,251,436,000. The corresponding percentages for general contractors (including operative builders) in the fourth column of Table XXI, applied to the combined value of work done by operative builders and general contractors in Table VIII, would give the approximate value of work done by this group according to the respective classes of ownership, and corresponding figures for subcontractors may be found by the same method.

TABLE XXI.—OWNERSHIP OF CONSTRUCTION BUSINESS HANDLED BY ALL ESTABLISHMENTS

CLASS OF OWNERSHIP	ALL CLASSES OF ESTABLISHMENTS		GENERAL CONTRACTORS <sup>1</sup>			SUBCONTRACTORS		
	Value	Per cent of all business	Value	Per cent of—		Value	Per cent of—	
				All business	All classes		All business	All classes
All construction business.....	\$6,250,266,665	100.0	\$4,370,890,529	100.0	69.9	\$1,879,376,136	100.0	30.1
Private.....	4,260,282,270	68.2	2,705,762,254	61.9	63.5	1,554,530,016	82.7	36.5
Quasi public or community.....	359,389,659	5.7	240,464,775	5.5	66.9	118,034,884	6.3	33.1
Public.....	1,630,594,736	26.1	1,424,663,500	32.6	87.4	205,911,236	11.0	12.6
Federal.....	124,293,896	2.0	106,492,598	2.4	85.7	17,801,298	.9	14.3
State.....	511,359,549	8.2	458,487,573	10.5	89.7	52,871,976	2.8	10.3
County or township.....	261,088,976	4.2	225,414,095	5.2	86.3	35,674,881	1.9	13.7
Municipal.....	733,852,315	11.7	634,289,234	14.5	86.4	99,563,081	5.3	13.6

<sup>1</sup> Includes operative builders.

A little less than two-thirds of all privately owned construction work was reported by general contractors (including operative builders), but this group of establishments reported slightly more than two-thirds of the quasi public or community construction and about seven-eighths of all public construction. Corresponding percentages for the subcontractor group are also shown in the last column of Table XXI.

In the last section of this table publicly owned construction business is further subdivided according to class of public ownership into Federal, State, county or township, and municipal groups. Of all construction business reported by establishments which had a business of over \$25,000, only 2 per cent was for the Federal Government. These figures did not include road work paid for by Federal aid to States, since this work was reported by contractors as State work in accordance with instructions for filling out reports. Construction business for States, including Federal aid road work, constituted 8 per cent of the total business of all classes of establishments, while 4 per cent of their total business was for counties or townships and 12 per cent for municipalities. If the percentages in the second column of Table XXI are applied to the computed total value of construction work done, amounting to \$4,794,773,000, the approximate value of each class of public construction work done was

Federal, \$95,895,000; State, \$393,171,000; county or township, \$201,380,000; and municipal, \$560,988,000.

**Class of construction.**—The distribution according to class of construction of all business handled under general contract or directly for owners is presented in Table XXII. Of the general contract business of all classes of establishments about two-thirds was building, 15 per cent highway and street work and 13 per cent public works and utilities construction, leaving only about 9 per cent for the other listed classes of construction. General contractors handled 85 per cent of all building work under general contract, while subcontractors reported 15 per cent of such work directly for owners. The kinds of work which were done by subcontractors directly for the owner were, in the majority of cases, repairs or remodeling and a small part of the work reported by general contractors was also of this nature. More than 90 per cent of each other kind of construction business listed was handled by general contractors, except the small miscellaneous item which was about evenly divided. Almost 84 per cent of the business done directly for owners by subcontractors was building work, and less than 8 per cent public works and utilities construction. Corresponding totals for the principal classes are shown for the respective States in Table XXXVIII of Chapter IV.

TABLE XXII.—VALUE OF EACH CLASS OF CONSTRUCTION HANDLED UNDER GENERAL CONTRACT OR DIRECTLY FOR OWNERS

CLASS OF CONSTRUCTION	ALL CLASSES OF ESTABLISHMENTS		GENERAL CONTRACTORS <sup>1</sup>			SUBCONTRACTORS		
	Value	Per cent of all business under general contract	Value	Per cent of—		Value	Per cent of—	
				All business under general contract	All classes		All business directly for owner	All classes
All business under general contract or directly for owner.....	\$4, 011, 765, 910	100. 0	\$4, 325, 405, 093	100. 0	88. 1	\$596, 360, 817	100. 0	11. 9
Building.....	3, 270, 048, 218	66. 6	2, 770, 102, 111	64. 3	85. 0	491, 546, 107	83. 8	15. 0
Highway and street.....	721, 431, 194	14. 7	714, 995, 112	16. 5	99. 1	6, 435, 082	1. 1	. 0
Water power development.....	23, 285, 734	. 5	22, 673, 406	. 5	97. 4	612, 328	. 1	2. 0
Railroad and car line.....	90, 177, 973	1. 8	87, 519, 314	2. 0	97. 0	2, 664, 659	. 5	3. 0
Public works and utilities.....	644, 095, 537	13. 1	599, 005, 911	13. 8	92. 0	45, 089, 626	7. 7	7. 0
Air transport work.....	6, 835, 112	. 1	6, 528, 007	. 1	95. 5	307, 105	. 1	4. 5
Subway, other than buildings.....	71, 911, 572	1. 5	71, 911, 572	1. 7	100. 0			
Miscellaneous.....	83, 380, 570	1. 7	43, 675, 660	1. 0	52. 4	39, 704, 910	6. 8	47. 0

<sup>1</sup> Includes operative builders.

**Class of buildings.**—Building construction done under general contract or directly for owners, valued at more than three and a quarter billion dollars, was reported by all classes of establishments of the larger business group throughout the United States. Of this total, commercial and residential building each represented a little less than 28 per cent, manufacturing building 13 per cent, and educational building 10 per cent, as shown in Table XXIII. No other designated type of building represented as much as 5 per cent of all building business. A slightly larger proportion of the business of general contractors (in-

cluding operative builders) consisted of commercial building, valued at 29 per cent of their total, while residential building was only 26 per cent, and manufacturing and educational building in about the same proportions as for all classes of establishments. Subcontractors, on the other hand, showed that more than one-third of all their building work done directly for owners was on residential buildings, 19 per cent on commercial buildings, 16 per cent on manufacturing buildings, and less than 9 per cent on educational buildings. General contractors handled more than 90 per cent of the total of all building work under

general contract or directly for owners on hotels, military and naval buildings, public buildings, such as court houses, jails, etc., religious and memorial buildings, social and recreational buildings, and rail and

water transportation buildings. The distribution of total reported building work in each State is presented in standard Table 2 of the respective State reports on the construction industry.

TABLE XXIII.—VALUE OF EACH CLASS OF BUILDING CONSTRUCTION HANDLED UNDER GENERAL CONTRACT OR DIRECTLY FOR OWNERS

CLASS OF BUILDING	ALL CLASSES OF ESTABLISHMENTS		GENERAL CONTRACTORS <sup>1</sup>			SUBCONTRACTORS		
	Value	Per cent of all building	Value	Per cent of—		Value	Per cent of—	
				All building	All classes		All building	All classes
All building construction.....	\$3,270,648,218	100.0	\$2,779,102,111	100.0	85.0	\$491,546,107	100.0	15.0
Commercial.....	908,393,810	27.8	816,453,812	29.4	89.9	91,939,998	18.7	10.1
Educational.....	328,909,383	10.1	287,114,733	10.3	87.3	41,791,650	8.5	12.7
Hotel.....	106,609,197	3.3	95,083,320	3.5	90.1	10,545,877	2.1	9.9
Hospital and institutional.....	167,038,418	4.8	138,161,550	5.0	88.0	18,876,868	3.8	12.0
Manufacturing.....	432,381,105	13.2	355,049,150	12.8	82.3	76,440,946	15.6	17.7
Military and naval.....	14,553,275	2.0	13,351,329	.5	91.7	1,201,946	.2	8.3
Public: Courts, jails, etc.....	66,654,459	2.0	61,250,828	2.2	91.9	5,403,631	1.1	8.1
Religious and memorial.....	100,639,402	3.1	90,836,983	3.3	90.3	9,802,419	2.0	9.7
Residential.....	903,405,248	27.6	729,084,802	26.2	80.7	174,340,386	35.5	19.3
Social and recreational.....	86,119,298	2.6	77,489,821	2.8	90.0	8,629,477	1.8	10.0
Air transport.....	15,453,014	.5	13,729,964	.5	88.8	1,723,050	.4	11.2
Rail and water transportation.....	46,675,715	1.4	43,652,083	1.6	93.5	3,022,732	.6	6.5
Miscellaneous.....	108,918,894	3.2	66,091,707	2.0	54.0	47,827,127	9.7	46.0

<sup>1</sup> Includes operative builders.

**Class of public works and utilities.**—Public works and utilities construction business, handled under general contract or directly for owners by all classes of establishments, was valued at \$644,095,537. About one quarter of this amount was the value of bridge, tunnel, and similar work reported by all classes of establishments as shown in the analysis of the figures in Table XXIV. Central station light and power plant work represented another quarter of the total, and city sewage disposal, drainage, and water supply,

combined, a third quarter. The distribution reported by general contractors was approximately the same as that for all classes of establishments, but almost 90 per cent of the relatively small amount of public works and utilities work reported by subcontractors was done on three classes, bridge, tunnel, etc., central station light and power plant and water supply. A breakdown of public works and utilities construction in each State is shown in standard Table 2 of the respective State reports on the construction industry.

TABLE XXIV.—VALUE OF EACH CLASS OF PUBLIC WORKS AND UTILITIES CONSTRUCTION HANDLED UNDER GENERAL CONTRACT OR DIRECTLY FOR OWNERS

CLASS OF CONSTRUCTION	ALL CLASSES OF ESTABLISHMENTS		GENERAL CONTRACTORS <sup>1</sup>			SUBCONTRACTORS		
	Value	Per cent of public works and utilities	Value	Per cent of—		Value	Per cent of—	
				Public works and utilities	All classes		Public works and utilities	All classes
Public works and utilities.....	\$644,095,537	100.0	\$589,005,911	100.0	93.0	\$45,089,626	100.0	7.0
Bridge, tunnel, etc.....	162,629,794	25.2	146,212,191	24.4	89.9	16,417,603	36.4	10.1
Central station, light and power plant.....	188,173,448	24.6	142,953,388	23.9	80.4	15,220,060	33.8	9.6
Dock, pier, retaining wall, etc.....	40,101,679	6.2	38,983,115	6.5	97.2	1,118,564	2.5	2.8
Flood control, irrigation, and land drainage.....	26,282,216	4.1	25,758,489	4.3	98.1	523,727	1.1	1.9
Refuse disposal plant.....	4,280,368	.7	3,845,955	.6	89.9	434,413	1.0	10.1
Park, grounds, etc.....	4,304,653	.7	3,831,928	.6	88.0	472,727	1.0	11.0
River and harbor improvement.....	47,182,080	7.3	47,057,819	7.9	97.7	125,167	.3	.3
Sewage disposal and drainage.....	96,672,088	14.0	94,297,667	15.7	98.6	1,374,421	3.0	1.4
Water supply.....	71,913,365	11.2	63,209,698	10.6	87.9	8,708,667	19.3	12.1
Oil and natural gas pipe line.....	25,503,153	4.0	25,522,628	4.3	99.8	40,527	.1	.2
Telephone line and system.....	3,140,898	.5	2,838,268	.5	90.4	302,130	.7	9.6
Radio tower, etc.....	176,575	( <sup>2</sup> )	176,575	( <sup>2</sup> )	100.0	—	—	—
Miscellaneous.....	4,604,814	.7	4,338,194	.7	92.4	356,620	.8	7.6

<sup>1</sup> Includes operative builders.  
<sup>2</sup> Less than one-tenth of 1 per cent.

## CONSTRUCTION—UNITED STATES SUMMARY

**Class of subcontract work.**—The distribution of the \$1,338,500,755 valuation of all business done under subcontract by all classes of establishments, presented in Table XXV, shows that 27 per cent of all such work consisted of heating and plumbing, including the related lines of pipe covering, automatic temperature control and automatic sprinkler systems. Other kinds of work which represented a considerable proportion of the total value were electrical, 9.2 per cent; roofing and sheet-metal work, 8.2 per cent; marble and tiling, 7.5 per cent; steel erection, 6.1 per cent; and plastering

5.9 per cent. Almost the entire amount of business done under subcontract was reported by establishments classified as subcontractors except in a few lines of work in which general contractors were also reported to be engaged, notably in excavating, concreting, carpentering and woodflooding, and steel erection. Relatively smaller amounts of masonry and stone work were also reported as done under subcontract by general contractors. Table XXXIX of Chapter IV gives a similar analysis of all business done under subcontract by States.

TABLE XXV.—VALUE OF EACH PRINCIPAL CLASS OF WORK HANDLED UNDER SUBCONTRACT

CLASS OF SUBCONTRACT WORK	ALL CLASSES OF ESTABLISHMENTS		GENERAL CONTRACTORS <sup>1</sup>			SUBCONTRACTORS		
	Value	Per cent of all business under subcontract	Value	Per cent of—		Value	Per cent of—	
				All business under subcontract	All classes		All business under subcontract	All classes
All business under subcontract.....	\$1,338,500,755	100.0	\$45,435,436	100.0	3.4	\$1,293,015,319	100.0	96.6
Excavating.....	35,702,238	2.7	7,156,810	15.7	20.0	28,545,428	2.2	80.0
Concreting.....	62,457,128	4.7	7,276,878	16.0	11.7	55,180,250	4.3	88.3
Masonry.....	58,299,447	4.4	2,668,731	5.9	4.6	55,630,716	4.3	95.4
Stonework.....	26,187,459	2.0	653,453	1.4	2.5	25,534,006	2.0	97.5
Steel erection.....	82,237,260	6.1	5,516,802	12.1	6.7	76,720,458	5.9	93.3
Roofing and sheet-metal work.....	110,274,400	8.2	165,329	.4	.1	110,109,071	8.5	99.9
Roofing.....	47,945,410	3.6	147,503	.3	.3	47,797,907	3.7	99.7
Sheet-metal work.....	44,800,315	3.4	17,826	(?)	(?)	44,842,489	3.5	100.0
Roofing and sheet metal combined.....	17,468,675	1.3				17,468,675	1.4	100.0
Electrical.....	123,794,221	9.2	246,820	.5	.2	123,547,401	9.6	99.8
Heating and plumbing.....	305,472,922	27.3	326,811	.7	.1	305,146,111	28.2	99.1
Heating and piping.....	140,930,648	10.5	153,965	.3	.1	140,776,683	10.9	99.0
Pipe covering.....	13,523,794	1.0	10,763	(?)	.1	13,513,031	1.0	99.0
Plumbing.....	159,163,330	11.9	192,083	.4	.1	159,001,247	12.3	99.9
Plumbing and heating combined.....	41,136,942	3.1				41,136,942	3.2	100.0
Automatic temperature control.....	4,681,829	.3				4,681,829	.4	100.0
Automatic sprinkler system.....	6,036,379	.5				6,036,379	.5	100.0
Elevator construction.....	64,482,343	4.8				64,482,343	5.0	100.0
Ornamental iron.....	35,586,411	2.7	63,673	.1	.2	35,522,738	2.7	99.8
Carpentering and woodflooding.....	29,994,190	2.2	2,574,382	5.7	8.6	27,419,808	2.1	91.4
Marble and tiling.....	99,863,257	7.5	49,955	.1	.1	99,813,302	7.7	99.0
Painting and decorating.....	58,553,179	4.4	89,593	.2	.2	58,463,616	4.5	99.8
Plastering and lathing.....	78,334,771	5.9	503,462	1.1	.6	77,831,309	6.0	99.4
All other classes.....	107,261,529	8.0	18,192,767	40.0	17.0	89,068,762	6.9	83.0

<sup>1</sup> Includes operative builders.<sup>2</sup> Less than one-tenth of 1 per cent.

## FIELD OF CONSTRUCTION ACTIVITY

**All reporting establishments.**—The field of construction activity of establishments engaged in various lines of work in different localities is indicated in Table XXVI by figures which show the location of construction business in the home city, in the home State, and outside the home State, as reported by 29,799 establishments throughout the United States which had a business of over \$25,000 during 1929. The total value of business of which the location was reported was \$6,013,000,000. Of this amount, that reported by all classes of establishments as done in the home city was valued at \$3,436,000,000, or 57.1 per cent of the total, in the home State, including the home city, at \$4,956,000,000, or 82.4 per cent of the total, and outside the home State at \$1,057,000,000, or 17.6 per cent of the total.

The parallel analysis of the location of the business reported by operative builders shows that 94.4 per

cent was done in the home city and 99.4 per cent in the home State. The comparatively small amount which was done outside the home State was reported by establishments in only four States. These represented three types of situations, one in which the combined report of the home office also covered business done by established branches located in other States; the second in which business was done in adjacent States, probably in the suburbs of the city in which the reporting establishment was located; and an exceptional case in which a speculative builder who summered in the mountains and wintered at the seashore did actual construction work in both places in widely separated States. General contractors reported 51.1 per cent of their total business as done in the home city, 80.3 per cent in the home State, and 19.7 per cent outside the home State. Subcontractors did a greater percentage of their business in the narrower field, 67.9 per cent in the home city, 85.8 per cent in the home State, and only 14.2 per cent outside.

# CONSTRUCTION—UNITED STATES SUMMARY

**TABLE XXVI.—LOCATION IN THE HOME CITY, IN THE HOME STATE, AND ELSEWHERE, OF CONSTRUCTION BUSINESS REPORTED BY ESTABLISHMENTS THROUGHOUT THE UNITED STATES**

CLASSIFICATION AND LOCATION OF OFFICES OF REPORTING ESTABLISHMENTS	Establishments reporting	Total value of business reported	IN HOME CITY		IN HOME STATE		OUTSIDE HOME STATE	
			Value	Per cent of total business	Value	Per cent of total business	Value	Per cent of total business
<b>All classes of establishments</b> .....	29, 799	\$6, 013, 034, 932	\$3, 436, 147, 534	57. 1	\$4, 955, 681, 207	82. 4	\$1, 057, 352, 825	17. 6
Operative builders.....	731	147, 848, 562	139, 538, 536	94. 4	146, 921, 302	99. 4	927, 260	. 6
General contractors.....	14, 382	4, 095, 988, 419	2, 094, 695, 359	51. 1	3, 289, 989, 866	80. 3	805, 988, 553	19. 7
Subcontractors.....	14, 686	1, 769, 197, 051	1, 201, 913, 639	67. 9	1, 518, 760, 039	85. 8	250, 437, 012	14. 2
<b>All classes by geographic divisions:</b>								
New England.....	2, 715	458, 307, 166	203, 701, 385	44. 5	329, 165, 830	71. 8	129, 141, 336	28. 2
Middle Atlantic.....	8, 295	2, 136, 487, 182	1, 267, 049, 140	59. 3	1, 778, 670, 074	83. 3	357, 817, 058	16. 7
East North Central.....	7, 780	1, 517, 505, 001	989, 369, 608	65. 2	1, 292, 404, 862	85. 2	225, 100, 136	14. 8
West North Central.....	2, 427	419, 368, 399	189, 371, 953	45. 2	293, 518, 830	70. 0	125, 849, 569	30. 0
South Atlantic.....	2, 124	423, 128, 921	229, 915, 351	52. 2	309, 575, 930	73. 2	119, 552, 924	24. 0
East South Central.....	898	186, 320, 065	63, 847, 285	40. 8	118, 824, 741	70. 0	37, 495, 324	9. 7
West South Central.....	1, 656	293, 094, 559	146, 661, 196	49. 7	264, 553, 528	90. 3	28, 541, 031	15. 9
Mountain.....	688	86, 169, 323	43, 322, 355	56. 1	72, 428, 127	84. 1	13, 741, 196	5. 0
Pacific.....	3, 316	522, 593, 466	307, 919, 261	58. 9	496, 630, 285	95. 0	26, 054, 181	5. 0

Among the respective geographic divisions the greatest concentration of construction business in the home city was reported by establishments in the East North Central, Middle Atlantic, Pacific, and Mountain divisions, in the order named. The smallest proportion of work in the home city was reported by establishments in the East South Central and New England divisions. Reference to Table XL of Chapter IV, which gives corresponding figures for the respective States, shows that establishments in the States of Illinois, Michigan, and Wisconsin, in the East North Central division, and in New York State in the Middle Atlantic division, reported that more than two-thirds of their total business was located in the home city. Reporting establishments in the State of Massachusetts, in the New England division, on the other hand, showed only a little more than one-third of their total business in the home city.

The highest percentage of construction business located within the home State was reported by all classes of establishments in the Pacific division. An analysis of the figures for the three States in this division indicates that approximately 95 per cent of the reported business of establishments in both Washington and California was located in the home State. Although establishments in the State of Oregon reported the location of almost a quarter of their business outside the home State, the relative amount of their business in comparison with the total for the division was too small to greatly affect the distribution of that total.

More than 25 per cent of construction business outside the home State was reported by establishments located in the West North Central, New England, and South Atlantic divisions. Work outside the home State in large volume constituted more than one-third of the total business in Nebraska, Georgia, Massachusetts, Minnesota, and more than one-quarter in Iowa, Missouri, and South Dakota. A study of the analysis of the location of construction business reported by each class of establishments, presented in Table 3 of

Chapter V of this report and in each individual State report, indicates that the classes of establishments which most frequently reported work in large quantities outside the home State were the following:

CLASS	Business outside State	Per cent of total
Manufacturing building.....	\$60, 802, 836	67. 2
Highway.....	93, 008, 833	21. 8
Bridge and culvert.....	53, 290, 735	40. 8
Dredging, river, harbor, etc.....	45, 275, 760	43. 9
Railroad.....	59, 590, 101	56. 7
Central station.....	77, 425, 977	49. 3
Steel erection.....	37, 593, 705	30. 0
Pipe line and miscellaneous metal work.....	38, 747, 104	58. 6

**Establishments of principal cities.**—The location of construction business reported by establishments in cities of over 100,000 in 1930, presented in Table XXVII, shows that 61.3 per cent of their business was located in the home city, and 18.7 per cent outside the home State. In contrast with the figures for all establishments throughout the country, these figures indicate that establishments in the larger metropolitan districts did comparatively less work in other localities within the home State, and a greater proportion of work outside the home State. Thus, it appears that establishments in the larger urban areas had a broader field of activity, but attention should also be called to the fact that central offices of establishments submitting combined reports for all their branches were usually located in the larger business centers of the country. The effect of the inclusion of combined reports in the figures for any given locality has been treated at some length in the discussion of the distortion of distribution ratios for construction materials. In this connection, however, it may be mentioned that some part of the business reported as located outside the home State in a combined report from the central office of an establishment which had branches in other States, would have appeared as work in the home State if an individual report had been submitted for each local branch. Similar figures for principal cities in individual States are shown in Table XLI of Chapter IV.

## CONSTRUCTION—UNITED STATES SUMMARY

TABLE XXVII.—LOCATION IN THE HOME CITY, IN THE HOME STATE, AND ELSEWHERE, OF CONSTRUCTION BUSINESS REPORTED BY ESTABLISHMENTS IN 92 CITIES OF OVER 100,000 POPULATION

LOCATION OF CITIES AND OFFICES OF REPORTING ESTABLISHMENTS	Number of cities	Establishments reporting	Total value of business reported	IN HOME CITY		IN HOME STATE		OUTSIDE HOME STATE	
				Value	Per cent of total business	Value	Per cent of total business	Value	Per cent of total business
United States <sup>1</sup> .....	92	16,233	\$4,341,630,622	\$2,061,406,644	47.3	\$3,528,244,903	81.3	\$813,444,719	18.7
<b>Geographic divisions:</b>									
New England.....	13	1,124	230,738,880	112,508,805	38.0	183,060,876	63.2	106,678,004	36.8
Middle Atlantic.....	18	4,703	1,672,833,414	1,050,953,543	62.8	1,351,302,041	80.8	321,490,773	19.2
East North Central.....	19	4,683	1,128,029,555	704,803,300	70.5	958,611,683	85.0	169,517,972	15.0
West North Central <sup>1</sup> .....	8	1,183	207,040,444	131,973,705	49.3	181,785,381	67.8	80,155,063	32.2
South Atlantic.....	9	1,008	242,032,064	100,212,043	41.3	190,771,322	78.5	52,100,742	21.5
East South Central.....	6	506	108,043,250	44,878,124	41.2	70,351,082	72.8	20,502,168	27.2
West South Central.....	8	854	203,275,571	104,871,475	51.6	182,135,119	89.6	21,140,452	10.4
Mountain.....	2	219	20,351,240	19,555,130	96.0	26,087,740	88.8	3,293,404	11.2
Pacific.....	9	1,903	398,565,204	241,400,409	60.6	376,149,153	94.1	23,410,051	5.9

<sup>1</sup> Not including Kansas City, Kans., for which too few reports were received to justify separate tabulation of this breakdown.

The figures in Table XXVIII present data for comparison at a glance of the average annual business of establishments of the larger business group, in the 93 principal cities of the United States and in all other areas outside those cities. The average business of all classes of reporting establishments throughout the United States was \$204,300; in the larger cities, \$269,100; and in other areas, \$126,300. The average annual business of operative builders during 1929 was

\$204,700, that of general contractors, \$285,600, and that of subcontractors, \$124,600. The number and average business per establishment for both operative builders and subcontractors were about twice as great in the larger cities as in the outlying areas, while the average business of general contractors was almost three times as great in the larger cities, although the number of such establishments was about a sixth less than in other localities.

TABLE XXVIII.—TOTAL AND AVERAGE VALUE OF BUSINESS REPORTED BY ESTABLISHMENTS WHOSE OFFICES WERE LOCATED THROUGHOUT THE UNITED STATES, IN 93 PRINCIPAL CITIES AND IN OTHER LOCALITIES

CLASSIFICATION OF ESTABLISHMENTS	ENTIRE UNITED STATES			PRINCIPAL CITIES			OTHER LOCALITIES		
	Establishments reporting	Value of business		Establishments reporting	Value of business		Establishments reporting	Value of business	
		Total	Average		Total	Average		Total	Average
All classes of establishments.....	30,687	\$8,250,227,000	\$204,300	16,711	\$4,406,047,000	\$269,100	13,396	\$1,753,320,000	\$126,300
Operative builders.....	750	153,524,000	204,700	516	124,025,000	242,100	234	23,500,000	122,200
General contractors.....	14,760	4,217,367,000	285,000	6,090	2,039,570,000	430,400	8,076	1,277,788,000	158,200
Subcontractors.....	15,081	1,879,376,000	124,000	9,505	1,432,443,000	160,700	5,570	446,933,000	80,200

**Business of establishments of 93 principal cities and other localities.**—A summary of statistics relating to the business of establishments whose offices were located in 93 principal cities of 100,000 population each, is presented in Table XXIX, with a parallel tabulation for establishments located outside these cities. A comparison of the corresponding items shows their relative importance in the business operations of contracting establishments in the larger cities and in other localities.

Both in number and in proportion of total business handled, the operative builder and subcontractor were relatively more important in the metropolitan areas, where they handled 2.8 per cent and 31.9 per cent, respectively, of the total reported business, and the general contractor, 65.4 per cent. In other areas

throughout the country the general contractor group reported 72.9 per cent of all business. The percentage of all business done by own forces shows that a considerably greater part of actual work was done by general contractors outside the larger cities with less tendency toward specialization. This is also borne out by the ratios to total business of various items for all classes of establishments and for each contractor group. In the cities 23.1 per cent of all business was reported as handled under subcontract and in other localities only 17 per cent. Similarly, the relative value of subcontract work let by all classes of establishments was greater in cities, 26.2 per cent, than elsewhere, 15.8 per cent, and each contractor group also sublet a greater part of its work in the cities.



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**TABLE XXIX.—VALUE OF CONSTRUCTION BUSINESS, PRINCIPAL ITEMS OF EXPENDITURE, AND CONSTRUCTION WORK DONE BY ESTABLISHMENTS WHOSE OFFICES WERE LOCATED IN 93 PRINCIPAL CITIES AND IN OTHER LOCALITIES**

ITEM	VALUE (IN \$1,000) OF PRINCIPAL ITEMS REPORTED BY—				PER CENT OF ALL CLASSES			PER CENT OF TOTAL BUSINESS			
	All classes of establishments	Operative builders	General contractors	Subcontractors	Operative builders	General contractors	Subcontractors	All classes of establishments	Operative builders	General contractors	Subcontractors
<i>Principal cities</i>											
Number of establishments reporting.....	16,711	516	6,890	9,505	3.1	40.0	56.9				
Value of construction business handled.....	\$4,496,947	\$124,025	\$2,939,579	\$1,432,443	2.8	65.4	31.9	100.0	100.0	100.0	100.0
Value of business under general contract or directly for owner.....	3,457,251	124,020	2,908,043	424,288	3.6	84.1	12.3	76.9	100.0	98.9	29.6
Value of business under subcontract.....	1,039,696	5	31,537	1,008,155	( <sup>1</sup> )	3.0	97.0	23.1	( <sup>1</sup> )	1.1	70.4
Principal items of expenditure.....	3,611,630	113,780	2,391,004	1,106,253	3.2	66.2	30.6	80.3	91.1	81.4	77.2
Subcontract work let.....	1,177,892	87,770	1,038,852	51,270	7.5	88.2	4.4	26.2	70.3	35.3	3.6
Wages paid.....	1,029,385	9,341	598,877	421,168	.9	58.2	40.0	22.0	7.5	20.4	29.4
Cost of materials.....	1,404,359	16,689	753,875	633,815	1.2	63.7	45.1	31.2	13.3	25.6	44.2
Value of work done by own force <sup>2</sup> .....	3,319,055	37,155	1,900,727	1,381,173	1.1	57.3	41.6	73.8	29.7	64.7	96.4
<i>Other localities</i>											
Number of establishments reporting.....	13,886	234	8,076	5,576	1.7	58.2	40.2				
Value of construction business handled.....	\$1,753,320	\$23,599	\$1,277,788	\$446,938	1.6	72.9	25.5	100.0	100.0	100.0	100.0
Value of business under general contract or directly for owner.....	1,454,515	28,599	1,263,843	162,073	2.0	86.9	11.1	83.0	100.0	98.9	36.3
Value of business under subcontract.....	298,805		13,943	284,860		4.7	95.3	17.0		1.1	63.7
Principal items of expenditure.....	1,366,995	25,110	1,002,073	389,811	1.8	73.3	24.9	78.0	87.8	78.4	76.0
Subcontract work let.....	277,602	15,372	252,020	10,204	5.5	90.8	3.7	15.8	53.8	19.7	2.3
Wages paid.....	438,157	3,805	315,235	119,116	.9	71.9	27.2	25.0	13.3	24.7	26.7
Cost of materials.....	651,236	5,933	434,812	210,491	.9	66.8	32.3	37.1	20.7	34.0	47.1
Value of work done by own force <sup>2</sup> .....	1,475,718	13,227	1,025,762	436,729	.9	69.5	29.6	84.2	46.2	80.3	97.7

<sup>1</sup> Less than one-tenth of 1 per cent.

<sup>2</sup> Obtained by subtracting the value of subcontract work let from the value of all construction business.

In comparison with the value of construction work done by the reporting establishments' own forces, the cost of labor and materials was in the following proportions for the respective groups:

	ESTABLISHMENTS LOCATED IN—	
	Principal cities	Other localities
	Per cent	Per cent
All classes of establishments:		
Wages paid.....	31.0	29.7
Cost of materials.....	42.3	44.1
Operative builders—		
Wages paid.....	25.1	28.8
Cost of materials.....	44.9	44.9
General contractors—		
Wages paid.....	31.5	30.7
Cost of materials.....	39.7	42.4
Subcontractors—		
Wages paid.....	30.5	27.3
Cost of materials.....	45.9	48.2

Statistics for all cities of over 100,000 population in 1930 are presented in full detail in the published reports for the respective States. Much additional information of great interest could be derived from a further analysis of these figures. The brief treatment of this subject here, while it does not do justice to the information contained therein, may suggest further analyses to those interested in carrying out these comparisons for the other statistics available.

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## CONCLUSION

In the foregoing pages an effort has been made to point out some of the many comparisons which are found in the statistics of the construction industry, collected and compiled in connection with the Fifteenth Decennial Census of the United States. The illustrations presented and analyses made will serve only to indicate the great wealth and variety of the statistics which are presented in the reports for the respective States and the United States. The individual who is interested in one or another of the many problems to which these statistics are pertinent, may derive for himself other comparisons of specific interest which have not been brought out in these pages. In the explanatory text in Chapter I, as well as in that which accompanies each of the analytical tables, a few unavoidable complications which tend to distort certain figures in some of the tabulations have been emphasized, in order that they may be given due consideration when use is made of the figures affected.

The analytical tables based, for the most part, upon United States total figures in various distributions, have been interspersed with the text in this chapter. In chapter IV, immediately following this text, are additional full-page tables which present the distribution of the principal data among the respective

States, while the standard United States summary tables which are presented for the United States and the nine geographic divisions, in the same form and sequence as in the individual State reports, make up Chapter V of this report.

In conclusion, it may be well to suggest that for many general uses which demand relative or average figures, those based upon the United States totals may be of greater value than those based upon individual State or city totals, owing to the fact that irregularities caused by unusual or local conditions in the smaller

areas are leveled in the figures for the larger group, with the result that a closer approximation of normal average relationships is obtained. If care is taken to understand the exact nature and applicability of the figures presented in these reports, it is believed that they will be found to fulfill the intended purpose of the original sponsors of this first census of the construction industry in furnishing basic data for the solution of the many problems involved in the practical and efficient handling of construction work.