

Employment created by construction expenditures

A billion dollars spent on construction generates 24,000 full-time jobs for 1 year, most of them in supporting industries, according to studies of 13 activities covering over half the value of new construction

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Almost 24,000 workers were employed for one full year for each billion dollars spent in 1980 for new construction such as buildings, houses, and highways. More than half of the jobs were created in industries that produce, sell, and deliver materials and equipment required for construction, such as the manufacturing, trade, transportation, and mining industries. (See table 1.) The 13 activities surveyed covered more than half of the value of new construction. Each activity created roughly an equivalent number of jobs in the economy. The fewest jobs were generated in commercial office buildings and civil works land projects (nearly 22,000 jobs per billion dollars) and the largest number were in public housing (26,000 jobs).

The studies: limitations and uses

Since 1959, the Bureau of Labor Statistics has surveyed labor and material requirements for various types of construction activity. The studies are designed to measure the total employment impact of construction activities, primarily those which would be affected by government actions. Total employment includes labor at the construction site (onsite) and labor required to manufacture, sell, and transport the materials, equipment, and supplies used in construction (offsite). The employment impact is developed only for expenditures on construction contracts. No attempt is made to mea-

sure the impact of activities such as planning, design work, purchasing rights of way, land acquisition and development, and public utilities installations. The employment generated from the spending and respending of wages and profits—the “rippling” or multiplier effect—also falls outside the scope of these studies.

The studies provide information on the amount of labor time required to complete the various types of activity per \$1,000 of construction contract cost; cost of material, equipment, and supplies; distribution of costs; and occupational requirements of the specific activity.

Data are collected by visits of BLS field representatives to all general contractors and subcontractors whose projects were in a sample of projects completed during a specific time period—usually 1 year. The sample is selected from the universe of projects known to have been completed during the period. The universe is obtained from information provided by the Federal agency financially supporting the construction or insuring the funding of the construction or, for private sector activities, by the Bureau of the Census. Factors such as regional location, cost, and type of structure are considered in the sample design.

For each project, data are obtained on the total cost of the project, the contract cost of each operation, and the physical characteristics of the project. This information is important in determining how well the sample represents the universe and is also used in subsequent analysis.

Onsite employment information, obtained from con-

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tractors' payroll records, is used in developing onsite employee-hour requirements, wages, and total payroll costs. Access to the payroll records makes possible the collection and presentation of information on occupational distributions, timing of construction operations, and wage relationships between crafts.

Information collected on the distribution of costs is broken down by labor costs, material costs, and overhead and profit. In addition, a detailed listing of materials by type is obtained from written invoices and interviews with the contractors.

Offsite employment estimates are derived from the materials and equipment cost information. The estimates are developed in two stages. First, input-output tables, developed by the Department of Commerce, are used to derive volume of output in various industries generated by each of the materials purchased. Second, by applying industry productivity factors, the volume of output is translated into the amount of employment generated in each industry.

To apply the input-output tables appropriately, data on material purchases, which are obtained in current dollars, have to be adjusted to prices corresponding with those in the input-output tables. This requires a carefully developed set of material price indexes. In order to apply industry productivity factors, current data on productivity for each industry must be developed.

The major intent of these studies was originally to determine the impact of public works programs on employment, but the data have stimulated interest in other forms of analysis. Occupational data, for example, are used by the Department of Labor to help determine future training needs and predict shortages and surpluses

in skilled trades, and are used by the Bureau as benchmarks for the occupational matrix which, in turn, is used to project occupational demand for the construction industry. Market analysts and manufacturers find data on type and value of materials extremely valuable for projecting demand for their products. Materials data also serve as benchmarks for the Department of Commerce's input-output tables. In addition, subsequent resurveys provide data on trends in onsite labor requirements which give indications of construction productivity change. Thus, the studies have been gradually expanded to cover private as well as public construction. Plans are to eventually cover all major types of construction activities as well as to resurvey various activities periodically.

This article summarizes data from all the activities studied to date.¹ Because the data relate to various construction activities and time periods, they provide a general picture of the employment generating effects of construction expenditures. The employment estimates are stated in terms of full-time year-long jobs. Because of part-time workers, transients, and the seasonal nature of employment in the construction industry, more workers would normally be employed than indicated by the full-time job estimates. In addition, while many major construction activities are covered, several significantly different activities are not.²

Also, the estimates are somewhat conservative due to the productivity assumptions used. Data on the decline in onsite labor requirements, used as proxy productivity increases, extend from 1959-60 into the mid-1970's. After that period, productivity growth in the economy generally dropped off sharply. However, because more

Table 1. Estimated jobs generated per billion dollars of contract expenditures (in 1980 dollars) for various types of construction, by industry

Activity	All industries	Construction industries			Other industries			
		Total	Onsite	Offsite	Total	Manufacturing	Trade, transportation, and services	All other
Private housing:								
Multifamily	25,400	11,100	9,900	1,200	14,300	7,600	5,200	1,500
Single-family	22,000	9,500	8,300	1,200	12,500	6,100	5,100	1,300
General hospitals	24,800	12,700	11,400	1,300	12,100	6,800	4,200	1,100
Elementary and secondary schools	23,200	10,300	9,100	1,200	12,900	7,300	4,200	1,400
Federally-aided highways	24,600	11,900	10,900	1,000	12,700	5,900	4,800	2,000
Sewer works:								
Lines	23,600	9,800	9,300	500	13,900	8,100	3,900	1,700
Plants	24,000	10,100	9,400	700	13,900	8,700	3,700	1,400
College housing	22,500	10,900	9,400	1,400	11,600	6,300	4,000	1,300
Civil works:								
Land	21,900	10,000	9,500	500	11,900	4,500	5,200	2,200
Dredging	23,100	13,600	12,300	1,400	9,500	4,700	3,500	1,200
Public housing	26,000	14,600	12,200	2,400	11,400	5,800	4,300	1,200
Federal office buildings	24,900	11,000	9,700	1,400	13,900	7,000	5,500	1,300
Commercial office buildings	21,900	9,800	8,800	1,000	12,100	6,700	4,200	1,300

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

These estimates of employment requirements were developed from labor requirements studies data. Data were adjusted for price and productivity changes between the years of the most recent surveys and 1980. Productivity adjustments used were the average annual rates of decline in onsite labor requirements in constant dollars. For a description of deflators used, see

Survey of Current Business, August 1974, pp. 18-27.

Estimates of the number of full-time jobs generated per billion dollars of expenditure were derived using 1,800 employee hours per year-round job for onsite construction; 2,000 hours for offsite construction; 2,089 for manufacturing; 1,795 for trade, transportation, and services; and 2,041 for mining and all other.

recent construction measures are not available, the earlier figures are extrapolated to obtain the 1980 employment figures. As a result, the employment estimates have probably been slightly underestimated.

The studies upon which this article is based include federally-aided highways, Federal office buildings, Corps of Engineers civil works land and dredging projects, sewer lines and plants, elementary and secondary schools, commercial (private) office buildings, college housing, public housing, private single- and multi-family housing, and general hospitals. Resurveys are underway for three of these activities in addition to a new study of retail stores and shopping centers.³

Employment impact

One interesting feature of the data is the narrow range of total labor requirements for different types of construction activities studied within roughly the same time period. This is true regardless of whether the activity involves residential buildings, nonresidential buildings, or heavy construction. For example, of the 10 activities studied during 1958-63, total hours generated per \$1,000 of expenditures ranged from 208 for sewer plants to a little more than 250 for highways and civil works dredging. (See table 2.) Of the four activities sur-

veyed in 1971 and 1972, employment ranged from 114 hours for elementary and secondary schools to 138 hours for private multifamily housing. Sewer lines and plants fell between these two extremes.⁴ More recent studies show the same relationship; however, most have been abbreviated studies and thus do not report total hours.

Onsite labor. Onsite hours showed more variation than did total hours, ranging from 72 hours per \$1,000 of expenditure for single-family housing to 134 for civil works dredging in 1958-63 and from 42 for schools to 50 for multifamily housing in 1971-72. According to more recent studies, the range in onsite hours has narrowed somewhat. For example, in the 1975-76 period, the range was from 30 hours for Federal office buildings to 33 for public housing.

The ratios of onsite hours to total hours also showed considerable variation. They ranged from 33 percent for single-family housing to 53 percent for civil works dredging, two of the first studies to be conducted. Civil works dredging projects, unlike other construction activities, require that much of the onsite work be done by ships' crews working on dredges and barges. However, in residential construction, the ratios of onsite to to-

Table 2. Employee hours created per \$1,000 of contract expenditures (in current dollars), by industry, all studies, 1958-76

Activity and year	Total, all industries	Construction		Other industries			Activity and year	Total, all industries	Construction		Other industries		
		Onsite	Offsite ¹	Manu- fac- turing	Trade, trans- porta- tion, and ser- vices	Mining and all other			Onsite	Offsite ¹	Manu- fac- turing	Trade, trans- porta- tion, and ser- vices	Mining and all other
Federally-aided highways:													
1958 ²	250.7	97.3	9.0	66.1	52.5	25.8	Civil works:						
1976	80.5	32.2	3.3	22.8	15.4	6.9	Land projects:						
Federal office buildings:							1960	213.4	84.7	4.5	53.2	46.9	24.1
1959 ²	235.8	97.1	10.9	79.2	35.7	12.9	1972	(³)	43.2	2.5	(³)	(³)	(³)
1973	(³)	42.8	4.7	(³)	(³)	(³)	Dredging projects:						
1976	(³)	29.8	4.7	(³)	(³)	(³)	1960	251.4	133.9	15.6	56.8	31.6	13.5
Public housing:							1972	(³)	57.0	7.0	(³)	(³)	(³)
1960 ²	246.0	113.7	15.9	65.3	36.9	14.2	Sewer works:						
1968 ²	175.1	79.6	11.9	47.8	26.7	8.8	Lines:						
1975	(³)	33.2	7.1	(³)	(³)	(³)	1963	208.8	85.9	4.8	75.9	27.2	15.0
Commercial office build- ings:							1971	128.3	48.0	3.0	48.8	18.8	9.7
1974	97.5	37.2	4.8	33.0	16.6	5.9	Plants:						
Elementary and secondary schools:							1963	208.1	82.7	5.7	80.0	27.1	12.6
1959 ²	231.8	86.0	11.7	78.0	41.4	14.8	1971	127.4	47.0	4.0	51.6	17.6	7.2
1965 ²	193.2	72.3	8.8	65.8	34.4	12.0	Private multifamily housing:						
1972	114.1	41.6	6.0	40.8	18.8	6.8	1971 ²	137.5	50.0	6.5	46.9	26.1	8.1
College housing:							Private single-family hous- ing:						
1961 ²	236.3	93.6	14.1	77.5	37.2	13.8	1962 ²	215.7	72.1	11.0	68.6	48.7	16.1
1972	(³)	48.3	8.1	(³)	(³)	(³)	1969 ²	145.6	51.9	8.2	47.2	29.6	8.7
							General hospitals:						
							1960 ²	226.0	88.8	12.3	78.0	34.2	12.7
							1966 ²	189.0	76.1	9.8	64.0	29.6	9.5
							Nursing homes:						
							1966 ⁴	192.7	73.7	8.4	66.6	33.6	10.4

¹ Revised, based on adjustment to 1979 benchmarks of *Employment and Earnings* series. Some SIC groupings were not revised for earlier years; thus data on offsite construction hours are not strictly comparable. Differences, however, would be slight.

² Indirect data revised from original study results due to reprocessing materials through

improved input-output tables.

³ Not available.

⁴ Estimated except for onsite construction hours. Based on case study.

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

Table 3. Estimated employee hours created per \$1,000 of contract expenditures (in 1980 dollars) for various types of construction, by industry

Activity	All industries	Construction industries			Other industries			
		Total	Onsite	Offsite	Total	Manufacturing	Trade, transportation, and services	All others
Private housing:								
Multifamily	48.5	20.2	17.9	2.3	28.3	15.8	9.4	3.1
Single-family	41.9	17.3	14.9	2.4	24.6	12.8	9.2	4.2
General hospitals	47.1	23.1	20.5	2.6	24.0	14.2	7.5	2.3
Elementary and secondary schools	44.4	18.7	16.3	2.4	25.7	15.3	7.6	2.8
Federally-aided highways	46.6	21.6	19.6	2.0	25.0	12.4	8.6	4.0
Sewer works:								
Lines	45.4	17.7	16.7	1.0	27.7	16.9	7.0	3.8
Plants	46.1	18.3	16.9	1.4	27.8	18.2	6.7	2.9
College housing	42.9	19.9	17.0	2.9	23.0	13.2	7.2	2.6
Civil works:								
Land	41.0	18.1	17.1	1.0	23.2	9.3	9.4	4.5
Dredging	43.5	24.8	22.1	2.7	18.7	9.9	6.3	2.5
Public housing	49.2	26.8	22.0	4.8	22.4	12.1	7.8	2.5
Federal office buildings	47.4	20.1	17.4	2.7	27.3	14.7	9.9	2.7
Commercial office buildings	41.9	17.9	15.9	2.0	24.0	13.9	7.5	2.6

NOTE: Detail may not add to totals due to rounding. Data were adjusted for price and productivity change between the years of the most recent surveys and the current year for which price indexes were available. The appropriate deflator for each construction activity was used

to adjust employment requirements for price changes from the most recent study year to 1980. See *Survey of Current Business*, August 1974, pp. 18-27 for a description of the deflators used.

tal hours were also rather wide—from 33 percent for single-family housing to 46 percent for public housing.

After adjusting the data for price and productivity changes and extrapolating the data to 1980 to facilitate comparison, the narrow range of the level of total hours becomes even more evident, ranging from 41 per \$1,000 for civil works land projects to 49 for public housing construction. Onsite hours exhibited considerably more variation, extending from 17 hours for single-family housing to 27 for public housing. (See table 3.) Onsite labor requirements are affected by factors such as architectural design and structural features, relative proportion and types of materials and equipment used, differences in occupational skills and labor-capital ratios, and varying price and wage levels.

Onsite occupational requirements, like onsite hour requirements, vary significantly by type of construction activity, reflecting the characteristics of the projects and, particularly, the materials used. For example, carpenters, normally the largest group of skilled workers for building construction, reached their highest level in residential construction. For single-family housing, they represented more than one-third of all onsite occupational hours. On the other hand, for heavy construction such as highways, sewer lines and plants, and civil works construction, carpenters accounted for a relatively small proportion of hours, 1 to 2 percent. Conversely, operating engineers were the largest group of skilled workers for highways, sewer lines and civil works land projects (composing about one-fourth of onsite requirements) and one of the smallest for building construction (1.4 to 4 percent). Plumbers accounted for 14 to 16 percent of onsite employment for hospital construction, but very few plumbing jobs were generat-

ed in heavy construction activities.

Unskilled and semiskilled workers represented about a third of the construction jobs overall, from a little more than 23 percent for schools to around 50 percent for highways and civil works land projects.

According to the studies, no dramatic shifts have occurred in occupational requirements for construction. Obviously, some slight shifts have occurred, such as the displacement of plasterers by wallboard installers, and of carpenters who lay hardwood floors by soft floor layers, but these changes have been gradual. In addition, except for single-family housing where the proportion of laborers and helpers increased from 23 percent in 1962 to 28 percent in 1969, there has been no evidence that more intensive use of prefabricated components in building structures has stimulated substitution of lower skilled workers for higher skilled craftworkers. Indeed, even in single-family housing construction, this trend could reflect the geographic shift of a larger volume of houses being built in the South where lower skilled workers normally account for a higher percentage of employment. (Detailed data on the distribution of onsite hours by occupation are available from the author.)

Offsite labor requirements. There are two types of offsite hours. First are those generated in the contractors' offices and warehouses—hours which are required to support the onsite construction work. These hours normally average about 5 percent of total hours, based on data from the Bureau's employment and earnings survey. The other type of hours are generated in industries other than construction and are estimated from the use of materials, equipment, and supplies.⁵ These hours

normally account for about 60 percent of total hours.

Usually, the greater the degree of prefabrication of materials used, or the greater the proportion of materials costs, the greater the number of offsite hours required. For example, more hours in manufacturing are required when ready-mix concrete is used than when contractors mix their own concrete at the site of construction. Similarly, the inclusion of built-in equipment such as escalators, elevators, and air-conditioning increases costs and manufacturing hours substantially. The effect on employment in individual industries varies for each type of construction because of differences in the construction process, including use of construction materials and equipment. Single-family housing construction, for example, uses a large quantity of lumber and wood products and, hence, has a significant impact on employment in establishments providing those materials.

The percentage of offsite hours to total hours varied widely among the surveys, ranging from 47 for civil works dredging to about 67 for single-family housing. Within residential construction, the range was from 54 for public housing to 67 for single-family housing.

The ratio of offsite to onsite hours averaged about 1.5, and ranged from 0.9 for civil works dredging to 2.0 for single-family housing. This means that each hour

spent at the site of construction generated an average of one and one-half hours of work in offsite construction and in other industries which produce the materials, equipment, and supplies used at the site.

Distribution of costs

In general, the distribution of various cost components shows a declining proportion of total costs going to materials, supplies, and equipment; a relatively stable proportion going to onsite wages and salaries; and an increasing proportion going to overhead and profit. (See table 4.) One possible explanation for this trend is the increasing cost of construction financing and, to a lesser extent, higher indirect labor costs relative to onsite wages and salaries. Materials, equipment, and supplies, while increasing in cost, apparently are declining relative to other cost components. In addition, new materials, improvements in existing materials, and substitutions of materials which meet performance building codes while reducing costs (for example, plastic pipe instead of copper pipe for heating, ventilating, and air-conditioning and cold water applications) all contribute toward lowering of the proportion of materials to total costs.

Onsite wages and salaries average about one-fourth to one-third of all costs. Materials, which formerly ac-

Table 4. Distribution of construction contract costs, 1958-76

[In percent]

Activity	Total contract costs	Onsite wages and salaries	Materials, supplies, and built-in equipment	Construction equipment	Overhead and profit ¹	Activity	Total contract costs	Onsite wages and salaries	Materials, supplies, and built-in equipment	Construction equipment	Overhead and profit ¹
Federally-aided highways:						Civil works:					
1958	100.0	23.9	50.6	(²)	25.5	Land projects:					
1976	100.0	23.8	46.7	(²)	29.5	1960	100.0	26.0	35.0	19.3	19.7
Federal office buildings:						1972	100.0	25.0	32.0	20.0	24.0
1959	100.0	29.0	51.3	1.9	17.7	Dredging:					
1973 ³	100.0	34.0	50.0	(⁴)	16.0	1960	100.0	32.3	17.3	24.9	25.0
1976	100.0	25.8	42.5	2.9	28.8	1972	100.0	30.0	24.0	28.0	19.0
Public housing:						Sewer works:					
1960	100.0	35.5	45.0	2.5	17.0	Lines:					
1968	100.0	32.4	41.9	1.5	24.2	1963	100.0	24.3	44.5	11.2	20.0
1975 ³	100.0	32.7	48.7	4.4	14.2	1971	100.0	24.3	35.2	16.7	23.8
Commercial office buildings:						Plants:					
1974	100.0	26.7	42.2	2.7	28.5	1963	100.0	26.6	49.2	8.2	16.0
Elementary and secondary schools:						1971	100.0	25.2	47.0	5.6	22.2
1959	100.0	26.7	54.1	1.4	17.8	Private multifamily housing:					
1965	100.0	25.8	54.2	1.0	19.0	1971	100.0	27.9	44.2	3.0	24.8
1972	100.0	28.2	44.4	2.1	25.3	Private single-family housing:					
College housing:						1962 ⁵	100.0	22.1	47.2	1.0	29.7
1961	100.0	29.3	52.6	1.6	16.5	1969 ⁶	100.0	20.4	43.4	.9	35.3
1972 ³	100.0	36.0	51.1	(⁴)	13.0	General hospitals:					
						1960	100.0	28.2	53.2	1.2	17.4
						1966	100.0	29.6	50.4	1.3	18.7
						Nursing homes:					
						1966 ⁶	100.0	28.7	53.7	1.2	16.4

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

² Equipment included with overhead and profit.

³ Estimated. Includes actual costs of general contractors and estimated costs of subcontractors.

⁴ Equipment included in materials.

⁵ Includes selling expenses.

⁶ Estimated, based on case study.

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

counted for almost 50 percent of costs, now average about 40 percent. Contractor capital equipment varies from 1 to 3 percent for building construction to one-fourth to one-third of costs for some heavy construction projects. Overhead and profit compose roughly a fourth of costs for most types of construction projects. Included in "overhead" are such costs as supplemental wage benefits, insurance, construction finance charges, office and warehousing expenses, and salaries for offsite workers. (Data on the distribution of onsite hours by type of materials used are available from author.)

Materials, equipment, and supplies. Materials, equipment, and supplies, which are used to derive the indirect labor requirements, vary considerably by type of construction activity. Highways and civil works dredging projects, for example, require huge quantities of gravel, crushed and broken stone, and other minerals. Lumber products, while used by all types of construction activity, are one of the largest components of cost for residential construction, and by far are the largest for single-family housing construction where they account for nearly 40 percent of material costs.

Stone, clay, glass, and concrete products compose roughly a fourth of costs for most construction activities. Civil works requires the least, proportionately, and sewer lines, the most.

The construction equipment category represents the rental or depreciation costs of contractors' capital equipment used in the construction process, such as tractors, bulldozers, cranes, compressors, and trucks. These costs normally account for a very small proportion of costs for building construction, less than about 4 percent of contract costs. Heavy construction such as sewer and civil works projects, on the other hand, normally requires large amounts of equipment to excavate and move large quantities of dirt and rocks as well as ready-mix concrete, brick and block, and other materials. These may account for nearly 30 percent of all costs.

Trends in onsite labor

Because technical problems still impede development of an adequate productivity measure for the construction sector, the best available insight into changes in construction productivity is provided by these studies of labor and materials requirements for various types of construction over time. Although declines in employee-hour requirements would seem to be another way of expressing increases in output per employee-hour, changes in construction labor requirements reflect the introduction of new methods, equipment, and materials; geographic shifts in demand; and shifts in the type of construction activity; as well as improvements in productivity. The effects of productivity change on employ-

ee-hour requirements are difficult to isolate from these other factors.

Changes in onsite hours per \$1,000 constant dollars for each construction activity ranged from a decline of 0.3 percent per year for highways between 1970 and 1976 to a 4.7-percent drop for public housing between 1968 and 1975. (See table 5.) The small decline for highways reflects the lower level of activity of the interstate highway program and a shift to more labor intensive projects such as noninterstate highways, particularly in urban areas. The sharp decline in the rate for public housing reflects the shift from conventional public housing (those built under the direct supervision of local housing authorities) to turnkey projects (those built and completed by private contractors and then turned over to local housing authorities). When conventional projects only are used for comparison, the decline was 1.7 percent per year. (Data used to develop the average annual rates of decline for onsite hours are available from the author.)

Within these two extremes, most rates fell in the

Table 5. Change in onsite employee-hour requirements per deflated dollar for various types of new construction activities studied during 1958-76

Activity and year	Average annual percent change
Federally-aided highways:	
1958 to 1976	1.5
1970 to 1976	-0.3
1958 to 1970	2.2
Federal office buildings:	
1959 to 1975	-2.2
1972 to 1975	1.8
1959 to 1972	2.3
Elementary and secondary schools:	
1959 to 1971-72	-1.8
1964-65 to 1971-72	-1.6
1959 to 1964-65	2.0
College housing:	
1960-61 to 1971-72	2.5
Civil works:	
1960 to 1971-72	-2.4
Civil works land projects:	
1960 to 1971-72	-3.7
Sewer works line projects:	
1963 to 1971	-2.3
Sewer works plant projects:	
1963 to 1971	2.2
Private single-family housing:	
1962 to 1968-69	1.9
Public housing:	
1960 to 1975 ¹	-3.9
1968 to 1975 ²	-1.7
1968 to 1975 ¹	-4.7
1960 to 1968	-3.2
General hospitals:	
1959-60 to 1965-66	0.9

¹ Includes both conventional and turnkey projects in 1975.

² Includes only conventional projects in 1975.

NOTE: Average annual rates of change were calculated from the midpoints of construction for the various surveys.

1-to-3-percent range. It should be noted that the latest of the resurveys occurred in 1976. In the latter part of the seventies, productivity rates in the economy in gen-

eral declined, indicating that the decline in onsite labor requirements may have been significantly less than those reported here for earlier periods. □

— FOOTNOTES —

¹ For a previous article, see Claiborne M. Ball, "Employment Effects of Construction Expenditures," *Monthly Labor Review*, February 1965, pp. 154-58.

² The major activities not covered by these studies are industrial plants, utilities, farm, commercial (other than office buildings), additions and alterations, and maintenance and repair work. Furthermore, force account construction activities are outside the scope of these studies. The activities that are covered relate only to new construction, not to work such as housing rehabilitation and road repair. Such activities could be expected to be more labor intensive than many of those studied.

³ Federally-aided highways have been studied every 3 years since 1958. The 1961 hours are counted among the 10 activities, but are not shown in the table; the 1961 hours are 235 total and 92 onsite construction.

⁴ Several abbreviated studies were designed and conducted to allow more frequent measurement of the labor requirements of different types of construction as well as to reduce survey costs. These studies

omitted the collection of onsite occupational and materials data.

⁵ Indirect labor requirements were developed by aggregating the materials, supplies, and equipment cost data by product group. After calculating the average amount required per \$1,000 of contract cost for each product group, this bill of materials was deflated to the 1972 price level by the appropriate Producers' Price Index. These constant dollar values of materials, equipment, and supplies were then processed by the Bureau's Office of Economic Growth, using various interindustry studies of the U.S. Department of Commerce to generate estimates of final demand. Sector productivity factors were then applied to derive employee hours for the various industry groupings. The offsite hours in this article have been recently revised to incorporate the latest revisions of the input-output tables. Some older studies also were rerun on input-output tables for years closest to the study year which were not available at the time the original studies were done.

Maurice G. Wright, formerly of the Division of Technological Studies, and Karen J. Horowitz of the Office of Economic Growth assisted in the development of these offsite employee-hour estimates.

A note on communications

The *Monthly Labor Review* welcomes communications that supplement, challenge, or expand on research published in its pages. To be considered for publication, communications should be factual and analytical, not polemical in tone. Communications should be addressed to the Editor-in-Chief, *Monthly Labor Review*, Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212.
