

A REVIEW OF THE MAJOR ISSUES
FACING THE CONSTRUCTION INDUSTRY
IN THE UNITED STATES

by

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ABSTRACT

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Submitted to the Department of Civil Engineering on December 10, 1973 in partial fulfillment of the requirements for the degree of Master of Science in Civil Engineering.

The construction industry is one of the most important industries in the U.S. economy. The value of construction put in place has averaged 13 to 14 percent of the total gross national product in recent years. In terms of employment, the construction industry is the largest single industry in the country, employing some six million people at one time or another during a single year. In spite of this, it displays few of the characteristics of such an important industry. In fact, some of the characteristics it does exhibit and some aspects of its behavior in recent years seem less than desirable.

In order to begin to examine the construction industry and its operations, this thesis delves into certain aspects of the industry, including those relating to economics, labor, and management and organization. Within each area, specific issues facing the industry are examined and some of their causes, effects, and interactions noted along with some solutions designed to alleviate undesirable situations. One final topic of concern, that of technology, is not included because it is felt that this is an area distinct in itself and beyond the scope of the present research. Technology is, however, an area of undisputed importance in construction and ought, therefore, to be studied in detail elsewhere.

Many of the issues facing the industry, that are identified in the course of this thesis, are of considerable concern to the construction industry and warrant substantial further consideration and investigation. It is necessary to ascertain whether the industry is doing the best it can under

(Abstract continued)

the circumstances and whether conditions external and/or internal to the industry can and/or should be altered somehow to improve the industry's operation. Investigations along these lines might best be executed on both a micro and macro level. At the micro level, a single issue or a few related ones in a single problem area could be examined in depth, whereas at the macro level, a picture of the overall industry dynamics could be developed. In addition, the possibility of the implementation of major external and/or internal changes, such as the development and use of a national policy toward construction planning, might also be examined.

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CHAPTER 1

INTRODUCTION

1.1 The Construction Industry

The construction industry may be viewed as that industry which, through planning, design, construction, maintenance and repair, and operation, transforms resources of materials, labor, equipment, technology, capital, and land into constructed facilities. The types of constructed facilities produced by the industry are diverse, ranging from building construction which includes residential and nonresidential facilities to heavy construction, and may be either public or private. The major participants from the construction industry, who along with the owners, operators, and users are involved in the production and utilization of the constructed facility, include the architects, engineers, management consultants, general contractors, heavy construction contractors, special trade contractors or subcontractors, and construction workers. Building finance agencies, land developers, real estate brokers, and material and equipment suppliers and manufacturers, among others, are also involved in construction but are generally considered as distinct from but ancillary to the construction industry. The government, as might be expected,

interacts with the industry in a variety of roles, including those of purchaser, financier, regulator, and adjudicator. The regulatory environment within which the construction industry operates is yet another important feature of the industry and includes, for example, building and related codes, zoning ordinances, subdivision regulations, planning laws, licensing requirements, environmental regulations, safety legislation, monetary and fiscal policies, tax laws, financial institution operating rules, and wage regulations. Thus, any analysis of the industry must necessarily focus attention not only upon the traditional conception of the industry but also upon all of its support activities and its operating environment and upon the overall process from initial conception to actual use.

The role of the construction industry in the overall functioning of the economy is one of considerable importance¹. In recent years, the value of all construction (i.e., new and maintenance and repair) put in place has constituted 13 to 14 percent of the total gross national product, though income originating in construction (i.e., value put in place

¹The statistics cited here are from Mills' book (Ref. 27 in Chapter 2) and lectures in a course, "The Construction of Buildings" (1.912J), given at M.I.T., Cambridge, Massachusetts, in the spring of 1972.

excluding the value of materials and installed equipment) has been only 5 to 6 percent. Moreover, economists have long recognized that variations in the level and rate of investment in various construction activities have a significant influence on the overall stability of the economy as a whole. In terms of employment, physical construction activities alone employ some 5 to 6 percent of the nation's labor force, with craftsmen employed in construction constituting some 15 percent of the nation's skilled blue-collar workers, though these figures vary from month to month largely due to the seasonality of the industry. Turnover in the industry is high, and though construction contractors provided over 3.4 million yearlong jobs in 1970, for example, they actually employed some 6 million workers at one time or another during the year. In terms of employment, this is the largest single industry or closely related group of industries in the U.S. economy. Moreover, the construction industry plays a major role in satisfying society's needs for shelter, transportation, power, communication, water supply, waste disposal, and industrial production capabilities, among others, by providing the physical facilities required to meet these needs. In the long run, it also has a significant influence on the overall ability of other industries to produce and distribute goods and services for consumers.

The construction industry is one of the largest and most important industries in the U.S., and yet it displays few of the characteristics which are normally associated with size and significance in industry. In general, the firms in the industry are small and numerous, serve a local and specialized market, lack vertical integration, are based on a limited degree of capitalization, have a low overhead and profit margin, rely on a floating labor force, do little mass production, and are transient in nature. Some of these features of industry operation have arisen in response to the fact that demand varies continuously over the type of constructed facility needed and over time and space and thus is inherently unstable. These demand characteristics as well as other features of the industry stem from the characteristics of the constructed products themselves, including custom-built nature, immobility, costliness, complexity, and continuously changing technology. Thus, the industry that has developed in construction is largely a response to the requirements placed upon it. This is not to say, however, that all of its features are desirable or even necessarily best for its continued operation.

The construction industry is similar to certain other industries in some aspects, but is unique in others. Most construction activity (i.e., except for the rather small amount of speculative building and force account work) is

generated by sources outside the construction industry itself, and the industry enters the picture to begin construction activity only after a customer has determined his need for a facility and has decided to procure it. In this respect then, construction is very much like a service industry, undertaking work for others of the kind and at the time and place desired. Only a few manufacturing industries (those which produce heavy durable goods of a specialized nature) customarily manufacture goods to order as is done in construction, and even some of these industries produce other lines for a general trade as well in order to assure some constancy of operation. The immobility of the construction product, which requires that final assembly be accomplished at the place of ultimate use, further sets construction apart from many industries. As prefabrication increases, however, construction will become more of a manufacturing industry in this respect. The financing procedure in construction is also rather unique. In most industries, production in general is financed by entrepreneurial capital or short-term bank loans and is independent of any financing required by the customer in purchasing the product. In the construction industry, however, the specific project is financed, and this is usually done by means of mortgage loans which are made to the purchaser (i.e., owner) rather than to the manufacturer (i.e., contractor). This,

in turn, puts the lender in a position to exert influence on both design and construction operations since the constructed facility itself constitutes the security for the loan.

Despite these fundamental differences, construction is essentially a manufacturing operation, particularly at the level of the speciality contractor or subcontractor who puts materials, labor, and equipment together to produce a complete product. The general contractor is often more of an agent or broker, especially today as general contractors increasingly rely on subcontractors to do the work instead of their own forces. Land developers are most commonly characterized as dealers, though heavy contractors are also essentially dealers in that they buy equipment and later sell its services.

The environment within which the construction industry must operate is in a continuous state of flux and over the past decade has changed considerably. The complexity and scope of the task which confronts the industry is constantly increasing. For example, what once involved a single building or facility now involves large scale multi-building complexes, entire sections of decaying cities, and complete new towns. Where once proven technology of materials and processes and management techniques were sufficient, there now are required new materials, systems, industrialization

processes, and managerial and organizational approaches to economically and effectively meet the ever changing and expanding needs of society. Increased public awareness and concern for the quality of life and the environment have created new dimensions in many aspects of the industry's operation. The government's regulatory role with respect to the industry and its operations has been increasing. These changes, along with many others, necessitate changes in the functioning of the industry itself so it can better adjust to its changing environment, but there is resistance to change in an industry which is so oriented to tradition. Furthermore, it is unclear as to just what changes are necessary, and this requires research, something to which the construction industry contributes little.

For years, there has been concern about rapid cost escalation and lengthening delivery times, but all that has resulted in the industry is an almost continuous debate with respect to labor productivity and the effectiveness of managerial and technical personnel. This debate has only helped to foster and maintain an environment which discourages and resists, rather than stimulates and assists, the introduction of new technology which potentially could offset cost inflation and improve productivity and effectiveness. Numerous economic, labor, management and organization, and technology related issues, like these, are facing the industry

and must be recognized and their causes, effects, and interrelations established. Only then can a clearer understanding of the industry and its operations ever be achieved and the needed changes be determined, tested, and implemented.

1.2 Purpose and Scope

It is the purpose of this thesis to try to identify the major issues facing the industry, some of their causes and effects and interactions, and some proposed solutions. By this, it is hoped that an overall picture and understanding of the industry and its operations will be attained such that future research can begin to narrow the scope in order to do in depth studies of more restricted topics as well as continue the development of a broad framework within which to place these topics.

The issues relating to economics, labor, and management and organization are included in this thesis, but those relating to technology are excluded as it is felt that the field of technology is a distinct subject in itself and is beyond the scope of this work. All types of construction are generally considered though building construction is of greater interest to the author, and when a distinction between building and heavy construction is necessary, building alone is often considered.

The remainder of the thesis, then, deals with these issues. Chapters 2, 3, and 4 respectively consider the economic, labor, and management and organization related issues. In Chapter 5, the major issues are summarized and conclusions drawn, the industry's lack of research and available data is briefly considered, and recommendations for further research are made.

CHAPTER 2

ECONOMICS AND FINANCING IN THE CONSTRUCTION INDUSTRY

In this chapter, the major issues facing the construction industry in the area of economics are considered along with the industry's rather unique financing procedure. The following represent the major topics of discussion: (1) stability of the industry's demand market; (2) prices of construction products; (3) labor, capital, and total factor productivity; (4) industry growth; (5) profitability of the industry; and (6) financing in construction - availability and cost of money.

2.1 Stability of the Industry's Demand Market

A fluctuating demand market for constructed facilities has long been a major characteristic of the construction industry. It is an economic issue of utmost importance because of its pervasive influence throughout the industry, due to the resultant fluctuations in the volume of construction activity (see Figure 2.1).

To begin to look at this, it might be best to look first at the characteristics of construction products and, in turn, those of demand for these products. The basic characteristics of demand, i.e., variety, variability, and

Figure 2.1a: Indexes of GNP and total construction activity (source: Ref. 9).

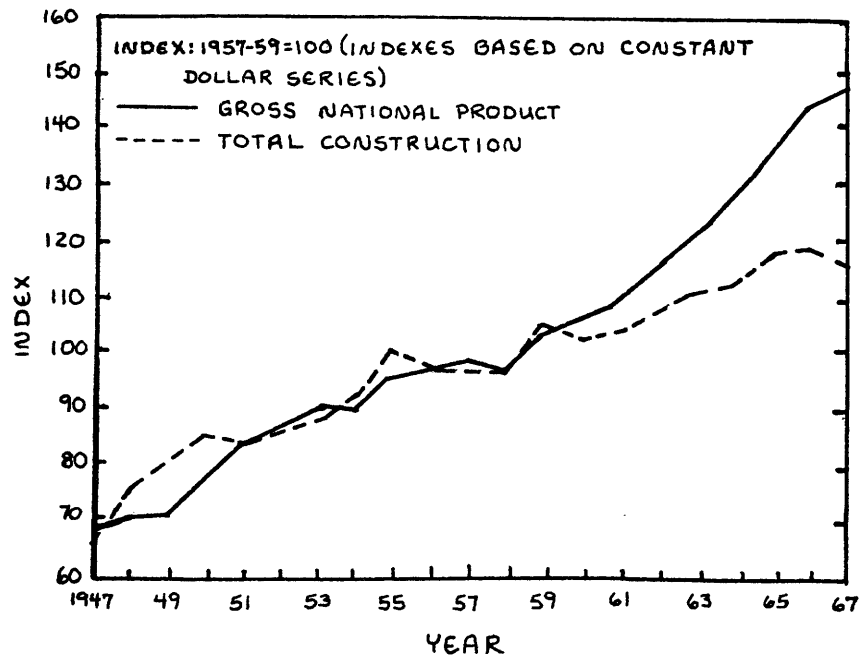
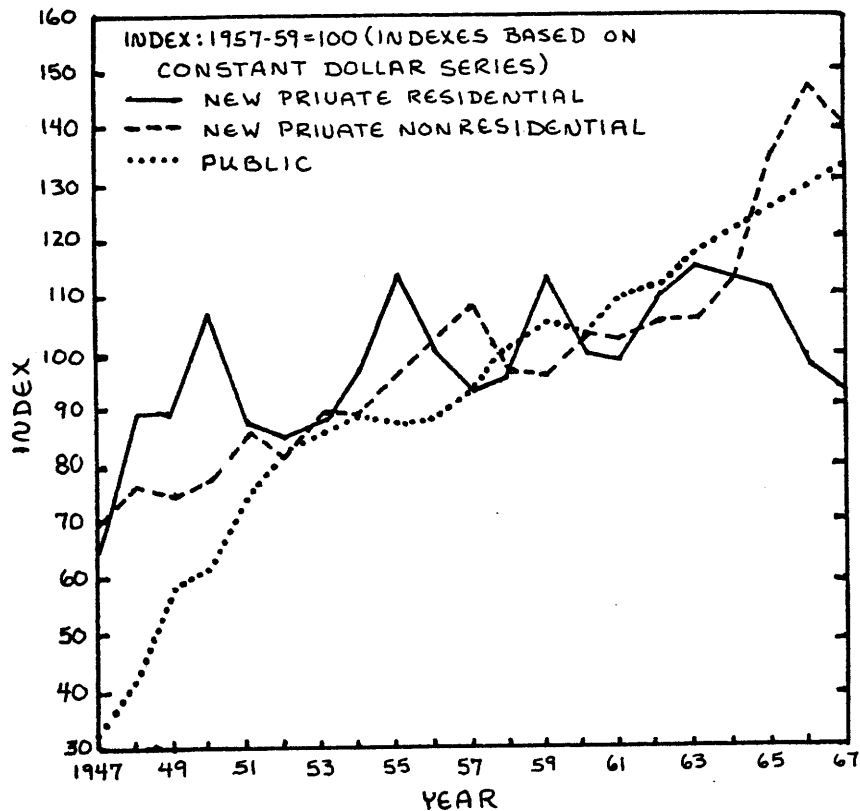


Figure 2.1b: Indexes of new private residential and nonresidential construction activity and public construction activity (source: Ref. 9).



NOTE: These graphs show the fluctuations in the volume of construction activity, and though volume is the result of both demand and supply, the exhibited behavior is predominantly due to the influence of demand.

local nature, stem directly from the product characteristics, including custom-built nature, immobility, complexity, continuously changing technology, and costliness. These demand characteristics, in turn, make the demand inherently unstable. For example, if one were to look at the demand for a specific type of construction and/or in a single locality, rather large fluctuations in volume over time would be observed, but if one were to look at demand for all types of construction throughout the U.S., considerably less fluctuation would occur (see Figure 2.1). It is this instability in demand which is largely responsible for making the industry as it is today; that is, it is highly specialized in order to meet the variety of demand and flexible in order to meet the variability and local nature of demand. It is these characteristics which, in turn, have led to many of the apparent inefficiencies in and undesirable characteristics of the industry, such as numerous small production units, easy entry/easy exit nature, lack of mass production, poor utilization of labor, and so forth, as will be discussed in later chapters.

Aside from the characteristics of demand which inherently make demand unstable, there are other factors, seasonality, public policy, and demographic influences, which have in the past tended to augment this instability. Seasonality is generally studied for its effect on employ-

ment, and thus the major portion of the discussion of this will be deferred to Section 3.3 where the utilization of labor will be considered. However since seasonal fluctuations do occur and are considerable, seasonality will be briefly discussed here. These fluctuations are, of course, short-term and vary from one type of construction to the next and from one locality to the next. Such fluctuations, since World War II, have been remarkably constant, though their magnitude has decreased somewhat in years of high construction demand. Though advances in technology to reduce seasonality have been made, their use is far from widespread. In order to effectively reduce the seasonal influence, it seems some sort of stimulus from the government is necessary, perhaps in the form of scheduling public construction in the off-season so as to lead the way or perhaps in the form of subsidies to offset the additional costs of winter construction. These seem like temporary measures though, and in the long run the use of increased off-season construction will have to be worked out between the many participants within the industry in light of the advantages to be gained from increasing the seasonal stability of construction (7, 27, 47).

The overall state of the U.S. economy and public policy, in the form of monetary, fiscal, and tax policies, are seen by numerous authors (2, 4, 6, 7, 10, 13, 17, 21, 25, 27, 28, 41, 46) as major influences on, and causes of,

the fluctuations in construction demand and thus the volume of construction activity. Macroeconomic models of the construction sector make a sharp distinction between private residential and nonresidential construction because of their widely different cyclical patterns (see Figure 2.1). Private nonresidential construction tends to rise during booms and fall during recessions and thus moves with the business cycle, while private residential construction exhibits a countercyclical pattern and thus helps to stabilize the economy. Public construction tends to increase fairly steadily over time. The net result is that construction as a whole tends to balance out to be fairly stable, though its composition is constantly changing.

This countercyclical tendency of residential construction is generally explained as follows. During a boom, money becomes tight due to: (1) increased demand for credit because of increasing business investment and/or (2) tighter government monetary policy which is meant to slow down the speculative excesses of the boom and prevent inflation. This leads to higher interest rates which, in turn, result in mortgages and construction loans becoming more costly. Furthermore, the flow of funds into the normal sources of residential construction financing dries up in a tight money market (as will be explained in Section 2.6), and thus there is less credit available for

such construction. The outcome is a decline in residential construction largely as a result of a decline in demand, since it is the consumer who bears the brunt of these conditions. The opposite naturally occurs during a recession when the money market loosens up.

The response of nonresidential construction is very different than this. Models describing the nonresidential construction market view such construction as just one other form of plant and equipment investment, and its determinants are felt to be essentially the same as those for business investment. The models usually rely on a stock adjustment process (the accelerator), and expansionary fiscal policy, as well as a boom, will cause increased nonresidential construction. Monetary factors are not felt nearly as strongly here as in the case of residential construction, and thus the tight money of a boom provides little deterrent to the expansion of the volume of nonresidential construction. A couple of factors account for this behavior. First, the availability of money is not as serious a problem in nonresidential construction for a number of reasons, including: (1) nonresidential construction can often be financed with internal funds (e.g., undistributed profits) and (2) such construction draws on a wide variety of external sources of funds, giving it flexibility and permitting short-term financing if necessary.

Second, the increased cost of funds can be more readily absorbed due to profit expectations and tax considerations and thus does not strongly influence decisions to undertake nonresidential construction.

Aside from monetary policy which primarily impacts private residential construction and fiscal policy which indirectly affects private nonresidential construction, there is tax policy which may affect either. Its primary impact on nonresidential construction is through capital consumption allowances which control the amount of retained earnings available for investment in construction and otherwise after taxes. In terms of private residential construction, the major impact is through income and real estate taxes which affect the feasibility and desirability of investment.

Thus, various aspects of public policy may encourage or discourage construction, affecting different types of construction differently and with the extent of the effect naturally depending at least somewhat on other conditions too numerous to mention here. The use of monetary policy to control inflation, moreover, has resulted in significant fluctuations in residential construction, much greater than those in nonresidential construction. In order to lessen these fluctuations, it seems necessary to shift the means of controlling inflation to an approach with a more general

impact on the economy. It is clear, however, that government economic policy cannot be expected to change so radically as to eliminate the fluctuations in construction demand. Rather, efforts must also be directed at helping the industry to improve its adaptations to such instability. One such effort, among others, might be to try to shift public construction of a residential or non-residential nature to periods of low demand. In addition, at the end of Section 2.6 which deals with financing in construction, some general suggestions are put forth as to how to improve the availability and cost of funds for construction financing, and these are certainly relevant here as well since difficulties with credit seem to be a primary cause of demand fluctuations.

The fluctuations discussed above are short-term ones with cycles of five or so years duration around an underlying upward trend (excepting of course seasonal fluctuations which have a cycle length of one year). Some authors (1, 8, 41) believe that long swings or building cycles with durations of fifteen to twenty-five years also exist in aggregate construction as well as in most of its major categories. Evidence for these long swings has been found through the interaction of construction with various major economic occurrences and demographic variables. Because these cycles are of such long duration and are so gradual, it seems these should not present the construction industry

with any problems, as do the short-term fluctuations, for the industry should have sufficient time to adjust.

2.2 Prices of Construction Products

The prices of construction products have received a considerable amount of attention, especially in recent years, because of the way they have been rising. Before looking into the factors which might be responsible for these rising prices, it is appropriate to look briefly at some problems which arise in deriving these prices.

The fact that the output of construction is so heterogeneous makes the calculation of price indexes very difficult. Three principal alternatives¹, all with numerous shortcomings, have been developed over the years. The official U.S. index for the price of new construction, i.e., the Department of Commerce composite construction cost index, is a moving-weight average of components separately deflated by all three methods, but it is still not felt to

¹The three alternative approaches are: (1) input-cost index which is often a simple average of wage rates and list prices of materials, (2) input-productivity technique which begins with an input-cost index and adjusts it for estimated changes in labor efficiency, and (3) component-price method by which indexes are developed for a few components of construction (e.g., structural steel) on the basis of actual prices paid by buyers of the goods.

be a very satisfactory index due to its numerous deficiencies, the gravest of which is its failure to take sufficient account of productivity improvements. This failure tends to impart a strong upward bias to the cost index, and as expected, some of the more recently suggested indexes exhibit a slower rate of increase than does the official one. Apparently, the Bureau of the Census is currently working toward developing a set of construction price indexes, one for each category of construction for which a value of new construction put in place estimate is derived. As of late in 1969, indexes of the price of new one family homes sold, including the value of the site, had been computed by determining the most important characteristics of these houses and estimating, by regression analysis, the price change in houses with a constant mix of these characteristics. But until better indexes are developed across the board, the Department of Commerce composite cost index and others like it will have to be used, bearing in mind their weaknesses, especially the fact that the Commerce composite index, among others, likely exaggerates the rate of increasing construction prices (12, 19, 30).

There are numerous factors which influence the price of construction, and the relative impacts of these factors vary from one type of construction to the next, one time period to the next, one locality to the next, and so forth.

On the average though, overall construction prices have been increasing and, according to currently available data, generally at a faster rate than those in the rest of the economy (see Table 2.1 and Figure 2.2). The factors which could be at least partly responsible for such increases can be grouped into two major categories: (1) those which are direct inputs to the constructed facility and its cost, such as labor, materials, equipment, financing, land, profit, overhead, and miscellaneous other cost items, which might be lumped together as cost-push influences (i.e., as causing cost-push inflation whereby prices of the factors of construction rise faster than their respective productivities) and (2) those which are related to the demand for construction, such as characteristics of construction buyers and users, government policies, and inventory of existing constructed facilities, which might be lumped together as demand-pull influences (i.e., as causing demand-pull inflation whereby the effective demand for a particular type of construction in an area grows faster than the industry's ability to meet that demand).

The cost of construction labor has long been a topic of discussion and will be considered in more detail in Section 3.4. Though average hourly and weekly earnings in construction have long tended to increase somewhat faster than those in other industries, it is really only in the last ten years or so that this has become really significant

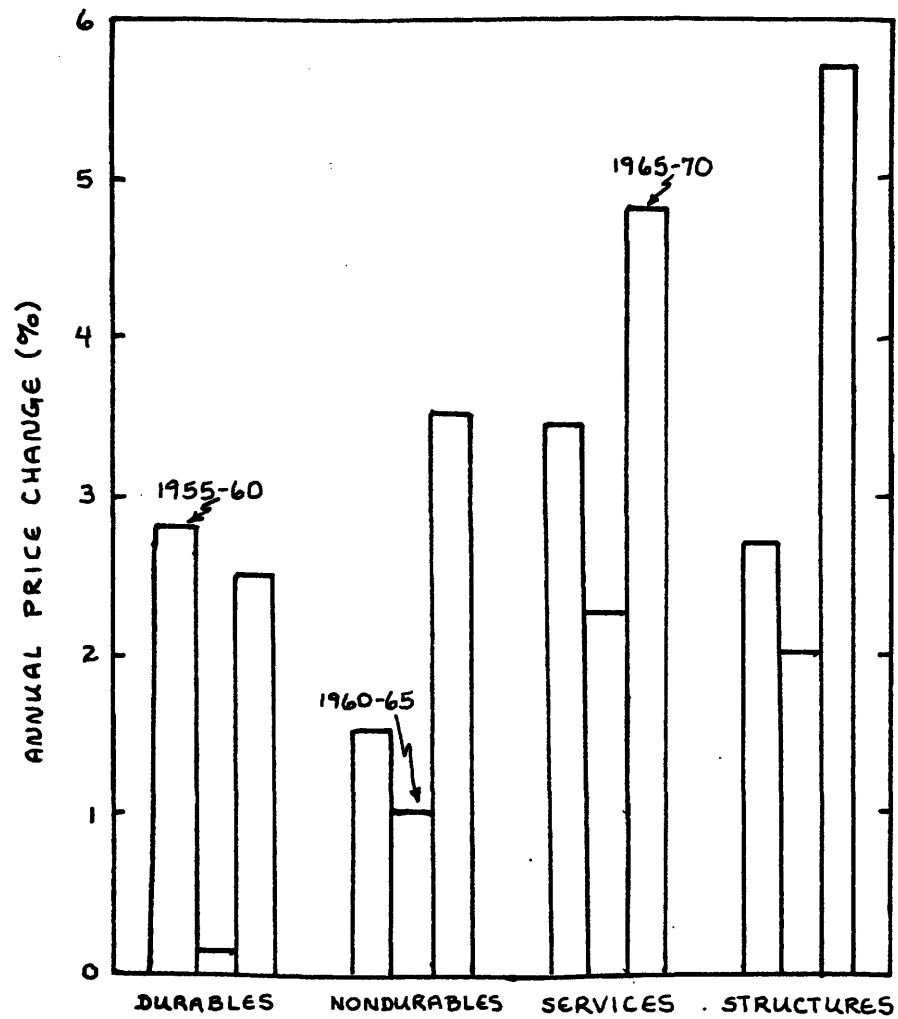
Table 2.1: Price increases in construction and in the U.S. economy as a whole (source: Ref. 11k).

Time Period	Annual Average % Increase of Prices	
	U.S. Economy As a Whole ^a	Construction ^b
1961-1965	1.5%	2.5%
1965-1966	2.6	3.4
1966-1967	3.1	5.0
1967-1968	3.8	well over 5.0

^aAs indicated by the implicit price deflator for the GNP.

^bAs measured by the Department of Commerce composite cost index.

Figure 2.2: Comparison of increases in prices of structures with those of other GNP components (source: Ref. 7).



(see Figures 2.3 and 2.4). These rates have frequently been justified by the existence of construction's typically short work year. In fact, one study (11m) showed that annual earnings for construction workers who are employed for any number of quarters in construction (it is common for them to be employed for less than four quarters or full-time) are substantially below those for most other industry workers. However in this and other studies (7, 9), it has also been shown that annual earnings for construction workers who are employed for four quarters in construction are higher than those for most other industry workers (see Figure 2.4). Moreover, labor is a very significant part of construction cost, and thus these recent increases have significantly affected the final cost (see Figures 2.5 and 2.6). This is especially true in nonresidential construction and multi-family housing, whereas in single family housing the increasing cost of the land in recent years has been equally, or even more, significant (3, 7, 18, 34).

Materials are another significant part of construction costs, but over the years their prices, though generally rising, have done so at a much stabler and slower rate than have wages, even with the introduction of new materials and processes. In the last couple of years however, materials prices have begun to rise more rapidly (see

Figure 2.3: Indexes of average weekly earnings of workers in construction and manufacturing (source: Ref. 9).

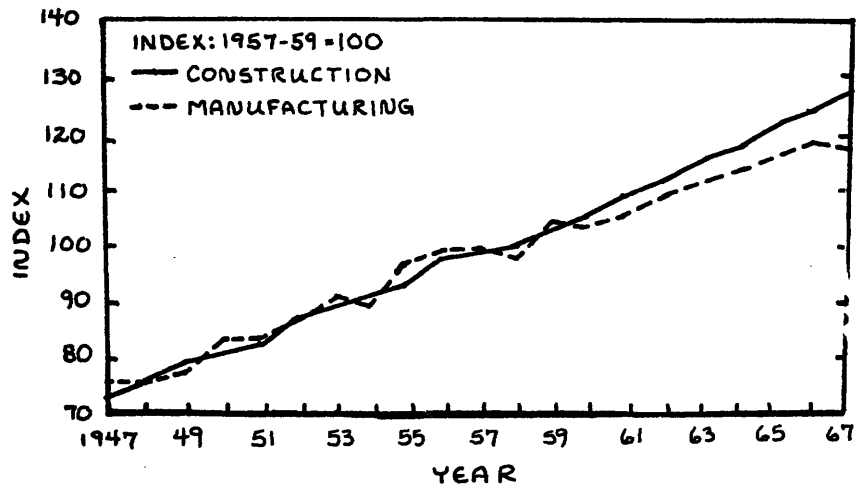


Figure 2.4: Spread in hourly earnings and in annual full-time earnings between construction and all industries as a whole (source: Ref. 7).

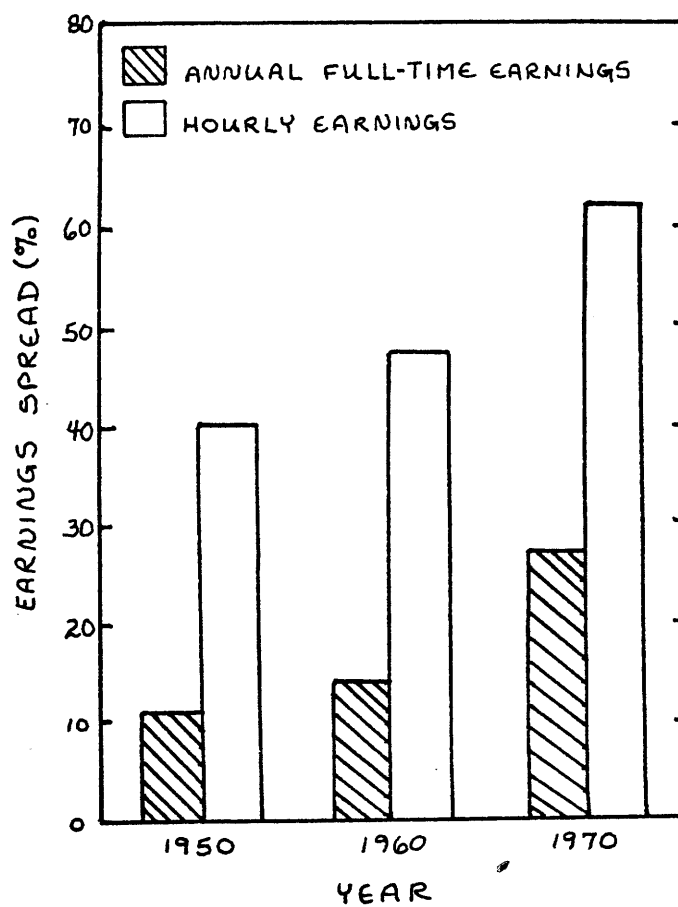
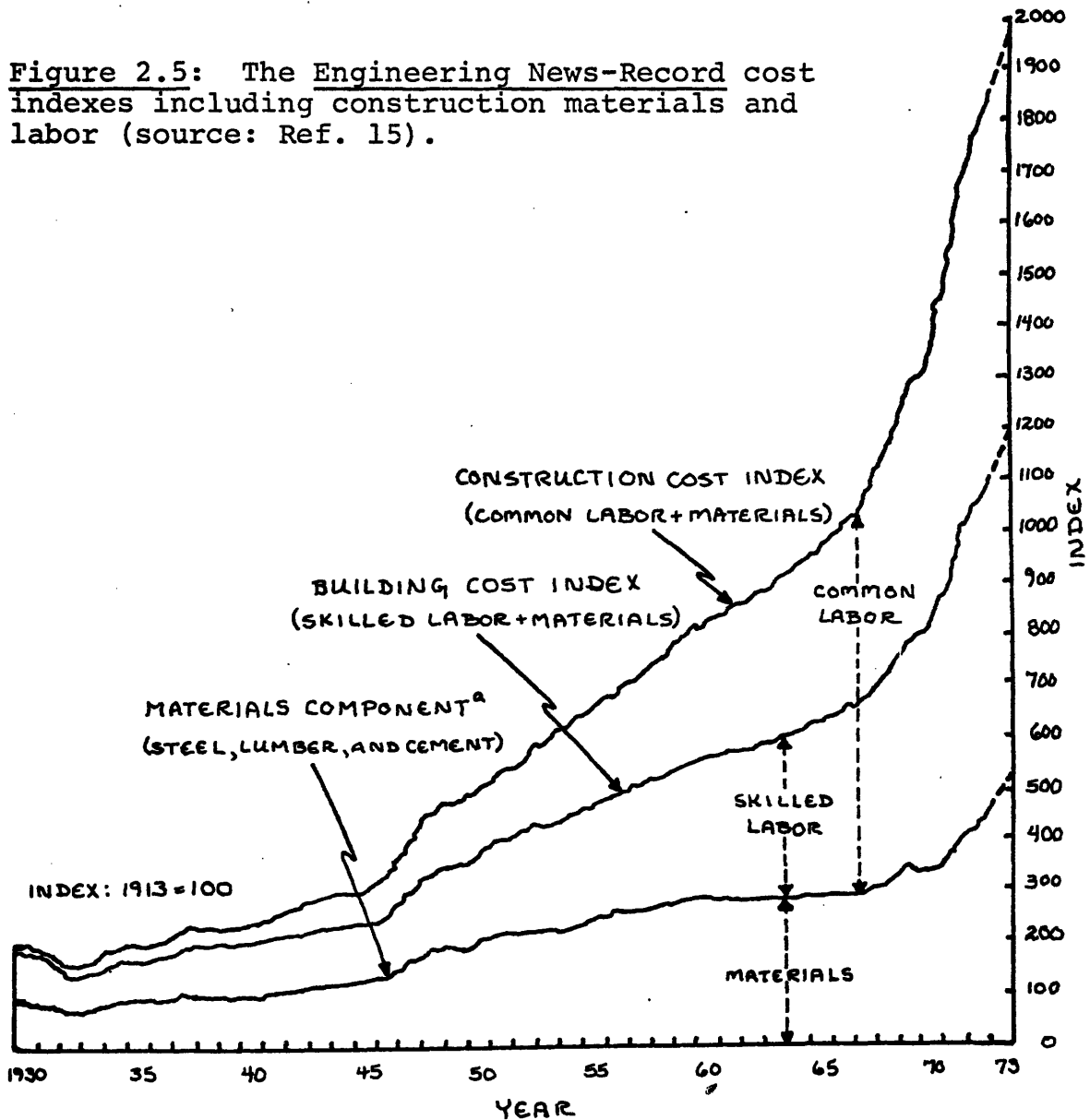
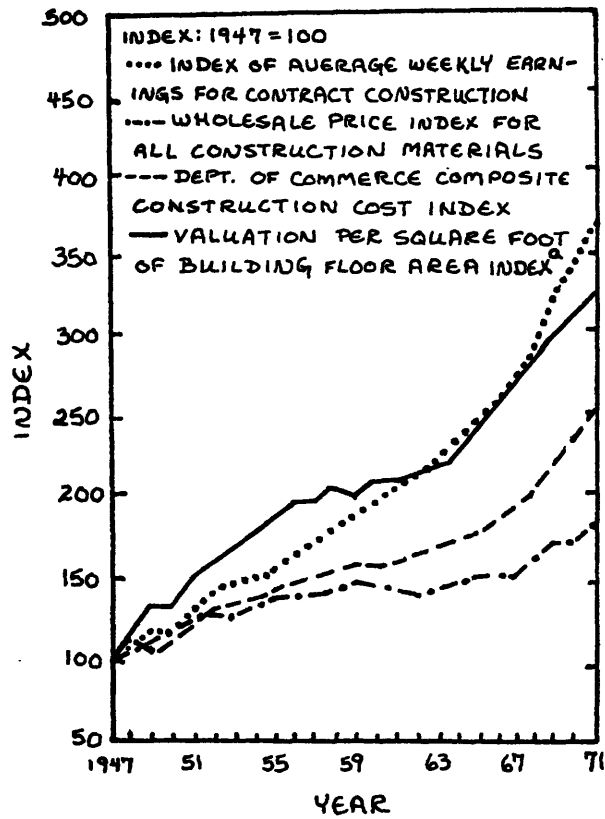


Figure 2.5: The Engineering News-Record cost indexes including construction materials and labor (source: Ref. 15).



^aThis is not an index. It is the materials component of both ENR cost indexes.

Figure 2.6: Cost indicators for nonresidential buildings (source: Ref. 11h).



^a Valuation per square foot is actual construction costs, exclusive of land, architect's fees, and equipment which is not an integral part of the structure, divided by the floor area under the roof, exclusive of the basement. This index is somewhat different from cost or price indexes in that it reflects, in addition to changes in price and cost, changes in the quality of construction, such as different materials and methods, as well as changes in productivity.

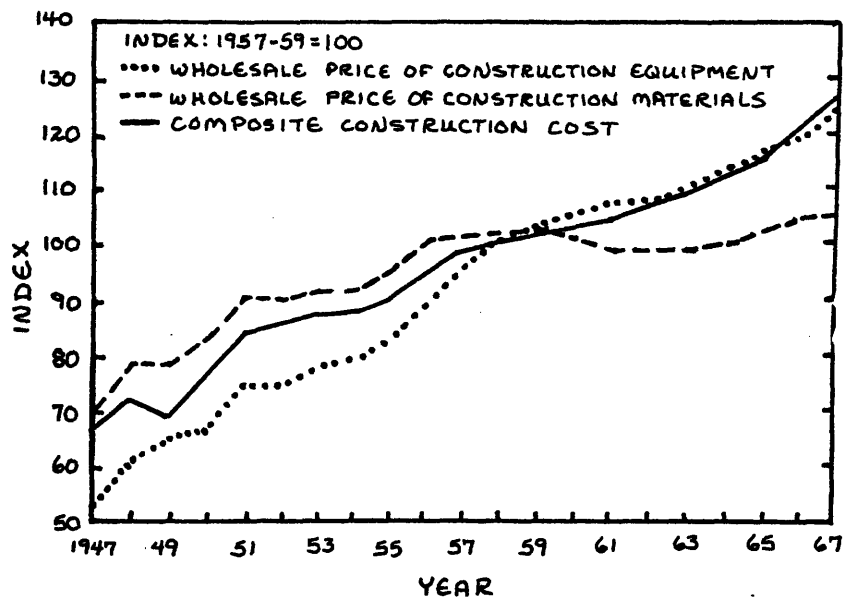
Figures 2.5 and 2.6).

The cost of capital input in construction consists mainly of expenditures in construction machinery and equipment and is really only a significant part of construction cost in heavy construction. While the price of equipment in the past generally rose at a faster rate than that of materials, in more recent years it has slowed down considerably (see Figure 2.7).

It was not until recently that financing began to receive much attention, and then it was for two reasons: (1) its impact on construction demand via monetary and other government policies as discussed above and (2) its impact on the final cost of the facility to the owner. The short-term or interim financing during construction, though becoming increasingly expensive, has not been a significant problem because it is such a small part of the construction cost, but the long-term financing by the owner, which has also been becoming increasingly costly, is of significance, especially in residential construction. One study (34) estimated that 40 to 50 percent of monthly occupancy costs in any residential facility consisted of debt retirement and of that about half was for the financing alone (see also Ref. 14, 18).

The cost of the land is another factor which has received an increasing amount of attention in recent years, for land costs have been rising at a faster rate

Figure 2.7: Price indexes of factors of construction
(source: Ref. 9).



than have the direct construction cost factors. This increasing cost of land is, of course, more significant with respect to single family housing than with other types of construction because the land cost is a larger portion of the total cost in housing. At the same time, though, an indirect effect, of higher land costs tending to induce higher construction costs, is felt by all types of construction (3, 7, 11d, 14, 18, 34).

The cost factors which have not yet been discussed are profit, overhead, marketing, design fees, and so forth. None of these form a really significant part of the final price to the purchaser, but they do merit some brief consideration though there is a paucity of information on their trends over time. Some of these, such as profit and design fees and even occasionally overhead to some extent, are included as percentages in the price. The degree of competition in the industry, among other factors, will certainly tend to influence these values. Furthermore, the state of technology, not only in terms of materials, equipment, and processes but also in terms of managerial efficiency, organization, and skill, influence these costs as well as those discussed above.

Thus, the conglomerate of costs which affects the price of construction products is extensive, and in turn,

numerous other factors influence these costs. In fact many of the costs, for example those of materials, equipment, financing, and land, may be considered to be established in supplying industries rather than in construction and thus are further subject to numerous influences outside the construction industry. The major direct cost factors which seem presently to be exerting the most upward pressure on construction prices are those of labor, land, and financing, and of these, the cost of labor is probably most significant throughout construction as a whole.

As mentioned above, excess demand might also be at least partially responsible for the rising price of construction. Because there is virtually no data on this impact, the best approach is to look at the factors which affect demand. Characteristics of construction buyers and users is the first item of importance. In the past, demand has seemed to be fairly inelastic though it is expected that this varies among the various types of construction, tending to be somewhat more inelastic in public construction than in private and, in private non-residential than in residential. Its tendency to be concentrated in a single region and of a single type results in rather sudden demand increases, and this, combined with the industry's being rather slow to catch up with such increases, often results in construction

prices rising further and more often and tending to stay there longer than might be expected in other industries where increases tend to be more gradual. Another consideration is the reaction of various purchasers to the business cycle; e.g., the impact of a short recession on the residential construction market would tend to be different from that on the nonresidential market. This brings up another set of major influences on demand, and these are government policies, including monetary, fiscal, and tax policies, economic development policies, direct and indirect government aids to stimulate construction, zoning and subdivision regulations, and so forth. Monetary, fiscal, and tax policies were extensively discussed above with the conclusion that their influences on demand for construction of specific types are considerable and can be positive or negative; in fact, these policies are frequently used by the government in an effort to control excess demand. The remaining policies are more commonly thought of as being used to encourage construction of certain types of facilities excepting zoning and subdivision regulations which generally result in restrictions on the type of construction. Government spending policies also naturally influence construction demand directly. One final impact on demand is, of course, the inventory of existing facilities and their current level of use (11k, 20, 23).

Thus, the potential causes of rising construction prices are numerous, and it is likely that contributions come from both sides, both cost-push and demand-pull, in varying degrees at various times. In one of its most recent efforts to control inflation, the government established the Construction Industry Stabilization Committee (CISC), which over the past two years has been fairly successful in holding down the rate of wage increases in construction, but its future success is unsure. Along with this, the government has gone through a series of wage-price controls ranging from strict ones in late 1971 to voluntary ones in early 1973. These have been moderately successful in keeping down labor costs but less so in controlling prices, and it is feared, with the recent establishment of voluntary controls, that wages will try to catch up to prices and inflation will result. Economic controls are thus only temporary, and longer term measures must be taken. It must be realized, however, that this is a complex problem with no easy, and at the same time desirable, solution or it would have been solved long before this. Part of the solution is likely just to make an effort to adapt to the situation. Howenstine (23) and others (27, 43), however, do suggest some approaches, though none are too specific, for dealing with the problem of rising construction prices in the long run, such as:

(1) promotion of measures to stabilize demand and to distribute it more evenly, (2) implementation of measures to encourage more effective utilization of resources and increase productivity, (3) developing means to estimate future demand and the needed resources so more effective planning can be done, and (4) restructuring the labor market in order to permit an improved trade-off between unemployment and inflation.

2.3 Labor, Capital, and Total Factor Productivity

The construction industry has long been accused of having a low productivity growth rate compared with that of other industries. Whether productivity is really as low as reputed is subject to question due to the extreme difficulty of measuring this index with any accuracy. Numerous studies have been done in the past on the growth rate of productivity in construction, resulting in just about as many different estimates of the rate (see Ref. 12, 35a for examples). Estimating construction productivity is difficult because of the heterogeneous nature of the product (i.e., varying size, function, quality, performance characteristics, date of completion, duration of construction time, and so forth). The simultaneous absence of sufficient data makes it even more difficult to measure productivity reliably for the industry as a

whole, let alone for various types of construction and geographic regions. These are the same basic problems which arise, as mentioned above, in determining a price index, and it is this index which is needed to arrive at an estimate of construction activity or volume of output in order to determine productivity (productivity is traditionally defined as the ratio of real output to the associated real input). Furthermore, productivity is generally limited to labor productivity or real output per man-hour. Not only does this assume the labor input is homogeneous, but it also fails to consider the other input factors of capital (investment in equipment, etc.) and materials, and technological change, which is thought to be largely responsible for productivity increases, frequently changes the mix of inputs as well as their quality.

Because productivity and its change are of considerable concern to the construction industry, efforts are being made to deal with the above difficulties. Most work in the area of labor productivity has been concerned with the determination of some more valid measures for real output or, alternatively, with some altogether new approaches. These new indexes show the annual growth rate of labor productivity to be higher, more like 3 percent or so from 1947 to 1967, instead of the 2.6 percent shown by the index based on the Department of Commerce composite

cost index (see Table 2.2). However, these new indexes still have several shortcomings, such as being based on limiting assumptions, failing to consider the lack of homogeneity of the input, and so forth (9, 12, 19, 31, 35b, 35d, 36, 44).

Based on the new labor productivity measures, construction still appears to be somewhat behind other industries (see Figure 2.8). This is understandable to some extent because construction is an industry in which the technology of the product, and even the product itself, is continuously changing, making it hard to gain expertise and efficiency as is possible in manufacturing, for example. This lack of standardization, as is characteristic of construction products, makes the industry similar to a service industry which also generally exhibits low labor productivity. Other reasons may also account for this and will be considered along with some possible approaches to dealing with factors which might be constraining labor productivity in Section 3.5 in the chapter on labor.

Capital, in terms of plant, equipment, and inventory, has been included in productivity measures by itself and in conjunction with labor in other industries, such as manufacturing, and private industry as a whole. In the construction industry, Cassimatis (9) chose to define capital input as the financial capital tied up in construction during the production process (thus indirectly including materials to

Table 2.2: Indexes of labor productivity (output per man-hour) in contract construction, as determined by various methods (index: 1957-59=100) (source: Ref. 9, 12, 19).

Year	(1)	(2)	(3)	(4)	(5)
1947	70.0	70.4	67.3	65.2	68.7
1948	70.8	78.7	70.7	72.8	74.2
1949	77.4	85.8	75.9	83.9	79.5
1950	79.4	81.3	74.2	83.6	95.3
1951	81.7	80.9	77.3	79.0	77.2
1952	80.6	83.0	79.1	79.9	77.3
1953	87.7	87.1	84.4	84.9	85.3
1954	93.3	92.3	91.4	92.0	94.0
1955	98.3	94.8	95.3	91.8	99.7
1956	97.4	94.9	93.1	92.6	87.0
1957	98.0	98.5	97.0	97.2	89.7
1958	99.8	100.0	100.0	100.6	100.0
1959	102.2	101.5	103.0	102.0	105.7
1960	102.4	104.0	106.3	106.7	107.3
1961	101.6	107.1	109.5	108.2	114.2
1962	100.7	108.5	111.7	113.8	118.8
1963	98.3	109.3	111.0	114.5	117.3
1964	101.7	112.3	116.0	na	117.1
1965	98.1	115.2	118.1	na	117.7
1966	99.2	119.0	121.3	na	na
1967	96.6	119.0	121.8	na	na
Average Annual % Rate of Growth	1.6%	2.6%	2.9%	3.0%	2.9%

(continued)

(Table 2.2 continued)

Column (1): The Office of Business Economics of the Department of Commerce uses their double deflation method to determine real output as the gross national product originating in the contract construction industry in constant dollars. Its implicit deflator is used here, but it is generally felt to be inadequate resulting in an understatement of real output and hence of labor productivity (source: Ref. 9).

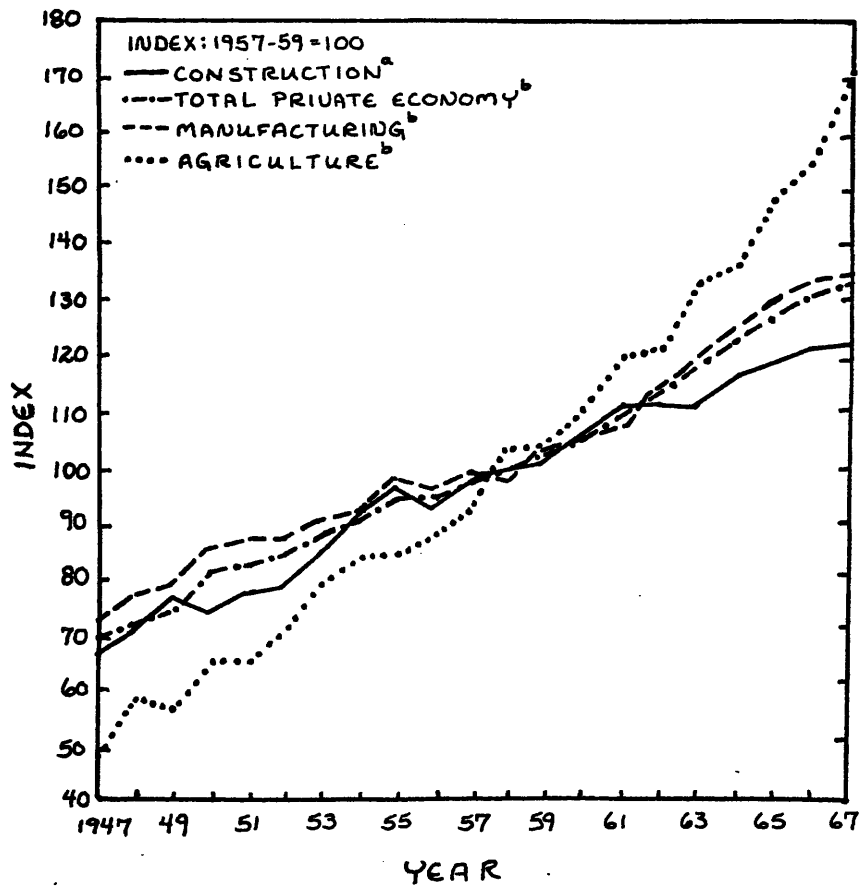
Column (2): The Department of Commerce composite cost index is used as the deflator to obtain real output. It, too, is generally felt to understate real output and thus labor productivity (source: Ref. 9).

Column (3): Cassimatis used a weighted average of three indexes (residential (E.H. Boeckh), nonresidential (Turner Construction Co.), and heavy construction (Bureau of Public Roads)) to arrive at his derived deflator which he used to determine real output and from that labor productivity (source: Ref. 9).

Column (4): Dacy derived price and productivity indexes simultaneously using indexes of man-hours, current dollar expenditures, wages, and materials prices (source: Ref. 12).

Column (5): Gordon developed a new price index based partly on actual buyers' prices paid for several structural components and partly on a modification of Dacy's method using aggregative data for the entire contract construction industry. Along with this a new productivity index was also derived (source: Ref. 19).

Figure 2.8: Indexes of output per man-hour for selected industries and the private economy (source: Ref. 9).



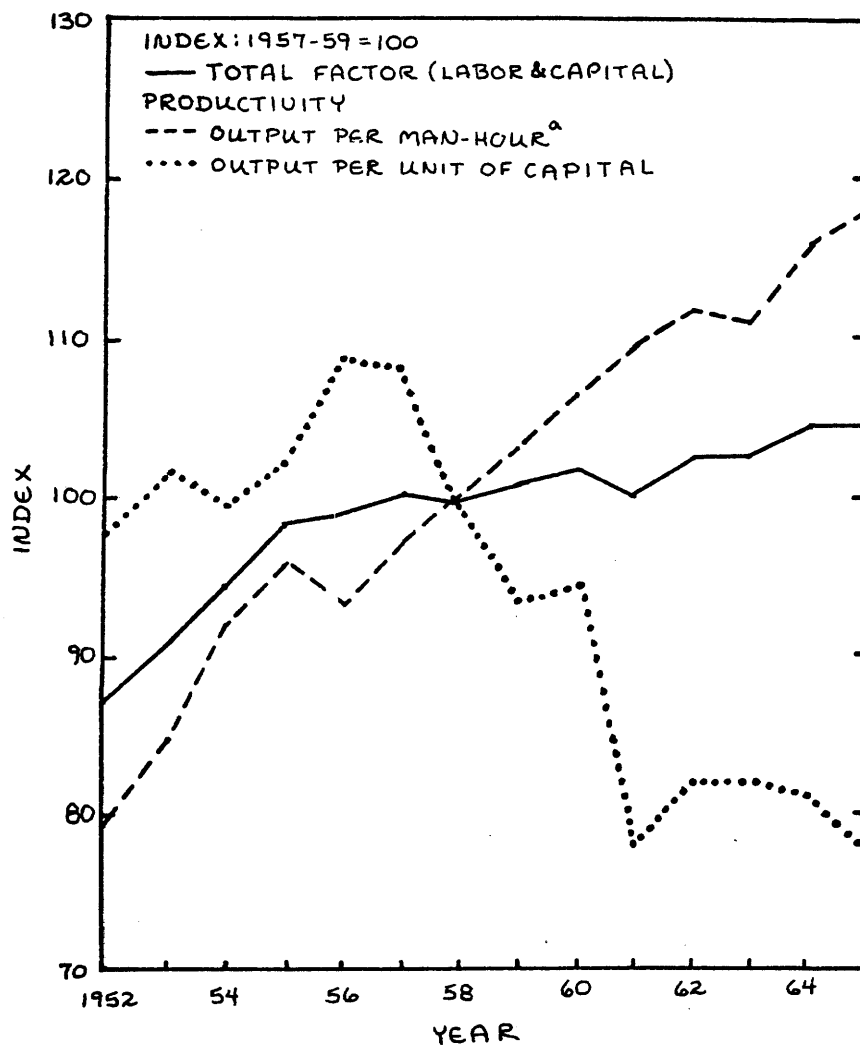
^aBased on Cassimatis' derived deflator (see Table 2.2).

^bBased on U.S. Bureau of Labor Statistics data.

some extent) in addition to that in equipment and inventories and developed a capital productivity index based on this definition (see Figure 2.9). The trend for capital productivity to decrease over time as labor productivity increases seems reasonable due to the substitution of capital for labor, though technological change resulting in increased efficiency in using capital should offset this somewhat. However, data in this area is very scarce, and more research certainly remains to be done (e.g., perhaps it would be better to try to develop separate capital and materials indexes, being sure to eliminate any overlap) before any significant conclusions, as to the performance of the construction industry in terms of capital productivity, can be drawn (9, 31, 37, 44).

Any single factor index, however, is only a partial measure of productivity in the industry as a whole. What is needed is a total factor index which is a weighted combination of all inputs, thus cancelling the effects of factor substitutions. Various economists (see Ref. 31, 44) have arrived at joint labor-capital productivity indexes, and Cassimatis (9) has derived one for the construction industry on the basis of his definition of capital input (see Ref. 35d for a different multi-factor productivity index for construction). As expected, this index (see Figure 2.9) increases over time but at a slower rate

Figure 2.9: Indexes of factor productivity in contract construction (source: Ref. 9).



^aBased on Cassimatis' derived deflator (see Table 2.2).

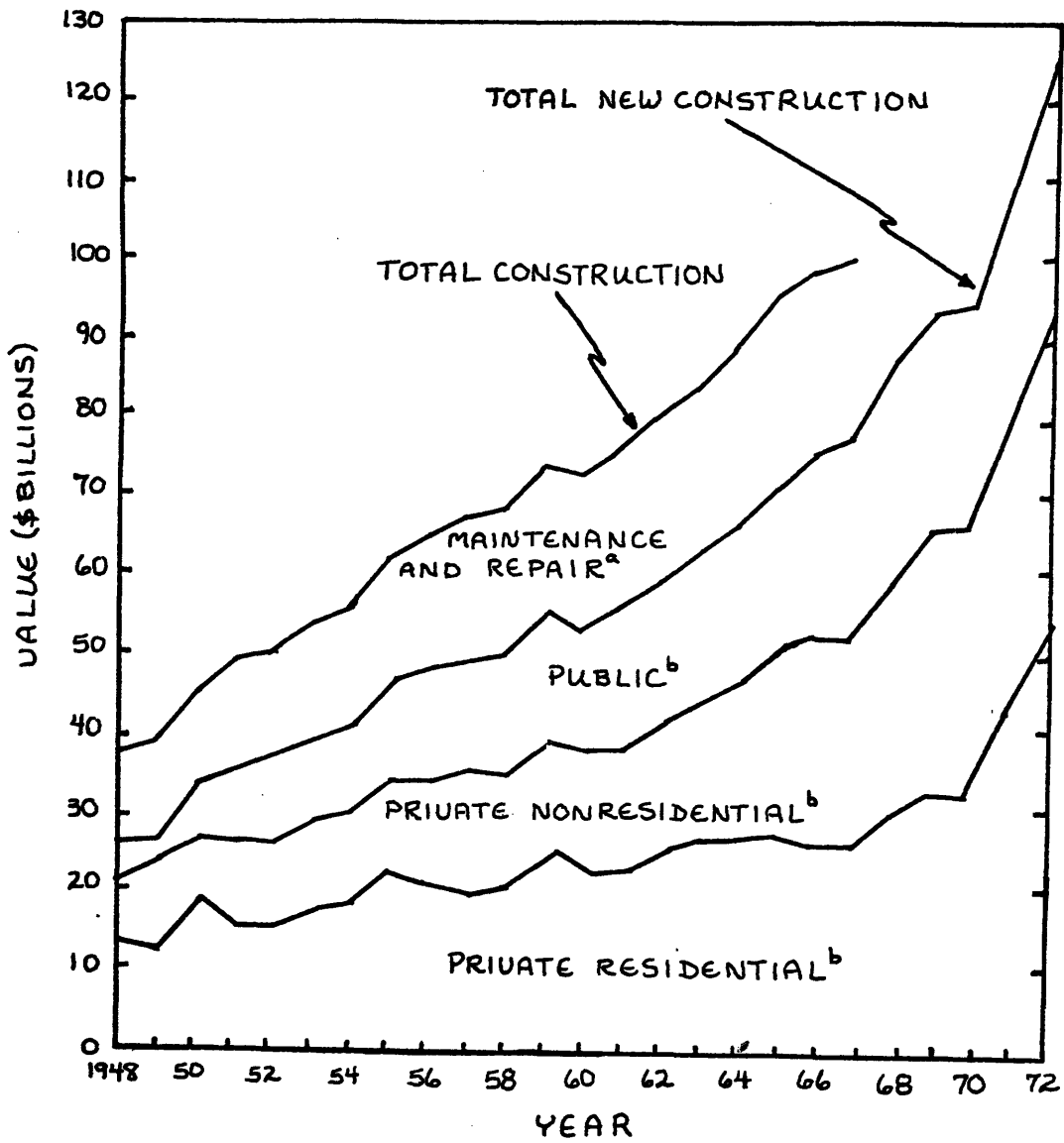
(1.5 percent per year from 1952 to 1967) than does labor productivity because of the influence of capital productivity.

Thus, progress is being made in this area, and the early indications are that productivity may not be as low in the construction industry as has long been believed, but the real problem seems to lie in defining and measuring this productivity to find out just how it does compare, as far as is feasible, with other industries. Only then can the true extent of low productivity in the construction industry be determined and the seriousness of the problem evaluated such that appropriate analysis can be begun.

2.4 Industry Growth

Over the years, the value of construction as a whole and of its major components has risen, though not always steadily (see Figure 2.10a). Much of this growth, however, has been due to inflation, and thus, while the general trend of construction's real output has been upward, it has risen and fallen many times in the process, naturally resulting in a growth rate considerably less than that exhibited by the value of construction (see Figure 2.10b). Construction's share of total U.S. output (i.e., GNP) has generally declined over the years since 1955, but since 1970 it has begun to recover a bit (see Figure 2.11).

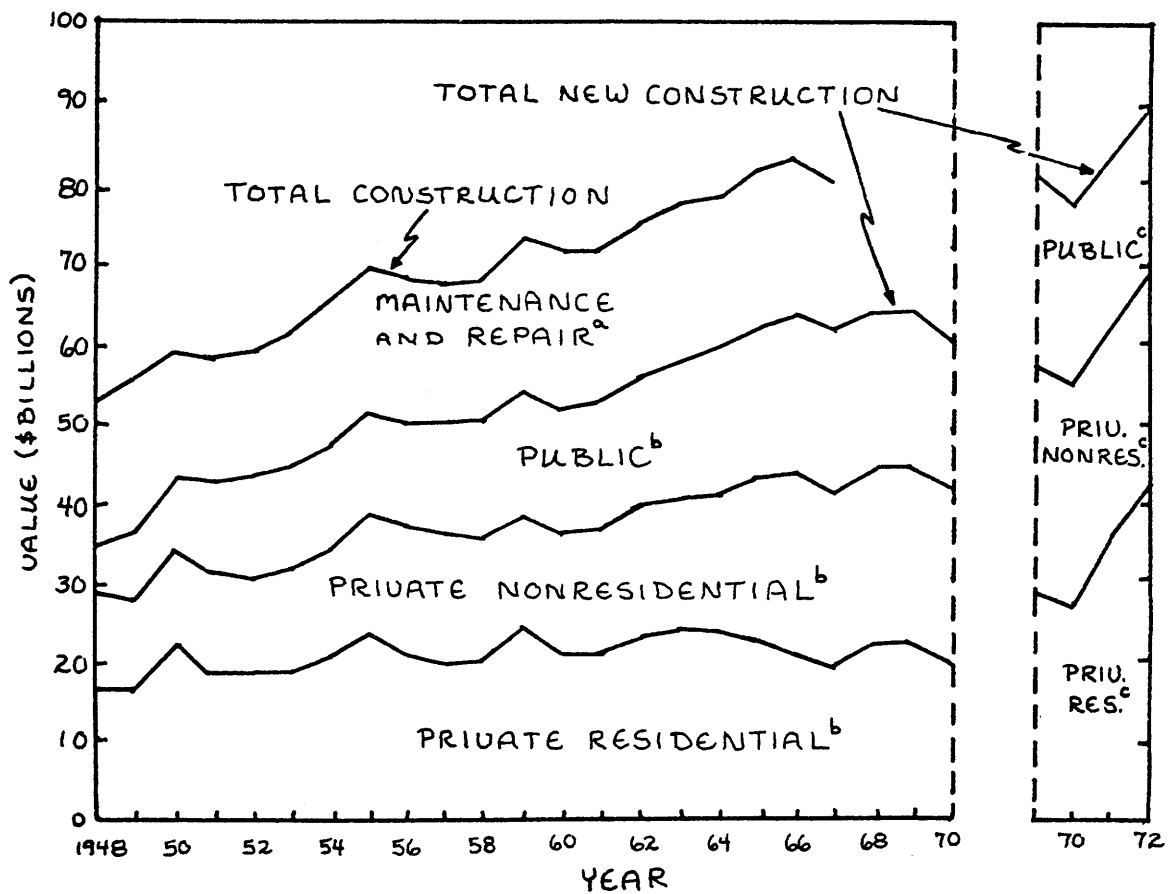
Figure 2.10a: Value of construction in current dollars
 (source: Ref. 9 and various issues of Construction Review).



^aFrom Cassimatis (9).

^bFrom various issues of Construction Review.

Figure 2.10b: Value of construction in constant dollars
 (source: Ref. 9 and various issues of Construction Review).

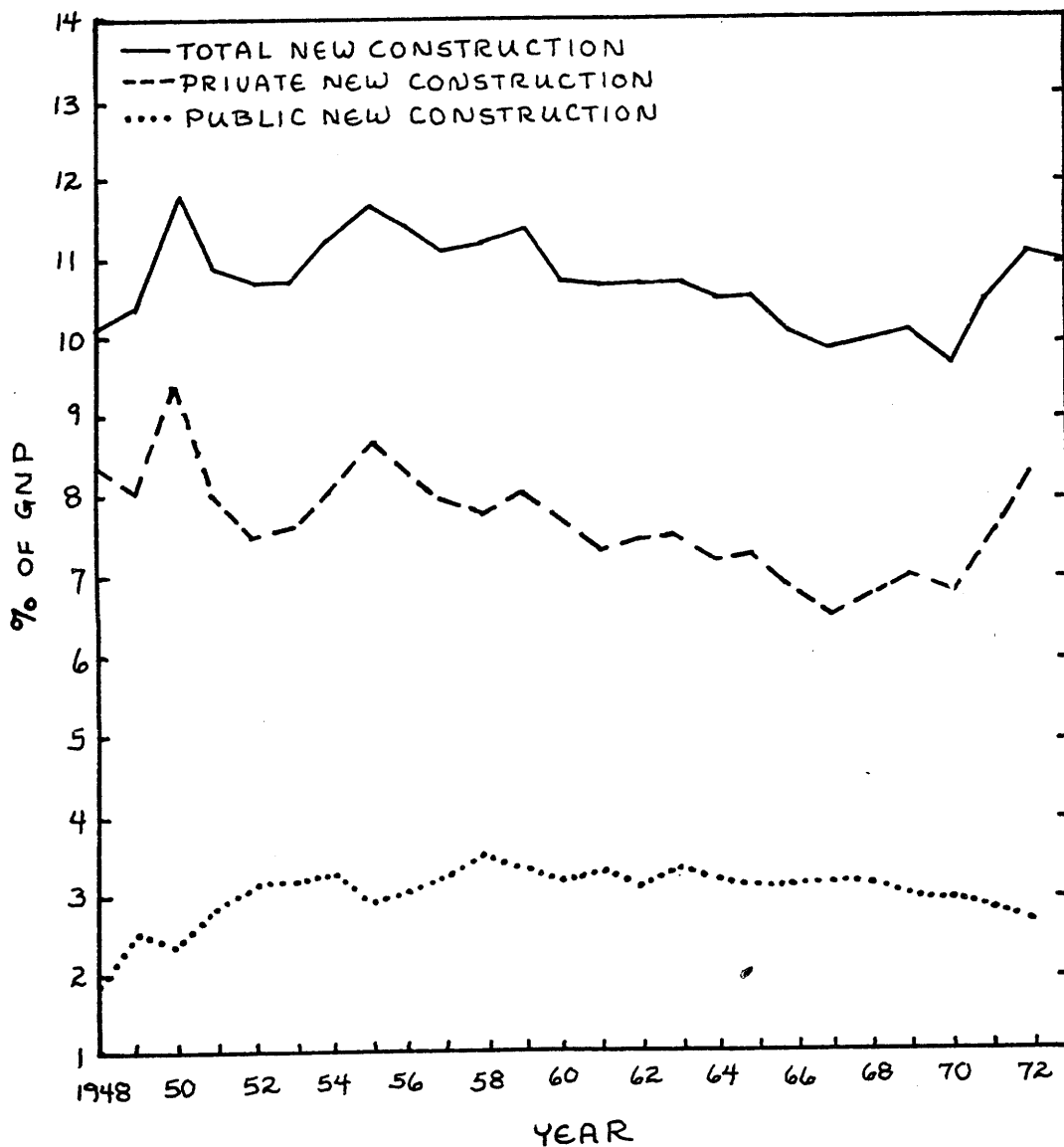


^aFrom Cassimatis (9) (in 1957-59 dollars).

^bFrom various issues of Construction Review (in 1957-59 dollars).

^cFrom various issues of Construction Review (in 1967 dollars).

Figure 2.11: New construction put in place as a percent of GNP (in current dollars) (source: Ref. 11g (for 1948 to 1966 data), 32 (for 1972 data and 1973 projection), and various issues of the Statistical Abstract of the U.S. and Construction Review (for 1967 to 1971 data)).



Finally, it is interesting to note how the relative proportions of the components comprising total construction have changed over the years (see Table 2.3).

In looking at the factors affecting growth, the level of demand is, of course, the first thing that comes to one's mind and rightly so for it has a most significant impact; this factor and what influences it have been thoroughly discussed above in Sections 2.1 and 2.2. The other side of the growth picture is the supply side, which affects the productive capacity of the industry, and Maisel (26), among others, does a good job of defining this. The availability, cost, and substitutability of the needed resources, including labor, materials, capital, and land, are of utmost importance. The efficiency with which these resources are used is also important and depends upon the availability of resources for substitution, quality of the resources, skill and proficiency of management, and the political, legal, and cultural environment. A final consideration is the productivity of these resources and how it is expected to change over time, due to technological change and so forth. Thus, the complex of factors which influence growth is considerable, making projections into the future nearly impossible.

One question which frequently arises is whether or not the construction industry has the capability of meeting

Table 2.3a: Relative proportions of the components comprising total construction (estimates derived from Figure 2.10a).

Year	% of Total Construction	
	New Construction	Maintenance and Repair
1948	67%	33%
1967	75	25

Table 2.3b: Relative proportions of the components comprising new construction (source: estimates derived from Figure 2.10a).

Year	% of New Construction		
	Private		Public
	Residential	Nonresidential	
1948	50%	32%	18%
1970	34	36	30
1972	44	32	24

the 10-year housing goal of 26 million dwelling units. The general impression conveyed by the reports put out by the President's Committee on Urban Housing (34, 35) is that it does, but that the goal can only be accomplished if there is extensive cooperation, commitment, and planning on behalf of government, labor, and management in working toward a common goal. In the first couple of years after the goal was established, residential construction was insufficient to meet the projected timetable, but in the last two years it has picked up. This relative success of the last two years seems to be more a result of the industry's ability to shift its resources from one sector to another in an effort to meet demand, than a result of any more dramatic changes in the industry, such as a significant increase in industrialized construction in the residential sector. Thus, whether or not the projected timetable will be met in the future is at least partly dependent on the concurrent demand in other sectors of the industry.

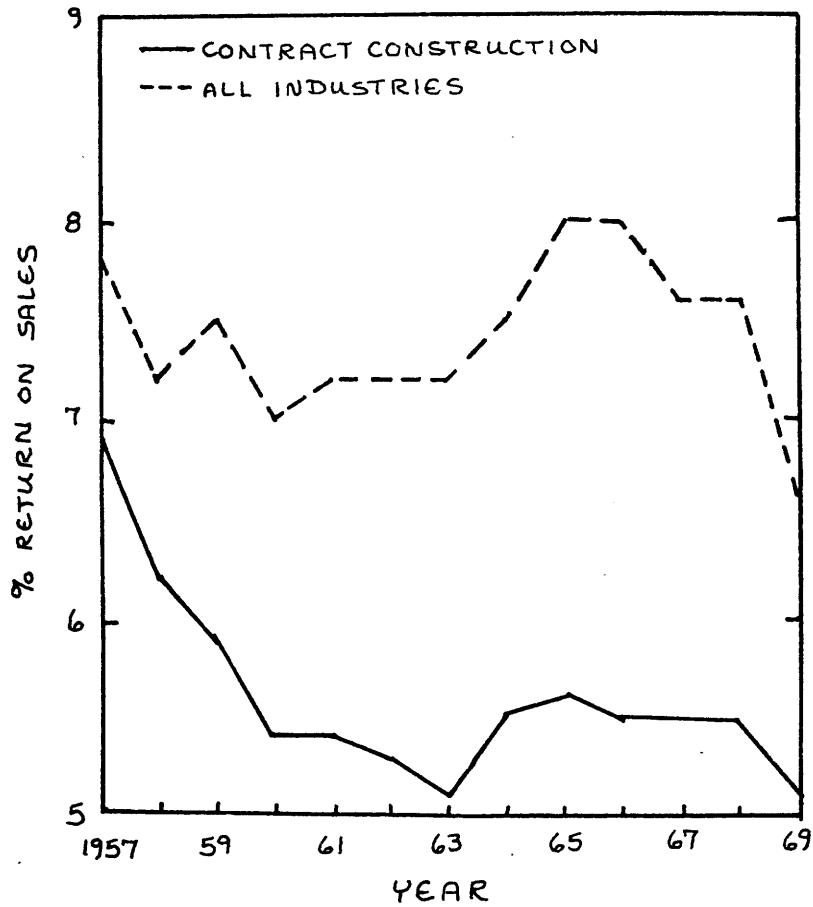
2.5 Profitability of the Industry

Profits in general, in other industries as well as in construction, have fallen since the prosperous period immediately following World War II though output has generally increased (9, 33). Information on profits in the construction industry is rather limited. Naturally enough,

it pertains only to contract construction which represents about 85 or 90 percent of all construction activity, the remaining 10 to 15 percent being force account (whereby owners of structures utilize their own labor to do construction work) or speculative construction. For many years and certain types of data, information is available only for corporations, and it is not clear that trends exhibited by corporations are representative of those exhibited by the proprietorships and partnerships which are so common in the construction industry. Furthermore, data is generally limited to construction as a whole or, at best, is broken down into building, general except building, and special trade contractors, giving nothing about the different types of construction products.

There are innumerable ways to look at profits, and the most common is to look at net profits before taxes as a percentage of business receipts, i.e., return on sales (see Figure 2.12). Return on sales for construction is noticeably below the all industry figure, seeming to stabilize at about 5.4 percent for the 1960's. Though this statistic tends to be low for construction, there is another profit indicator which should be considered, and this is return on investment (see Figure 2.13). The return on shareholders' investment fluctuates quite a lot for all industries as well as for construction, though as might be expected construction by itself fluctuates a little more

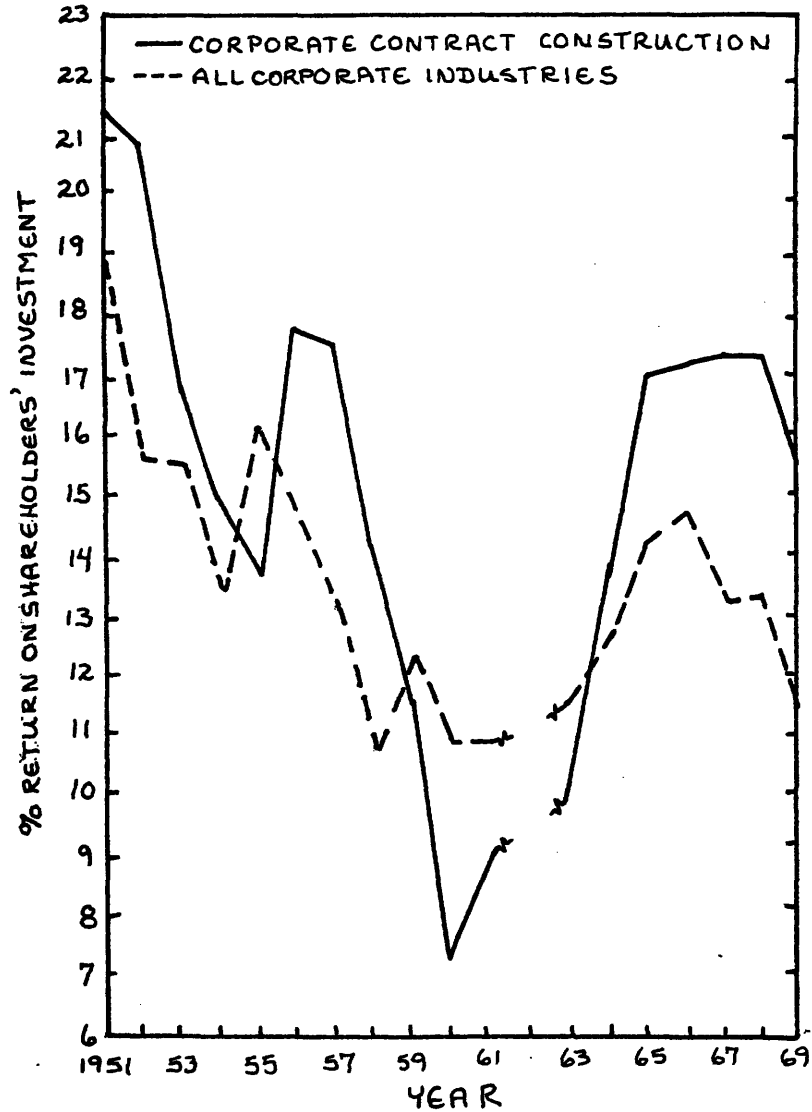
Figure 2.12: Return on sales^a for all industries and contract construction (source: various years of the Internal Revenue Service's Statistics of Income - Business Income Tax Returns).



NOTE: Data for proprietorships, partnerships, and corporations.

^aThat is, net income (less deficit) before taxes divided by total business receipts.

Figure 2.13: Return on shareholders' investment^a for all corporate industries and corporate contract construction (source: various years of the Internal Revenue Service's Statistics of Income - Corporation Income Tax Returns).



NOTE: Data for 1962 is not available, and for 1963 the ratio is based on net worth instead of average net worth.

^aThat is, net income (less deficit) before taxes divided by average net worth.

widely. About the only trend that can be gathered from this data is that construction does seem to have a higher return on shareholders' investment than does industry as a whole. This is somewhat expected because construction requires relatively little in the way of capital investment. Furthermore, this data is for corporations only, and their profits might be expected to be higher than those of proprietorships and partnerships due to their being better established, less prone to failure, and so forth, though their higher capital investment and overhead would offset this at least somewhat.

Various explanations can be given to account, at least to some extent, for the construction industry's relatively low profitability. Some of these are briefly as follows: (1) the construction industry is highly competitive - e.g., construction work is generally obtained by bidding, and if one leaves too much room for profit in his bid, he likely will not get the job for his bid will be too high; (2) construction is a risky and uncertain business, and profit is often eaten up by unexpected occurrences; (3) a large number of contractors fail every year, and this, along with other managerial problems, results in decreasing the potential profitability of the industry; and (4) construction costs, such as those of labor, have risen rapidly over the years and continue to do so, and the ability of

management to absorb these costs, for example by increasing productivity, and/or pass them on to the buyer in such a competitive market varies from one contractor to the next and often affects profits adversely (9, 10, 33).

The problem of rising construction costs and some methods of dealing with them have been extensively discussed above and will be discussed more later, but the rest of the causes of low profitability are basic characteristics of the industry and its management and organization. A common response to low profits is to cut overhead, generally by thinning out management. However, this does not seem to be a wise approach considering the fact that poor management is often largely responsible for low profits. A more sensible approach is to try to improve management's efficiency, planning, and overall business strategy so as to avoid unexpected occurrences or at least allow for them, improve utilization of the resources, decrease the frequency of contractor failures, improve one's chances of meeting competition under advantageous conditions, and so forth (some of these aspects will be discussed in more detail in the management and organization chapter) (9, 10, 33).

2.6 Financing in Construction - Availability and Cost of Money

The financing of construction projects, both while they

are being built and once they have been completed, is a necessary but very complex matter and is essentially unique to the construction industry. The details of the financing process vary depending upon the type and size of the construction project, the participants involved, the economic conditions at the time, the geographic location, and so forth. Nevertheless, the basic issue remains the same - the availability and cost of money. In looking at this issue, the major factors influencing it will be identified, such as where savings go, financial intermediaries and their investment flexibility, and government agencies and policies. But first, it might be useful to look at the various types of financing involved and its necessity for various types of construction projects.

Costliness is one of the basic characteristics of construction products, and thus almost any construction project requires a large outlay of money on the part of some of the participants - money which they may not have or may want to invest elsewhere in order to maximize their return. Thus, financing, usually secured by the property itself, is generally obtained both during construction and once it is completed, but who gets it largely depends upon the particular situation and participants. A construction loan generally provides financing during the construction process². It is a short-term loan obtained by

²If the general contractor needs still more working capital, he has to get a short-term loan on the basis of whatever collateral he has.

the owner, developer, or general contractor and is generally advanced as the work is completed such that the amount loaned is usually less than the value of the improvements and is repaid as soon as the whole project is finished (it is, in essence, replaced by permanent financing). Generally, before a construction loan can be obtained, a permanent mortgage commitment³ must be obtained. Through this commitment then, a permanent mortgage⁴ can be obtained by the owner (or developer who will likely transfer it to the owner when he enters the picture) once construction is complete. This mortgage is a long-term loan, being advanced as a lump sum for the purchase of the property (or paying off of the construction loan) and being repaid over a period of years. This tie between the financing of the production process and that of the purchase of the finished product is unique to the construction industry and results in developments, which affect the availability of permanent mortgage money, being transmitted to the construction market

³This is a contractual commitment of the permanent lender, in consideration of a fee, to become a permanent mortgagee on the property in question, provided the borrower (owner or developer) meets specified conditions by a specified date.

⁴It should be noted that a permanent mortgage can be used to purchase a new or used constructed facility, but here interest is mainly in terms of new construction.

and affecting the availability of construction loan money, even though the money generally comes from different lenders and the loans have rather different characteristics as respects, for example, maturity, risk, and yield (10, 11e, 16, 22, 35c, 38, 46).

The importance of obtaining financing secured by the property itself as discussed above varies with the type of construction. In private single family house construction, it is very important, for it is a rare family that has sufficient capital to purchase a home outright (or even if it did, it probably would not want to because of such things as tax treatment of home mortgage interest) and its other sources of external financing are rather limited. Furthermore, the builders of such housing are also often small and have limited capital, making construction loans a necessity. In private multi-family housing construction, mortgage financing of production and purchase is also important, even though this is an income-producing property and the owner and/or developer might be expected to have more in the way of internal funds available and have access to a broader range of external financing sources. Both Winger (46) and Golembe and Associates (35c) claim that about 75 to 80 percent of the purchase price of every residential construction transaction is financed with mortgage loans, but in periods of credit restraint it seems reasonable to expect multi-family housing to be in a better

financial position than is single family. Private non-residential building construction, the major components of which are industrial and commercial buildings, have an advantage over residential construction in terms of financing at any stage. Not only is it more likely that construction could be financed with internal funds, such as undistributed profits, should that seem desirable, but also there is a much wider variety of external funds available, such as through the sale of corporate bonds, commercial and industrial loans (i.e., loans not secured by the real estate), loans from national or even perhaps international capital markets, and other financial transactions. Furthermore, within the mortgage markets as well as outside, investors in nonresidential construction are generally preferred borrowers. Last but not least is the fact that even in times of high interest rates as long as money is available nonresidential construction may be reasonably feasible because increased credit costs may be more readily absorbed by nonresidential borrowers owing to profit and income tax considerations, capital consumption allowances allowing them to write off fixed investments quickly, and future business expectations (11a, 16, 17, 35c, 38, 46).

A brief mention about the funding of public construction is also in order here such that the competition it provides for funds is understood. The majority of public

construction is done at the state and local level, with about 60 percent of it being financed by municipal bonds⁵ and the rest financed by federal aid and current revenues (e.g., property taxes, grants, shared revenue from income and sales taxes, and miscellaneous nontax sources). The federal government does some construction of its own with the aid of federal bonds and current revenues. Though the government takes potential funds away from private construction through the sale of bonds, it also aids private construction in numerous ways through various programs as discussed below (11a, f, 1, 16).

The availability of capital for financing private construction at any stage depends, of course, on the flow of savings. In the U.S., the direct flow of funds from the savers to the borrowers plays only a small role; rather, it is more usual for the transaction to occur via financial intermediaries or institutions. These financial intermediaries, as will be discussed below, finance the majority of construction projects, and thus it is the factors which influence the flow of savings into these institutions and those which influence the institutions' decisions as to how

⁵The advantage of these over corporate and federal bonds is that they are exempt from federal income taxes (and state income taxes in state of issuance). This, of course, appeals to individuals, financial institutions, and corporations in high tax brackets.

to invest these savings that affect the availability of construction financing.

The majority of savers are individuals and are fairly small, tending to be concerned with the safety and liquidity of their money rather than immediate return and growth potential, and this is exactly what depository institutions (e.g., commercial banks, savings and loan associations, and mutual savings banks), one form of financial intermediary, can offer. Thus in recent years, such institutions have accounted for over 50 percent of all consumer financial savings. The other quality the small saver seeks is protection for the future through insurance, and thus he invests in contractual institutions (e.g., life insurance companies and pension plans), another form of financial intermediary, which have accounted for another 30 to 40 percent of consumer savings in recent years. During periods of strong credit demands and monetary restraints however, the financial institutions⁶ have trouble competing for savings because they are unable to adjust their investment portfolios and increase the returns to savers rapidly enough. The usual outcome is that the more sophisticated savers move their funds out of financial institutions and directly into the higher paying financial instruments, for

⁶This is especially true for savings and loan associations and mutual savings banks because most of their investments are in long-term mortgages at fixed interest rates.

example purchasing securities of the federal, state, and local governments, thus decreasing the availability of funds for private construction financing. Thus, while funds do tend to flow into these financial intermediaries in the long run, this flow is influenced by surrounding economic conditions in the short run (5, 11b, 35c, 46).

Another factor which influences the availability of financing is the investment flexibility of the various financial intermediaries. Tables 2.4, 2.5, and 2.6 give some indication of how these various institutions have, in the past, chosen to invest their funds. Savings and loan associations have been, and remain, predominantly residential mortgage lenders, both by law and tradition, on a local market. The bulk of their loans is limited to single family housing permanent mortgages though they are also active in construction lending for the same. Mutual savings banks also operate in a local market, and though they are authorized to acquire a variety of financial instruments, in recent years they have tended to reduce their other holdings (e.g., government securities) in favor of increasing their mortgage holdings, predominantly of single family homes. In terms of construction loans, these banks have been small but steady contributors, again mostly in the area of single family housing. In contrast, commercial banks, which are general purpose lenders and are thus very flexible in terms of the make-up of their

Table 2.4: Construction loans by major construction lenders in 1968^a (source: Ref. 38).

Lending Institution	Estimated Dollars (in Billions) Advanced on Construction Loans	% of Total Dollars in Construction Loans Attributed to Each Lender
Commercial Banks	\$10.0	51.8%
Savings and Loan Associations	6.1	31.6
Mortgage Bankers	1.7	8.8
Mutual Savings Banks	0.9	4.7
Life Insurance Companies	0.4	2.1
Real Estate Investment Trusts	<u>0.2</u>	<u>1.0</u>
Total for Above Institutions	\$19.3	100.0%

^a These figures are for 1968 only and many are necessarily estimates, but they seem fairly comparable with other data and serve to provide a general indication of the relative volumes of construction loans negotiated by the various lending institutions.

Table 2.5: Mortgage loans outstanding by type of lender and type of property, year-end 1969^a (in billions of dollars) (source: Ref. 45).

Lending Institution	Farm Properties	Commercial Properties	Residential Properties			Total Mortgage Debt	Lending Institution's % of the Grand Total
			Multi-Family	One to Four Family	Total		
Savings and Loan Associations	^c	\$10.5	\$11.6	\$118.1	\$129.7	\$140.2	33.0%
Mutual Savings Banks	\$0.1	7.2	12.2	36.3	48.5	55.9	13.2
Commercial Banks	4.2	22.1	3.2	41.5	44.7	70.9	16.7
Life Insurance Companies	5.9	25.6	12.6	28.1	40.7	72.2	17.0
All Others ^b	19.6	11.1	12.1	42.6	54.8	85.4	20.1
Total	\$29.8	\$76.5	\$51.7	\$266.7	\$318.4	\$424.6	100.0%
Property's % of the Grand Total	7.0%	18.0%	12.2%	62.8%	75.0%	100.0%	-----

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

^aThis data is preliminary for 1969, but it still serves to indicate the relative volumes of different types of construction permanently financed by various lenders.

^bThis source defines all others to include federal agencies (FNMA, FHA, VA, Farmers Home Administration - 6.4% of the grand total), trust departments of commercial banks, pension funds, nonprofit institutions, credit unions, real estate companies, and individuals.

^cLess than \$50 million.

Table 2.6: Ratio of residential mortgage holdings to total assets for various lending institutions^a (source: Ref. 35c).

Year	Residential Mortgages As % of Total Assets				
	Savings and Loan Associations	Mutual Savings Banks	Life Insurance Companies	Commercial Banks	Commercial Banks ^b
1950	78.7%	31.3%	17.3%	6.2%	(28.7%)
1955	81.2	49.8	23.6	7.5	(32.0)
1960	80.6	59.9	24.1	7.9	(27.8)
1961	79.8	61.4	23.7	7.6	(25.7)
1962	79.2	63.1	23.3	7.9	(24.0)
1963	78.9	65.8	23.1	8.5	(23.5)
1964	79.0	67.3	23.8	8.3	(22.7)
1965	78.9	68.9	24.1	8.6	(22.0)
1966	79.1	69.3	24.0	9.0	(22.0)
1967	78.3	67.6	23.0	9.2	(20.4)

^aThough this is only for residential mortgages, this table, along with Table 2.5, indicates the relative importance of mortgage lending to the various institutions. Furthermore, this table shows how the trends have changed over time.

^bMortgage holdings can also be related to time liabilities of some lenders, and in the case of commercial banks the comparison probably provides a better perspective. Thus, included in the parenthesized column is the ratio (in %) of residential mortgage holdings to total time and savings deposits of commercial banks.

investment portfolios, generally invest a relatively small portion of their funds in mortgages. However, their interest in short-term loans has led to their being the primary source of construction loans and also the customary source of short-term funds for contractors. Life insurance companies also exhibit considerable investment flexibility and tend to divide their funds between corporate debt securities and mortgages, contributing little to construction loans. Making loans on a national scale, they tend to concentrate on larger properties, generally nonresidential and some multi-family construction, though their contribution to single family housing is still significant. These, then, are the major financial institutions which contribute the major proportion of mortgage and construction loans, the rest coming from federal agencies and other private institutional and noninstitutional lenders, such as pension and welfare funds, mortgage bankers, real estate investment trusts, nonprofit and semi-public institutions, credit unions, and individuals (5, 13, 22, 35c, 38, 45, 46).

The investment flexibility of these financial institutions is of obvious importance to the availability of construction financing in that if they choose not to invest their funds in financing construction then there will be a lack of available capital for this purpose. This is generally not much of a problem in savings and loan assoc-

iations and mutual savings banks. Commercial banks and insurance companies, on the other hand, tend to shift in and out of mortgage markets during periods of credit market change because mortgage rates are rather slow to adjust to changes. This has tended to amplify the effects of credit market change on construction, especially residential, and since the allocation of funds in these institutions is not strictly regulated, about all that can be done is to try to make the mortgage markets look more favorable so the institutions will stay in them (5, 35c, 46).

The role of the government in influencing the flow of funds into construction financing is a significant one. There is a continuously changing list of government agencies and programs, each of which has a part in influencing this flow, particularly in the area of residential construction. Some of the major ones and their influences will be considered here.

The Federal Housing Administration (FHA) and the Veterans Administration (VA) have greatly stimulated residential construction because, by insuring lenders against potential loss, which is their major function, they have made mortgage funds available to more borrowers. The impact of these programs has fluctuated from time to time depending on market conditions, with their greatest influence being on encouraging life insurance companies and

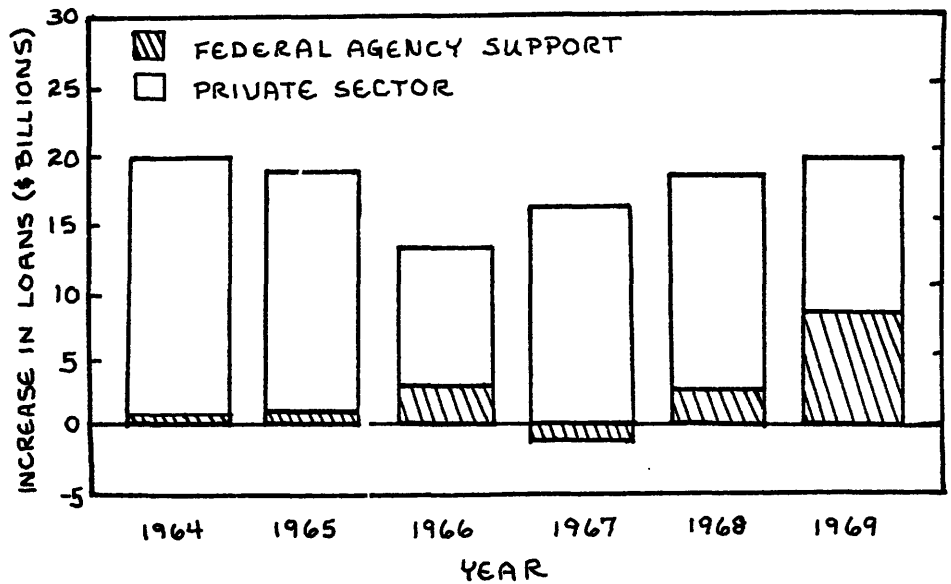
commercial banks to increase their share of residential construction financing. The Federal National Mortgage Association split into two programs a couple of years ago: the Federal National Mortgage Association (FNMA) and the Government National Mortgage Association (GNMA). The functions of the GNMA are numerous, two major ones being: (1) to provide aid, upon authorization of the President or Congress, in the financing of selected types of mortgages which cannot be adequately financed through the usual lending channels and (2) to guarantee obligations issued by lenders representing earmarked pools of mortgages held by such lenders, thereby enabling lenders to tap new sources of loanable funds. The FNMA became a government-sponsored private corporation and took over the secondary market operations in FHA, VA, and Farmers Home Administration backed home mortgages. In its secondary market function, it purchases and sells insured and guaranteed loans, thereby providing funds to the market when conditions become tight and mortgages to lenders in periods of credit ease. In 1970, the Federal Home Loan Mortgage Corporation (FHLMC) was created to perform a similar function for conventional mortgages, and the operations of the FNMA were also extended to conventional mortgages. The Federal Home Loan Bank System (FHLB System) provides a central credit facility to supplement the resources of its member institutions (mainly savings and loan associations) which are predominantly

engaged in home financing. The FHLB System links mortgage lending institutions to capital markets, and by making advances to its members it, in essence, provides funds for mortgages (11b, c, 13, 29, 35c, 45).

These then, in a nut shell, are the primary government agencies and programs which over the years have influenced and continue to influence the flow of funds into the construction financing market (see, for example, Figure 2.14). These certainly do not, however, represent the grand total of the government's role in influencing construction and its financing. The variety of federal activities is too great and too dynamic to allow a complete listing, but they reach every state, thousands of local communities, and millions of individuals in terms of private residential and nonresidential and public construction. For example, of particular interest now are programs to aid in providing a decent home for every individual, and all sorts of new programs⁷ have been proposed in an effort to make improved housing of the poor possible. At other times, interest has been more concentrated in encouraging the building of schools, highways, and industrial plants. In addition to such programs and agencies,

⁷For example, directly subsidizing the construction of dwellings for the poor or subsidizing the mortgage financing so as to stimulate building or subsidizing the rents paid by the low income tenants or providing a general income maintenance subsidy so as to enhance the purchasing power of the poor.

Figure 2.14: Increase in residential mortgage loans financed by federal agencies (FNMA and FHLB) and the private sector (source: Ref. 45).



NOTE: It is of interest to note that both 1966 and 1969 were years of tight money and high interest rates. Growth of residential mortgage loans dropped noticeably in 1966 but was maintained in 1969, and the data suggests that this difference was at least partially due to the actions of the federal agencies.

numerous government policies (in particular monetary, fiscal, and tax as discussed in Section 2.1) and regulations (such as those concerning the activities of financial institutions) impact the flow of funds for construction financing.

It is difficult to assess the net impact of all these different factors (i.e., savings flow, financial institutions, and government agencies, programs, and policies) on the availability and cost of capital for construction financing. What has been attempted here has been an effort to look at the various factors and their impacts individually. Only general suggestions can be put forth as to how to begin to improve the stability of the availability and cost of funds for construction financing, and some might be: (1) following sensible monetary and fiscal policies designed to avoid inflation and not relying on monetary policy to do it alone, for this results in rather serious fluctuations in credit availability and cost, especially for residential construction; (2) facilitating the flow of funds into financial institutions by, for example, permitting them to issue new financial instruments and thus enabling them to tap new sources of funds⁸; (3)

⁸ More specifically for example, savings and loan associations and mutual savings banks have, at times, been allowed to issue special short-term certificates at a higher interest rate than the passbook savings accounts to entice more money into these institutions.

expanding the investment flexibility of thrift institutions in order to ease their adjustment to changing market conditions and alleviate at least part of the cause of short-term instability in residential mortgage markets (though this will also enable them to move in and out of the mortgage market more readily); and (4) encouraging financial institutions and other lenders to negotiate mortgages by making such investments more attractive by means of tax incentives or otherwise or even by statutory directives (28, 35c). One last comment pertaining to financing is appropriate, and this is the necessity of coordinating the many government activities designed to influence the availability of funds and perhaps of consolidating some of the numerous and seemingly independent programs and agencies as well.

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CHAPTER 3

LABOR IN THE CONSTRUCTION INDUSTRY

The construction industry is still a comparatively labor-intensive industry, and thus labor and its associated aspects are rather important to the industry. The issues discussed in this chapter are those which relate most directly to the industry's labor force, the major topics being: (1) collective bargaining, (2) the availability of labor, (3) the utilization of the labor force, (4) construction wages, and (5) labor productivity.

3.1 Collective Bargaining

Many of the problems of the construction industry have been linked by numerous observers to its industrial relations system and, more specifically, to the structure of collective bargaining itself. It is the purpose of this section, after a brief look at the industry's industrial relations system and bargaining process, to identify the major problems directly associated with collective bargaining (e.g., numerous and prolonged strikes) and those more general problems believed to be acerbated by the bargaining structure (e.g., inflationary tendencies of wages).

The structure of industrial relations in the construction industry is very different from that in other indus-

tries, but it is not ill-adapted to the conditions of the industry for it has grown out of a pattern of technical, market, institutional, and historical conditions peculiar to the industry over a very long period of time. Unions exist in construction, in large part, to bring a degree of stability to the work conditions of an industry which, itself, provides a highly variable and unstable work environment¹. Interestingly enough, federal labor legislation, establishing procedures for union organization and collective bargaining, has affected construction very little in that special provisions have often been included in the legislation to allow for the special circumstances of construction.

It is estimated that about 80 percent² of construction

¹For example, by enforcing standards of work and compensation, participating in formal training, and referring men to work at the contractor's request and at the same time allowing the relationship between employer and employee to be casual, the craft union structure allows exceedingly flexible employment relationships to exist as is necessary for this skilled labor force, while maintaining stability in the labor market as a whole.

²This figure is the ratio of construction worker union membership to annual average construction worker employment, but not all union members are employed in construction. Each year, an unknown proportion works outside the construction industry for real estate firms, manufacturing and non-manufacturing enterprises, and so forth or is retired though retaining active union membership or is unemployed. A recent Bureau of Labor Statistics study (66) estimates that 60 to 70 percent of the construction workers are employed by firms that have collective bargaining agreements covering a majority of the workers.

workers are members of labor organizations, though the degree of organization varies among crafts, localities, and types of construction (generally lower in homebuilding) as well as seasonally and over time. The workers are largely organized into eighteen different international (Canada and U.S.) unions, seventeen of which are affiliated with the Building and Construction Trades Department of the AFL-CIO. Organization is generally along a craft or craft-industrial basis, and jurisdiction of each union over specific work operations (e.g., manual operations, designated materials, or designated industries) is of great importance to the unions. This, along with continuous changes in materials, technology, and other aspects of construction, results in a high frequency of jurisdictional disputes on the jobsite. As for the administration of unions, there are generally local and international associations of locals with various other levels in between. The organization and financing of the unions at all levels is rather extensive. The international unions have the power of sovereignty over the locals, defining their geographic and work jurisdictions, and, along with the regional and district councils, exercise more control and give considerably more aid to the locals than do national contractor associations. Still, the locals do maintain a considerable degree of autonomy in the conduct of their affairs; for example, the negotiation of collective

bargaining agreements, their provisions, and their enforcement are largely in the authority of the locals, with supervision from the internationals.

Contractors may hire any number of different crafts depending upon the type of work they do, the geographic area of their operations, and whether or not they are union. They are generally organized by sector of the industry into trade associations (e.g., Associated General Contractors of America (AGC), National Constructors Association, and Mason Contractors Association), though not all contractors are members of such an association. The associations, in turn, have local, regional, and national bodies with the nationals having the power to charter the locals but with the majority of activity occurring at the local level due to limited financing and staffing at the national level. Labor negotiations are generally carried out at the local level with little more than advice from the national. Because of more extensive internal conflicts of interest among members, less continuity of representation, more limited administration and financing, and a later start, the contractor associations have never been, and at this rate probably never will be, as strong as the unions.

Collective bargaining, then, is generally carried out at the local level between a local union (or in some cases a district council) representing a single craft and a contractor association representing employers of that craft.

The agreement generally covers a geographic area and particular types of work operations and sets the wages, fringe benefits, and working conditions for the two or three-year term of the contract. There are, of course, many exceptions, each with desirable and undesirable features, to this pattern³, and the structure of bargaining may also vary with the economic conditions⁴. Furthermore, it should be borne in mind that not all labor is unionized and that some informal bargaining between the contractor and unionized worker may go on beyond the formal bargaining itself. Nevertheless, conditions are strongly influenced by the prevailing labor relations policies (for more details on any aspect of contractor and union organization and collective bargaining see Ref. 4, 13, 24, 26c, 39, 40, 49, 50b, 77).

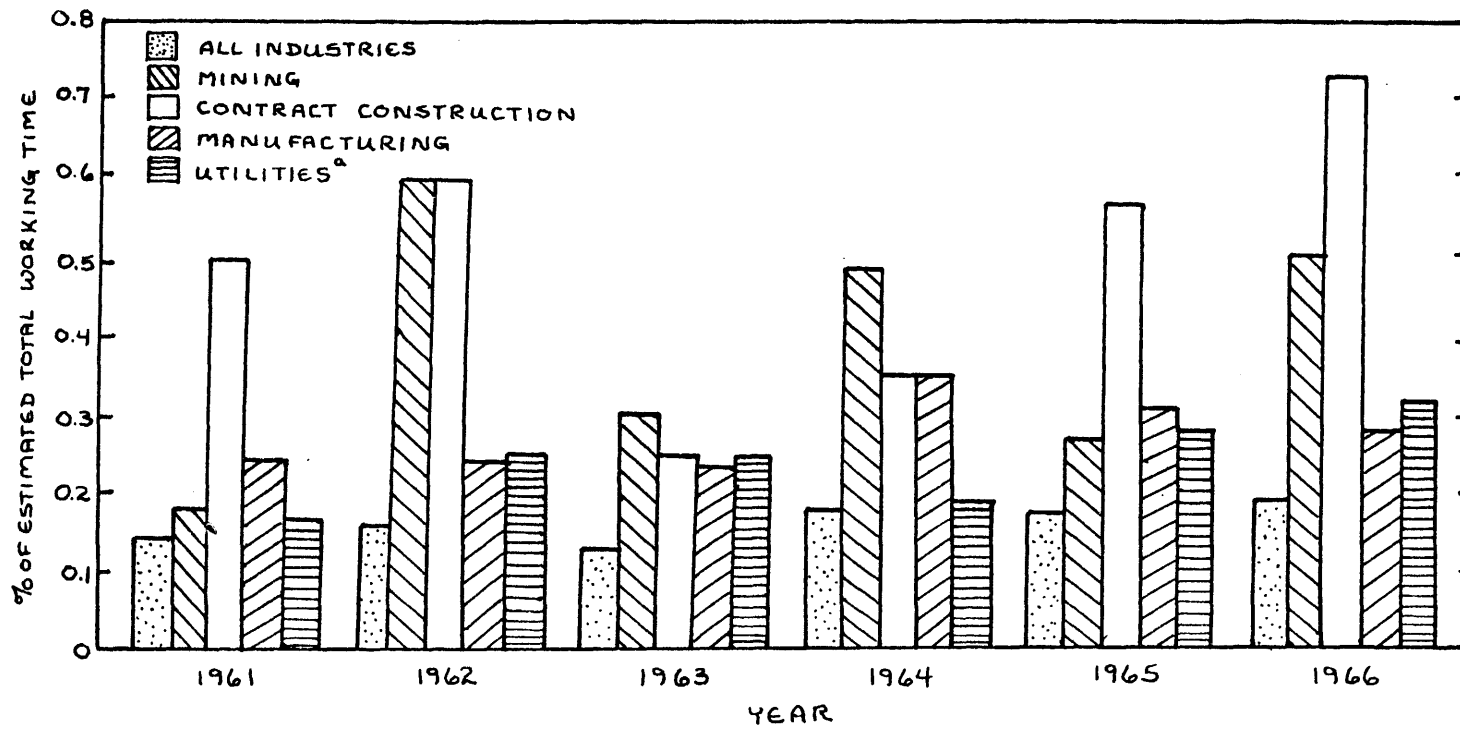
³ Some of these are: (1) nationwide agreements in a few special branches of the industry (e.g., pipeline and elevator construction); (2) national agreements with large, nationally operating contractors (e.g., Bechtel); (3) regional or metropolitan-area bargaining (e.g., in the West); (4) independent contractors (not belonging to an association) abiding by the union-association contracts or negotiating separately; (5) contractor associations joining together for negotiations with each craft (e.g., in some areas of the Northeast); and (6) formal or informal coordination of negotiations involving several trades in an area, perhaps in the form of joint bargaining over what goes into the agreement or simply, as is occurring today in some cities, a common expiration date.

⁴ For example, in slack periods unions tend to coordinate their negotiations, and in better times they tend to pursue their own advantages independently.

It was mentioned in the beginning of this section that a major problem associated with collective bargaining in the industry is the occurrence of strikes. Construction is often accused of being a strike-prone industry and rightly so as one look at Figure 3.1 will show. Strikes over general wage changes (the commonest cause of strikes by far), union organization and security, site administration, and jurisdictional disputes accounted for about 90 percent of all stoppages, workers involved, and man-days idle in contract construction over the 1961-1966 period and for about 80 percent of the same in manufacturing and all industries as a whole (8f) (see Table 3.1 for the relative rankings of these and other strike issues).

Jurisdictional disputes, which generally occur during the contract period, result in numerous strikes, but the strikes are usually of short duration and involve few workers. Still, they are a serious problem, and the disputes (not the stoppages necessarily) are inevitable in an industry like construction where organization and compensation is on the basis of occupation (craft) and technology is continuously changing. About the best that can be done is to try to resolve the disputes with a minimum of disruption of production, preferably before they become strikes. Because settlement through the National Labor Relations Board (NLRB) has not been at all successful, it has been necessary to rely on voluntary dispute-settlement machinery internal to the

Figure 3.1: Man-days idle due to work stoppages as a percent of estimated total working time, 1961 to 1966 (source: Ref. 8f).



^aTransportation, communication, electric, gas, and sanitary services.

Table 3.1: Major issues in construction stoppages for 1961-1966, ranked in terms of number of stoppages, workers involved, and man-days idle (source: Ref. 8f).

Major Issue in Stoppage	Number of Workers Involved	Man-Days Idle	Number of Stoppages
General Wage Changes	1	1	2
Union Organization and Security	2	2	3
Interunion or Intraunion Matters	3	3	1
Plant Administration	4	9	4
Job Security	5	6	6
Wage Adjustments	6	7	5
Supplementary Benefits	7	4	7
All Other Issues and Not Reported	8	8	8
Hours of Work	9	5	9

All other issues: Stoppages arising over miscellaneous contractual matters (such as duration of contract) and miscellaneous working conditions (such as arbitration and grievance procedures). (In the table, stoppages in which the issue was not reported have been included in this category.)

General wage changes: Wage changes which affect large numbers of workers in a similar manner at the same time.

Interunion or intraunion matters: Stoppages where the issue does not directly involve the immediate employer. Issues in this category include rivalry between unions of different affiliation (such as between AFL-CIO affiliates and independent unions), jurisdictional disputes over worker representation between unions of the same affiliation or two locals of the same union, jurisdictional disputes regarding work assignment, disputes within a union over the administration of affairs or regulations, and sympathy strikes.

Job security: Stoppages arising from such issues as seniority, division of work, subcontracting, new machinery or other technological issues, job transfers, and transfer of operations or prefabricated goods.

Plant administration: Stoppages arising from issues such as physical facilities or surroundings, safety measures or dangerous equipment, supervision, shift work, work assignments, workloads, work rules, overtime work, and discharge and discipline.

(continued)

(Table 3.1 continued)

Supplementary benefits: Generally, supplements to wages received by workers at a cost to employers. The term encompasses a host of practices (paid vacations, pensions, health and insurance plans, severance or dismissal pay, premium pay, etc.) that usually add to something more than a "fringe" and is sometimes applied to a practice that may constitute a dubious "benefit" to workers. No agreement prevails as to the list of practices that merit inclusion in this term. Other terms used include "fringe benefits," "wage extras," "hidden payroll," and "non-wage labor costs."

Union organization and security: Stoppages arising over issues such as recognition (or certification) of a union as the representative of the workers, refusal to sign an agreement, and strengthening a union's bargaining position or protecting its status through a closed shop, union shop, agency shop, or maintenance-of-membership arrangement.

Wage adjustment: Stoppages arising from issues such as incentive pay rates or their administration, job classification or rates, downgrading, retroactivity, and method of computing pay.

industry, such as the National Joint Board for the Settlement of Jurisdictional Disputes, which has been successful in keeping the strike durations down, but not the number of strikes. Probably the only hope for reducing the number is to include no-strike pledges in the contract and make more of an effort to resolve jurisdictional problems before they arise on the jobsite by bringing the unions into a project at the start (8f, 26c, 31, 40, 56, 71).

Strikes over the other issues (e.g., general wage changes, union organization and security, and site administration) most often occur during contract negotiations and thus are generally of rather long duration and involve many workers. The interdependence of the production process also contributes to the seriousness of these strikes, because after a few weeks a strike by a single trade will often cause a halt in the work of other crafts. Furthermore, the termination dates of the contracts for the various crafts are scattered throughout the winter, spring, and summer, and thus a succession of strikes is a frequent occurrence (though some cities have avoided this by moving the expiration dates closer together). Though a variety of dispute-settlement mechanisms⁵ are in use in the construction industry, these

⁵For example: (1) the Council on Industrial Relations, established by the electrical contracting industry, and similar mechanisms, established by the sheet metal and pipe trades, and (2) the National Disputes Adjustment Plan, entered into by the National Constructors Association and the Building and Construction Trades Department of the AFL-CIO in 1961, and a similar arrangement which the AGC is trying to establish.

are limited to only a few crafts and associations, and disputes are still generally handled informally and are often accompanied by a strike⁶. In 1971, the government stepped in and ordered that bipartite (labor and management) craft disputes boards be created (along with the CISC) for each trade at the national level in order to help resolve disputes and screen wage settlements. The boards and the tripartite (labor, management, and public) CISC did significantly reduce the incidence and seriousness of work stoppages in 1971. Though these craft boards may become permanent institutions and thus strengthen collective bargaining, local dispute-settlement mechanisms are also needed if long term improvement is to be achieved (8f, 26c, 26e, 39, 40, 46, 71).

The other problems associated with collective bargaining arise as a result of or are aggravated by the extreme decentralization of collective bargaining along craft, geographic area, and industry sector lines. First of all, such

⁶-----
Two factors account for this: (1) arbitration procedures commonly used by other industries are too slow for construction where a worker is generally employed only for a short time on a single project, and also the construction worker has the advantage of likely being able to get another job nearby during the strike and (2) most machinery that does exist has been developed at the national rather than the local level, and most trades have maintained the traditional hands-off policy of national unions toward local collective bargaining.

decentralization facilitates the inflationary tendency of wages⁷ (wage spiral). Secondly, it results in the geographic scope of collective bargaining agreements being too limited relative to the mobility of both workers and contractors (i.e., labor and product markets are often covered by more than one local). And finally, agreements tend to reflect only limited local concerns because the wider interests (e.g., regional and national) tend to be excluded from local bargaining. Thus, it seems that eliminating some of the fragmentation in collective bargaining would be useful, but it must be done with care. Various approaches, such as merging international unions and their locals and contractor associations and their locals, enlarging the geo-

⁷-----
This inflationary tendency is affected in three ways: (1) there are patterns of wage differentials (rigid in the short run) and comparisons among localities and among various crafts in a single locality, and deviations from traditional differentials often set a catching-up process in motion; (2) the succession of contract termination dates, along with traditional craft rivalries, creates a pattern of leap-frogging of settlements as each craft seeks to better the settlements achieved by the other; and (3) the tendency of unions to bargain first with weaker associations or those whose product markets are relatively price inelastic results in higher wages in the affected trades with a two-fold effect of: (a) a general upward pressure on wages in other trades as well due to (1) and (2) above and (b) settlements in these trades in one particular sector of the industry being transmitted to the same trades in another sector of the industry without the latter sector having had a fair chance in the negotiations (this in itself creates a problem for industry sectors which might not be able to afford the increase as well as affecting the wage spiral).

graphic scope of bargaining in many trades, and multi-craft bargaining where appropriate, could be used depending on the desired outcome. In some areas and crafts this has been done to a limited extent. To date, the CISC and craft disputes boards have helped to increase the role of the national unions and contractor associations in local collective bargaining, and the Construction Industry Collective Bargaining Commission has been working toward expanding the geographic scope of bargaining. However, the expansion process and its ramifications must be carefully considered. For example, it will be necessary to make allowances for the different industry sectors in the agreements, for their product markets are just too different for them all to be subject to the same wages and conditions (this was handled informally in small-area agreements). Furthermore, changes in scope must be sensitive to the internal structure and leadership of the union and contractor organizations. Thus, reduction of fragmentation in collective bargaining will necessarily be a slow process and will be successful only if all concerned want it enough to be willing to cooperate (26c, 39, 40, 43).

3.2 The Availability of Labor

Employment in construction has generally grown over the years though it has had its ups and downs, especially in terms

of the employment of construction workers, who are of major interest here, and even more so in terms of individual crafts (see Tables 3.2 and 3.3). Though unemployment rates⁸ vary greatly from one trade to another and over the years have generally fluctuated a fair amount, on the average they have always been higher than (generally twice or more) those in all industries as a whole (see Tables 3.3c and 3.4). Furthermore, the employment statistics (i.e., annual average employment) are rather deceiving in that they represent the number of yearlong jobs and not the actual number of workers employed in them. For example, in 1968 some 6.4 million workers were employed in contract construction to fill some 3.3 million full-time jobs which yields a ratio of 1.8 workers to jobs (in manufacturing this ratio was about 1.3 for that year) (40). This suggests, among other things, that the construction labor market is more flexible and/or underutilized than is that of most other industries, and both conditions have been found to exist.

Changes in the number of man-hours available to the construction industry can occur, in both the short and long

⁸Unemployment rates may be biased upward to a degree because the unemployed are distributed among industries and occupations on the basis of their last full-time civilian job. Thus, industries with relatively easy entry and exit for workers, like construction, tend to exhibit high levels of unemployment.

Table 3.2: Annual average employment in the contract construction industry (in thousands) (source: Ref. 66 (for 1947 to 1967 data) and various issues of Construction Review (for 1968 to 1971 data)).

Year	Total	Construction Workers	Office Workers
1947	1982	1759	223
1948	2169	1924	245
1949	2165	1919	246
1950	2333	2069	264
1951	2603	2308	295
1952	2634	2324	310
1953	2623	2305	327
1954	2612	2281	331
1955	2802	2440	362
1956	2999	2613	386
1957	2923	2537	386
1958	2778	2384	394
1959	2960	2538	422
1960	2885	2459	426
1961	2816	2390	426
1962	2902	2462	440
1963	2963	2523	440
1964	3050	2597	453
1965	3186	2710	476
1966	3275	2784	491
1967	3203	2705	498
1968	3285	2768	517
1969	3435	2896	539
1970	3381	2820	561
1971	3411	2832	579
Average Annual % Rate of Growth (1947-1967)	3.2%	2.2%	4.1%

Table 3.3a: Annual average employment in construction, by two definitions of what comprises construction (source: Ref. 50b).

Year	Employment in Contract Construction (in thousands)	Employment in the Construction Industry ^a (in thousands)
1961	2816	4190
1962	2902	4277
1963	2963	4296
1964	3050	4465
1965	3186	4590
1966	3292	4603
1967	3341	na

^aIncluding employees of contractors, government construction agencies, the self-employed, and unpaid family workers.

Table 3.3b: Percentage distribution of employment in construction^a, averaged for 1962-1966 (source: Ref. 50b).

Occupation in the Construction Industry	% of Construction Employment
Professional and Technical Personnel	4.7%
Managers, Officials, and Proprietors	12.2
Clerical Workers	5.2
Craftsmen, Foremen, and Kindred Workers	50.7
Carpenters	14.5%
Brickmasons, Stonemasons, & Tilesetters	3.7
Cement & Concrete Finishers	1.2
Electricians	4.0
Excavating, Grading, & Road-Building Machine Operators	4.7
Painters	6.7
Plumbers & Pipefitters	4.3
Plasterers	0.8
Roofers & Slaters	1.1
Structural Metalworkers	0.9
Tinsmiths, Coppermiths, & Sheet Metalworkers	1.0
Other	7.8
Operatives and Kindred Workers ^b	9.8
Service Workers ^c	0.5
Laborers (including helpers) ^d	17.0

^aIncluding employees of contractors, government force account, the self-employed, and unpaid family workers.

^bOperatives are traditionally considered semi-skilled workers, including apprentices, asbestos workers, oilers and greasers, truck drivers, etc.

^cService workers include guards and watchmen, cleaning personnel, and others.

^dLaborers include carpenters'helpers and other laborers.

Table 3.3c: Employment and unemployment data for the various crafts in construction
(source: Ref. 40).

Occupation of Craftsmen and Foremen	Number in Labor Force (in thousands)				Unemployment Rate				Change in Unemployment Rate		Approximate % of Total Number in the Occupational Category Employed in Construction ^a	
	1962	1967	1969	1970	1962	1967	1969	1970	1962-1967	1967-1970	1966	1970
Bricklayers, Stonemasons, & Tilersetters	206	209	219	205	8.7%	4.8%	3.2%	8.8%	-3.9%	+4.0%	74%	93%
Carpenters	896	876	925	906	8.9	5.0	4.4	8.4	-3.9	+3.4	77	84
Cement & Con- crete Finishers	54	61	69	73	12.9	10.3	5.8	9.6	-2.6	-0.7	95	97
Electricians	407	454	431	448	4.9	1.5	1.0	2.7	-3.4	+1.2	45	48
Excavating, Grading, & Road- Building Mach- ine Operators	248	290	342	347	11.7	5.5	5.6	7.5	-6.2	+2.0	78	81
Painters and Paperhangers	389	403	414	407	12.6	6.3	4.1	7.4	-6.3	+1.1	67	83
Plasterers	36	28	33	30	7.7	12.5	9.1	6.7	+4.8	-5.8	95	100
Plumbers & Pipe- fitters	279	344	354	378	6.7	3.6	2.0	4.0	-3.1	+0.4	64	70
Roofers and Slaters	62	59	67	72	10.1	3.3	4.5	6.9	-6.8	+3.6	98	95
Structural Metalworkers	57	76	na	na	10.9	6.2	3.2	7.2	-4.7	+1.0	56	69
Tinsmiths, Copper smiths, & Sheet Metalworkers	138	154	na	na	5.5	2.5	na	na	-3.0	na	35	na

^aIncludes employees of contractors, government construction agencies, the self-employed, and unpaid family workers. Excludes the construction and maintenance personnel of private nonconstruction firms.

Table 3.4: Annual average unemployment rates for all experienced wage and salary workers (age 16 years and over) and for those in construction (source: Ref. 67).

Year	All Experienced Workers ^a	Experienced Workers in Private Construction ^{a,b}
1948	4.3%	8.7%
1949	6.8	13.9
1950	6.0	12.2
1951	3.7	7.2
1952	3.3	6.7
1953	3.2	7.2
1954	7.0	12.9
1955	4.8	10.9
1956	4.4	10.0
1957	4.6	10.9
1958	7.3	15.3
1959	5.7	13.4
1960	5.7	13.5
1961	6.8	15.7
1962	5.6	13.5
1963	5.6	13.3
1964	5.0	11.2
1965	4.3	10.1
1966	3.5	7.1
1967	3.6	6.6
1968	3.4	6.2
1969	3.3	6.0
1970	4.8	9.7
1971	5.7	10.4

^aExcludes the self-employed, unpaid family workers, and those workers with no previous work experience.

^bAlso excludes the employees of government construction agencies.

term, by two general means: (1) adjustment of the actual supply of men (to be discussed in this section) and (2) alteration of the utilization (e.g., decreasing seasonality) of the available labor force (to be discussed in Section 3.3). In the short run, the supply of men can be expanded (or decreased) because of the rather high mobility of the industry's labor force in terms of manpower flows: (1) from one project to another, (2) from one type of construction to another, (3) from one locality to another, (4) from other industries to construction (or vice-versa), (5) from other occupations to construction crafts (or vice-versa), (6) from one construction craft to another, or (7) any combination of the above. These flows and their relative importance are insufficiently understood, but as a whole they play a significant role in the functioning of the industry (for a few statistics on various types of mobility in various industries see Table 3.5; for lots more statistics see Ref. 2, 55, 60). In the long run, changes in the supply are sensitive to the rate of entry of labor to the industry, by means of formal and informal training in the industry, training in other industries, military service, and vocational education, and the rate of loss of labor from the industry, by means of death, retirement, and so forth (26c, 40, 41, 50b). It is the purpose of this section to look at the supply side of the picture in terms of the various means of entry to the industry, the role of the hiring hall, and the entry of minority groups.

Table 3.5a: Inter-industry mobility: percentage of male wage and salary workers who had a different industry of major job in 1960 than in 1957, by industry of major job in 1957^a (source: Ref. 60).

Industry of Major Job in 1957	Different Industry In 1960
Total	24.1%
Agriculture, Forestry, and Fisheries	38.1
Mining	32.1
Contract Construction	30.2
Manufacturing	16.9
Transportation, Communication, and Public Utilities	20.4
Wholesale and Retail Trade	30.9
Finance, Insurance, and Real Estate	21.7
Services (except domestic)	31.2
Domestic Service	28.0
Government	24.3

^aBased on 1 percent sample data.

Table 3.5b: Inter-occupation mobility: percentage of males employed in both January 1965 and January 1966 who had a different occupation in January 1966 than in January 1965, by occupation in January 1966 (source: Ref. 55).

Occupation in January 1966	Different Occupation in January 1965
Total (18 years and over)	9.9%
Professional, Technical, and Kindred Workers	6.4
Farmers and Farm Managers	1.9
Managers, Officials, and Proprietors (except farm)	7.4
Clerical and Kindred Workers	14.0
Sales Workers	8.5
Craftsmen, Foremen, and Kindred Workers	8.7
Operatives and Kindred Workers	12.9
Private Household Workers	na
Service Workers	11.7
Farm Laborers and Foremen	8.6
Laborers (except farm and mine)	17.3

Table 3.5c: Inter-employer mobility: percentage of male wage and salary workers who were multi-employer workers in 1962, by industry of major job^a (source: Ref. 60).

Industry of Major Job in 1962	Multi-Employer Workers
Total	32.0%
Agriculture, Forestry, and Fisheries	38.6
Mining	33.4
Contract Construction	55.2
Manufacturing	26.7
Transportation, Communication, and Public Utilities	31.2
Wholesale and Retail Trade	34.0
Finance, Insurance, and Real Estate	31.2
Services	34.7

^aBased on 1 percent sample data.

Table 3.5d: Inter-industry and inter-employer mobility: percentage of multi-employer male wage and salary workers who were multi-industry workers, by industry of major job in 1962^a (source: Ref. 60).

Industry of Major Job in 1962	Multi-Employer Workers Who Were Also Multi-Industry Workers
Total	81.6%
Agriculture, Forestry, and Fisheries	69.5
Mining	69.1
Contract Construction	76.6
Manufacturing	86.6
Transportation, Communication, and Public Utilities	80.3
Wholesale and Retail Trade	79.4
Finance, Insurance, and Real Estate	82.3
Services	80.9

^aBased on 1 percent sample data.

Table 3.5e: Pattern of job shifts^a for males, by occupation group of job left, 1961 (source: Ref. 2).

Occupation Group of Job Left	Pattern of Job Shift (% distribution)			
	Same Occupation and Industry	Same Occupation, Different Industry	Same Industry, Different Occupation	Different Occupation and Industry
Total	33.5%	17.6%	10.0%	38.9%
Professional, Technical, and Kindred Workers	41.6	23.1	5.8	29.4
Farmers and Farm Managers	na	na	na	na
Managers, Officials, and Proprietors (except farm)	26.5	12.0	18.7	42.7
Clerical and Kindred Workers	16.3	16.0	17.1	50.7
Sales Workers	28.6	16.9	12.2	42.2
Craftsmen, Foremen, and Kindred Workers	53.1	14.5	8.8	23.6
Operatives and Kindred Workers	25.3	25.1	10.1	39.5
Private Household Workers	na	na	na	na
Service Workers (except private household)	30.9	17.3	9.0	42.7
Farm Laborers and Foremen	45.7	--	6.0	48.2
Laborers (except farm and mine)	22.3	19.3	9.5	49.0

^aThat is, all changes from 1 employer to another; any person could have several different job shifts.

First, however, a few words about manpower planning are appropriate.

The process by which the available supply of labor is compared to the expected demand and the adjustments are made for any shortages or surpluses on either side is a complex one and is basically what manpower planning is all about⁹ (for a very comprehensive discussion of manpower planning see Mills (40)). For example, some of the factors which might be considered in determining the adequacy of the labor supply at any point in time are the level and composition of demand, employment levels in industries other than construction, relative wage levels of construction and other industries, traditional patterns of mobility, size of the labor pool possessing construction skills, and training and education efforts. Adjustments in the supply might be in the form of changes in the allocation of labor, timing of projects, amount of recruitment and training, and so forth.

Because construction has such a localized nature, planning is generally done at the local level by the unions,

⁹ See Table 3.6, for example, where Mills (40) proposes a manpower balance sheet, whereby he balances net manpower demand (derived from estimated construction expenditures) with manpower supply. Such a balance is the basic objective of manpower planning, and such a balance sheet could serve as a useful device in revealing potential problems and alternative policy choices in the development of a comprehensive and consistent manpower plan.

Table 3.6: A balance sheet for construction manpower planning on a national level (source: Ref. 40).

	Number of Persons ^a (in millions)	1800-Hour Man-Years (in millions)
<u>Requirements 1978^b</u>		
Residential	0.85	0.50
Nonresidential	<u>1.00</u>	<u>0.60</u>
Total net increases	1.85	1.10
Gross losses (deaths and retirements) ^c	<u>0.40</u>	<u>0.24</u>
Total requirements	2.25	1.34
<u>Availability 1978</u>		
Without special efforts from:		
Apprenticeship ^d	0.70	0.60
Nonapprenticeship formal training ^d	0.05	0.04
Improving safety	<u>0.04</u>	<u>0.03</u>
Total	0.79	0.67
Required informal entry ^e	<u>1.46</u>	<u>0.67</u>
Total	2.25	1.34
With special efforts from:		
Nonapprenticeship formal training ^f	0.15	0.13
Better utilization ^g	0.51	0.30
Additional productivity increase ^h	<u>0.09</u>	<u>0.05</u>
Total	0.75	0.48
Total with and without special efforts	1.54	1.15
Required informal entry ^e	<u>0.71</u>	<u>0.19</u>
Total	2.25	1.34

(Table 3.6 continued)

NOTE: This table considers only gross flows of manpower. Implementation of manpower policy must consider the distribution of entry and training among trades, since appropriate distribution is essential to success.

^a Estimated at 1.7 persons per yearlong job, or 1100 hours per year.

^b Mills' estimates - for explanation see, for example, Dunlop and Mills (50b).

^c Bureau of Labor Statistics estimates adjusted to reflect the fact that only two-thirds of all construction craftsmen are in the (new) construction industry, as defined for manpower needs projections (others are in maintenance and other nonnew construction work).

^d Assuming relatively high rates of annual hours worked for mechanics with apprenticeship and other formal training.

^e These estimates are not to be taken as implying a manpower "gap" of this size. Informal entry has and will continue to be a major source of manpower to construction. Further, not all entrants require extensive training, especially in unskilled categories of work.

^f Assuming a tenfold increase of federally financed construction outreach and training by 1978.

^g Dependent upon project scheduling and deseasonalization.

^h Dependent upon special efforts to improve the rate of labor productivity increase in construction.

contractors, or joint committees (usually joint apprenticeship committees), but it is often haphazard and necessarily based on only partially informed expectations of the future demand for manpower and its supply, largely depending on extrapolations from past experience. Planning at the local level is of obvious importance in this industry, and if it is to improve, then improved systems of forecasting on a local level need to be developed, and planning needs to be expanded to cover the short, interim, and long-term conditions. Reasonably advanced techniques for forecasting manpower demand, some specific to crafts and industry sectors, are already in operation at the national level, and means for analyzing the supply of labor available to the industry, though less well developed, are also being studied. Though national forecasts are currently used by several institutions, there is little or no coordination of planning per se. It seems it might be useful to have joint private-public bodies form in each branch of the industry and meet regularly to assess the manpower situation and to make recommendations for private and public action, leaving the implementation of their suggestions up to those more directly involved. The major role of the government in manpower planning might best be to provide data, technical assistance, and funds to improve manpower projections and planning mechanisms on both a national and local basis. It seems, however, that most aspects of adjustment of the labor force to meet the demand must be left

to the industry itself, though an expansion of the influence of national unions and contractor associations on planning, which to date has been largely local in nature, would be useful, especially in broadening the scope and increasing the coordination of the planning and adjustment activities.

Entry to the construction industry may be by any number of means, but the one often mistakenly thought to be practically the only route is through apprenticeship¹⁰ (it is the major component of entry through formal training though - see Table 3.7). First of all, it should be remembered that not all crafts are even apprenticeable. In fact, apprentices constitute only about 1 percent of the industry's total work force, and there is about 1 apprentice for every 75 journeymen (here used as any fully qualified craftsman, foreman, operative, or kindred worker), though the exact numbers vary among the different crafts (66) (see Table 3.8). As Table 3.8b shows, more workers in nearly every craft leave the industry through death or retirement each year than enter it through apprenticeship, indicating that the current apprenticeship programs (i.e., registered ones) cannot

¹⁰ A few comments about the quality of apprenticeship statistics should be made: (1) the majority of the statistics apply to apprentices registered in the various crafts in construction and other industries, (2) there are no reliable regular estimates of the number of apprentices in nonregistered programs (Bureau of Apprenticeship and Training estimates that the number is about the same as that in registered programs (40)) and (3) major revisions at various times have made time-series data somewhat discontinuous.

Table 3.7: The percentage of each craft that learned the trade through formal training^a, determined by a survey conducted in April 1963 (source: Ref. 40 and 50b).

Construction Craftsmen	% That Learned Trade Through Formal Training
Brickmasons, Stonemasons, and Tilesetters	44.7%
Carpenters	31.1
Electricians	72.9
Excavating, Grading, and Road-Building Machine Operators	11.2
Painters	27.8
Plumbers and Pipefitters	55.0
Tinmiths, Coppermiths, and Sheet Metalworkers	70.9
Cranemen, Derrickmen, and Hoistmen	17.5
All Construction Craftsmen	39.4

^aIncluding apprenticeship, technical school training, and training in the armed services.

Table 3.8a: Apprentices^a as a percent of annual average employment, by occupation (wage and salary only), in contract construction (estimated) and as traditionally compiled, 1964 (source: Ref. 50b).

Occupation	In Training		Completions, Total Preceding 5 Years		New Registrations, Total Preceding 5 Years	
	Contract Construction	Industries All	Contract Construction	Industries All	Contract Construction	Industries All
Bricklayers	6.5%	4.3%	7.9%	5.3%	9.4%	6.3%
Carpenters	5.4	2.8	3.6	1.9	10.5	5.5
Cement Masons	3.5	3.0	4.0	3.4	6.9	5.9
Electricians	17.6	5.3	15.0	4.5	28.5	8.6
Structural Ironworkers	15.1	7.4	13.1	6.4	30.6	15.1
Painters	4.6	1.5	3.7	1.2	9.1	3.0
Plasterers	4.2	2.9	5.2	3.5	7.3	5.0
Plumbers	14.3	6.2	11.1	4.8	18.0	7.8
Roofers	6.1	4.4	2.8	2.1	13.7	10.0
Sheet Metalworkers	32.5	20.1	29.2	18.2	50.9	31.6

^aThe data on apprentices cited here is not on an industry basis. Only for electricians, however, are significant numbers of persons in nonconstruction believed included in the completions and registrations totals.

Table 3.8b: Ratios of active apprentices, apprenticeship completions, and journeymen losses to active journeymen, by craft for 52 major cities (source: Ref. 40).

Occupation	Average Ratio of Apprentices Per 100 Active Journeymen ^a		Apprenticeship Completions Per 1000 Active Journeymen ^b		Journeymen Losses Per 1000 Active Journeymen ^c	
	1950-1964	1965-1968	1950-1964	1965-1968	1950-1964	1965-1968
Asbestos Workers	na	20.5	na	41.5	na	27.2
Bricklayers, Marble, Terrazzo, Mosaic, Stone, and Tile Workers	7.4	5.3	25.7	10.8	19.7	19.5
Carpenters (including soft floor layers & millwrights)	4.3	4.4	7.2	4.8	15.7	14.2
Electricians	13.2	12.4	32.0	27.3	20.6	28.0
Ironworkers (including rodmen)	5.0	6.3	16.7	15.5	21.5	23.0
Lathers	na	7.0	na	18.2	na	26.0
Painters, Glaziers, and Paperhangers	3.3	4.2	7.9	8.8	22.6	24.2
Plasterers and Cement Masons	6.8	4.3	19.3	9.0	21.4	20.5
Plumbers and Pipefitters	10.2	11.3	19.3	16.0	20.8	23.5
Roofers	12.3	12.7	33.3	28.2	29.0	32.0
Sheet Metalworkers	12.7	12.7	27.9	25.2	15.5	17.2

^aRatio of number of persons working under apprenticeship agreements to number of journeymen working or available for work on July 1 of the specified year.

^bRatio of number of persons completing prescribed apprentice training during the previous twelve months to the number of active journeymen on July 1 of the specified year.

^cRatio of number of journeymen who became unavailable for work because of death, permanent disability, or retirement during the previous twelve months to the number of journeymen active on July 1 of the specified year.

supply enough new workers to maintain the size of the current labor force, let alone increase it.

There are many schools of thought as to what influences the volume of apprentices. It is often claimed that unions restrict apprenticeship by their requirement of certain ratios of apprentices to active journeymen and other regulations, and to some extent this is true though there are often valid reasons for the particular ratios and regulations. At the same time however, employers are often unwilling to train even as many as their collective bargaining contracts permit, if they train any at all. Though statistical analyses¹¹ done on a variety of factors in an effort to see just what affects the volume of apprentices have reached only inconclusive results, it seems reasonable to expect that the major influence on the number of apprentices is the local employment conditions of the craft in the industry at the time and the generally conservative attitude, on the part of workers, unions, and even employers, with regard to expectations

¹¹ For example, statistical analyses, on an aggregate and craft basis, of apprentice registrations, cancellations, and completions and their relation to national economic conditions, such as levels of unemployment in the economy as a whole and in construction, levels of employment in construction, relative wage levels of construction and of all non-agricultural industries as a whole, wage differentials between skilled and semi-skilled workers in construction, and changes in inter-industry mobility, have been done but so far have yielded mostly conflicting results.

of future conditions. This situation makes it nearly impossible to believe that apprenticeship programs can be expanded sufficiently to meet future demand and certainly not without more of a guarantee that the demand will actually materialize; it is here where improved manpower information on a craft, industry sector, and local basis could be immensely helpful.

However, it has not yet really been established whether this potential shortage of apprenticeship-trained journeymen is really a problem and whether efforts should be made to expand the apprenticeship programs (if they are expandable) or whether other means of entry and training can, or should be, expanded to fill the gap. The role of apprenticeship programs today is largely one of producing the key workers who rise to supervisory and training positions. It seems that the less formal programs can produce workers sufficiently skilled to do the majority of the work as long as there are some apprenticeship-trained ones around as well. The relative numbers, however, must be established before one will know the extent to which, if any, apprenticeship programs need to be expanded. Of importance, too, is the extent to which less formal means of training can be expanded.

In light of this, the suggestion, which is frequently made, that perhaps apprenticeship programs should be administered by the government in a vocational school type of

situation, does not seem appropriate. Perhaps this could be done in addition to the regular apprenticeship programs in order to produce additional less broadly skilled workers, and the government could play an effective role in an advisory capacity with respect to apprenticeship programs themselves. But, it seems best to leave the running of apprenticeship programs up to the industry where they have long been jointly administered by the unions and employers¹² and involve an on-the-job training portion as well as related instruction in the classroom and where a fully trained journeyman can most likely be produced. Furthermore, while some of the frequently expressed criticisms of the programs¹³ may be true in some cases and such matters should be continuously reevaluated, the basic objective of these programs (i.e., to produce fully trained journeymen) must be remembered. This is not, of course, to say that the programs, as they are now, are perfect or that they could not do with some reforms. Just as an example, there needs to be improved communication between these programs and the

¹²Little in the way of formal apprenticeship training is done in the nonunion sector where it is up to the employers to do it on their own.

¹³For example, that they are too long (3-5 years), requirements for admission are too restrictive, and content includes more than is necessary and that this discourages entrance and makes training unnecessarily costly.

public school system such that the young become more aware of their existence; the government could certainly help in this. In addition, perhaps the scope of apprenticeship training could be broadened through community apprenticeship programs whereby an employee can go to the various participating employers in order to learn different aspects of his trade (for more on any aspect of apprenticeship see Ref. 3, 11, 15, 24, 28, 40, 49, 50b, 57, 58, 76).

It seems, then, that means of entry to the industry other than through apprenticeship have been becoming, and will continue to become, increasingly important. The claim that unions control the labor supply through apprenticeship programs is impossible for there are too many other means of entry. However, they do have some control over these other means through their admission requirements for journeymen, though the fairly sizeable nonunion sector of the industry helps to limit the extent of such control. Furthermore, especially in recent years, the necessity of objectivity and nondiscrimination in the admission and apprenticeship requirements has been repeatedly emphasized through various court decisions. Frequently, especially in periods of what the unions see as short-run high demand, unions may issue working permits to nonmember skilled workers and let these men work on a temporary basis (26c, 40, 49, 57, 73).

Formal and informal training in the construction industry itself is probably the major means of entry to the industry.

Formal nonapprenticeship training programs, such as affirmative action programs to train minority group workers and disadvantaged youths or prepare them for apprenticeship programs and programs for journeyman upgrading and retraining, are becoming increasingly common. These are generally operated by unions and/or management and are often sponsored or at least much encouraged by the federal government. The primary other means for obtaining training in the industry is through informal training on the job whereby a worker begins as a laborer, truckdriver, or helper and moves up to the journeymen class. Assessing the importance of such informal training to the industry is difficult, but the results of one study¹⁴ of 784 workers show that 21.5 percent indicated this as their only source of skill acquisition. Much of this informal training is carried on in the nonunion sector of the industry, particularly in homebuilding, and once sufficient skills are acquired, these workers often move into skilled jobs in the union sector. Unions' fears of an over-supply of labor, however, have led to their making informal training in the union sector considerably

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This study (18) included 784 workers in four major crafts (bricklayers, carpenters, electricians, and operating engineers) in upstate New York. Of the 784 respondents, 280 either had taken apprenticeship or did not answer in any way. Of the remaining 504, 455 checked the "picked up on the job" option, and of these, 169 checked only that option.

more formal in an effort to maintain control over the numbers of men. Workers who come out of these programs are generally better trained than those trained only informally, and if these programs continue, they promise to be a potential source, among others, for expansion of the industry's trained labor supply.

As for training obtained outside the industry, there are several sources, most with room for some expansion. As was mentioned above, there is a fair amount of inter-industry mobility and a sizeable number of skilled construction craftsmen outside of the construction industry (see Table 3.3c) who could potentially move into the industry under the appropriate conditions, but these workers, for the most part, obtained their skills in the construction industry rather than in other industries where training is often more informal. Some training is also obtained through vocational secondary schools though this is often only a stepstone to apprenticeship or at least is used in conjunction with some other means of training (see Table 3.9). It is felt that unions are somewhat responsible for hampering the efforts of vocational schools in this area. The government has recently developed an interest in such vocational education, and in fact, the Construction Industry Collective Bargaining Commission has developed a subcommittee to provide leadership in improving the quality of vocational education and its linkage with the apprenticeship system.

Table 3.9: The importance of various sources of training outside the construction industry in four major crafts^a (source: Ref. 18).

Craft	Respondents		Vocational Education			Military Training			Friends and Relatives		
	Total	Non-apprentice	Number	% of all respondents	% of non-apprentice respondents	Number	% of all respondents	% of non-apprentice respondents	Number	% of all respondents	% of non-apprentice respondents
Total	784	504	103	13.1%	20.4%	96	12.2%	19.0%	198	25.2%	39.3%
Bricklayers, Tile setters	127	60	4	3.1	6.7	2	1.2	3.3	33	26.0	55.0
Carpenters	207	143	36	17.4	25.2	21	10.1	14.7	73	35.5	51.0
Electricians	230	89	41	17.8	46.1	32	13.9	36.0	27	11.7	30.3
Operating Engineers	220	212	22	10.0	10.4	41	18.6	19.3	65	29.5	30.7

^aThe figures shown here are based on questionnaire returns from 784 workers in the four crafts in upstate New York. The results show only that the worker obtained at least some of his training from the source indicated (i.e., each worker could have checked more than one means of training). Furthermore, those with apprenticeship training were told to stop at that question, and thus they are not included in the numbers who received training from other sources.

Military training is another source of training, but it, too, seems generally to be accompanied by some other means of training (see Table 3.9). In fact in recent years, the military has done relatively little training, though it has kept the training courses on its books such that they can be activated should the need arise. Finally, a sizeable portion of construction workers receive at least part of their training through friends and relatives¹⁵ (see Table 3.9), and farm work is yet another means (for more on non-apprentice sources of training see Ref. 17, 18, 40, 43, 50b, 57, 76).

Thus, there are many means by which a construction worker may acquire his skills and enter the industry, and oftentimes he relies on more than one of these means. Though it seems possible that the future supply of labor can be expanded, largely through the nonapprentice sources of training, it is not clear that it can be expanded enough or in the right skill levels or trades or localities, for too little is known about the nature and relative significance of the various means of training and entry to the industry. Much research is needed into the various flows in and out of the

¹⁵In fact, the upstate New York study (18) shows that as many learn this way as do through vocational education and military training combined.

labor pool possessing construction skills and the many factors which influence them.

The union hiring hall is an institution in the construction industry about which there have been many complaints, especially from minority group leaders and government officials who have alleged that the unions use the hiring hall to restrict the employment of minority craftsmen and from employer groups who have maintained that shortages of skilled manpower are due, in part at least, to the unions' ability to limit the size of the labor pool through such hiring arrangements. It is, of course, the exclusive work referral system¹⁶, which is estimated to cover about 50 percent of the workers in the organized sector of the industry, about which most complaints are made, for it does not leave the employer free to look for labor on his own, rather he must rely on the union to supply it¹⁷. By law, the exclusive hiring hall must operate in a nondiscriminatory fashion as to union membership or nonmembership and as to race, color, religion, and national origin. In reality though, unions are almost universally solely responsible for the administra-

¹⁶An Office of Labor Management Policy Development study (74) found that of 291 key collective bargaining agreements in effect on April 1, 1969, on file with the Bureau of Labor Statistics, 132 provided exclusive work referral (i.e., hiring arrangements whereby employers hire workers solely and exclusively from union sources), 98 nonexclusive work referral, and 61 no provision for work referral.

¹⁷Even in the nonexclusive situation, however, the convenience of using the hall and the contractor's reluctance to incur the displeasure of the union tend to militate against hiring outsiders unless absolutely necessary.

tion of these systems, and though certain qualifications, on which registration and referral of job applicants are often based, are legal, more often than not they are rather subjective criteria, making discrimination against nonmember applicants certainly feasible and probably not uncommon especially in loose labor markets. Generally, if the hiring hall cannot supply the needed labor in a specified amount of time, the contractor is free to find his own, and he is usually free to reject any applicant without having to give a reason.

In order to see some of the positive features of the union hiring halls, it is instructive to look briefly at the hiring process in the nonunion sector of the industry¹⁸. By and large the process is highly informal, haphazard, and time-consuming, consisting of a contractor soliciting applicants from his present employees, contacting workers he previously had employed, or asking his subcontractors or even competitors if they know of anyone available. The only formal means is through newspaper ads, but these are often unsatisfactory because the respondents tend to be under-

¹⁸ Interestingly enough, a survey (17) of nonunion residential builders and subcontractors in Erie County, New York revealed that 78 percent thought that a central employment exchange operated by the local builders association was a good idea, 69 percent thought they would have occasion to use it, and 58 percent expressed a willingness to pay an annual fee for its maintenance.

qualified for the job.

It seems evident that some kind of a centralized formal referral system is a necessity in an industry, like construction, which is characterized by casual employment patterns. This is not to say that the operation of union hiring halls today is perfect, but it is better than no system at all, and modifications should be possible. Some desirable reforms might be: (1) involving employers more intimately in the operation (probably financing too) of the referral system, (2) encouraging the use of nonexclusive referral systems rather than exclusive ones, and (3) improving means of screening applicants. The suggestion has often been made that union hiring halls should be abolished and that a management-operated referral system should be implemented instead. It seems, however, that it is perhaps better to make a legitimate effort to adjust the existing system first (for more on hiring halls see Ref. 17, 26f, 31, 38, 49, 61, 74).

Minority entry to the building trades has been of special concern in recent years as a result of the enactment of the Civil Rights Act in 1964 and other legislation forbidding discrimination and the growing fear of shortages of labor in construction resulting in one's looking toward minority group and disadvantaged workers to augment the labor supply. When the construction industry is looked at as a whole, it

employs a larger proportion of nonwhites than does American industry as a whole¹⁹. However, a very large proportion of these minority workers are laborers, and there are some skilled crafts and geographic areas which have hardly any minority members, though the situation has been improving in recent years (see Table 3.10b). In comparison with other occupations, construction craftsmen as a whole are doing quite well, with racial imbalance here being about the same as that among other craftsmen and considerably less than that among some white-collar and more prestigious occupations (see Table 3.11). All of this is not to say there is no problem with racial imbalance in the construction industry, only that it is probably no worse than elsewhere except in a few specific crafts. Aside from this general imbalance in employment, there is also more of a tendency for minority group workers to be plagued by more and longer periods of unemployment (see Table 3.10a), and this, in turn, results in their average annual earnings being less than those of other workers in the industry.

There are numerous factors, which acting together, have resulted in the racial imbalance as it exists in the con-

¹⁹In the economy as a whole today, nonwhites constitute approximately 11 percent of annual average employment. In 1964, it was reported that 13.5 percent of those workers who reported any income from contract construction employment were black (40) (see Table 3.10a).

Table 3.10a: Racial composition of wage and salary workers in contract construction, 1964 (source: Ref. 40).

Category of Contract Construction Work	Minority Workers as a % of Workers Who Received Most of Their Total Earnings from Contract Construction	
	All Workers	Workers Employed in Contract Construction in All Four Quarters of 1964
General Contractors	13.7%	11.5%
Heavy Contractors	14.2	12.1
Highway and Street Contractors	14.4	12.6
Other Heavy Contractors	14.0	11.8
Special Trade Contractors	10.4	7.8
Plumbing, Heating, and Air Conditioning	5.9	4.1
Electrical	3.2	1.9
Masonry, Plastering, Stone, and Tile Work	24.3	19.3
Roofing and Sheet Metal-work	11.2	9.0

Table 3.10b: Percentage of blacks employed in various building trades in all industries (source: Ref. 40).

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Building Trade	% of Workers that are Black							Approximate % of Total Number in Occupational Category Employed in Construction	
	1970	1967	1950	1940	1930	1910	1890	1966	1970
Bricklayers	15.5	13.5	10.9	6.0	6.9	7.5	6.1	74	93
Carpenters	6.6	6.1	3.9	3.9	3.5	4.3	3.6	77	84
Cement Finishers	30.3	37.7	26.2	15.2	15.8	13.0	10.3	95	97
Electricians	3.4	3.6	1.0	0.7	0.7	0.6	na	45	48
Painters	9.8	9.9	5.2	3.8	3.6	2.9	2.0	67	83
Plumbers and Pipefitters	3.9	3.2	3.3	2.2	2.0	1.7	1.1	64	70
Excavating, Grading, and Road Machinery Operators	5.0	6.9	na	na	na	na	na	78	81
Roofers	10.5	15.3	na	na	na	na	na	98	95
Structural Metalworkers	6.7	3.9	na	na	na	na	na	56	69
Tinsmiths, Copper-smiths, & Sheet Metalworkers	na	1.9	na	na	na	na	na	35	na
Laborers in Construction	na	26.9	na	na	na	na	na	100	100

Table 3.11: Nonwhites as a percentage of total annual average employment for various occupations (source: Ref. 40).

Occupation	Nonwhites As % of Total Annual Average Employment			Change in %	
	1950	1960	1968	1950-1968	1960-1968
Blue-Collar	3.9%	4.5%	6.5%	+2.6%	+2.0%
Foremen	1.3	1.6	3.4	+2.1	+1.8
Mechanics and Repairmen	4.5	5.8	7.9	+3.4	+2.1
Metal Craftsmen	2.8	3.4	5.4	+1.6	+2.0
Construction Craftsmen	4.9	5.7	7.5	+2.6	+1.8
Other Craftsmen	3.3	3.7	6.4	+3.1	+2.7
White-Collar	na	3.5	5.7	na	+1.2
Professional and Technical	na	3.4	4.8	na	+1.4
Managers and Officials	na	2.1	2.5	na	+0.4

struction industry. Some of the major ones are: (1) outright discrimination on the part of unions and contractors along with some other nondiscriminatory attitudes, such as unions' general concern over an over-supply of labor and management's frequent reluctance to train workers; (2) social and cultural factors, e.g., blacks tend not to perceive construction as a potential occupation except at the lower skill levels where they are better represented; (3) educational factors in the form of meeting the qualifications and passing the tests in order to become apprentices or journeymen; and (4) lack of information as to how to enter and about potential opportunities in the industry. Thus, efforts to correct this imbalance will have to be directed at all these factors, not simply at eliminating discrimination, but also at actively encouraging minority participation and modifying selection and training procedures.

The approaches which have been put forth as to how best solve the problem of racial imbalance fall into three categories: (1) the Civil Rights Act of 1964 and other legislation and their enforcement by the courts, (2) imposed and hometown plans, and (3) modification of the usual industry practices. The legislative and court action approach is most useful in cases of continuing racial discrimination in order to break the pattern, for it can effectively require and enforce changes in union and contractor procedures and compliance with quotas. However, it seems this approach cannot

really do much to greatly increase minority entry in most cases, because it cannot effectively enforce the training of these workers or even that much in the way of future recruitment, though it can be hoped that it serves to encourage such cooperative efforts.

Under the imposed plan²⁰, there is no requirement or provision for training unskilled workers. Use of the plan, then, results mainly in increasing the employment of minority workers who already have the necessary skills, and when unqualified workers are hired, there is no guarantee they will be trained. Thus, the plan does little to increase the entry of new minority workers to the industry. Further, because it is done on a contract basis, it tends to result in little continuity of employment for the minority workers. It seems that the hometown plan²¹ potentially has more chance for

²⁰-----
The first imposed plan was the Philadelphia Plan, established in 1969. Under this plan and others like it in other cities (by 1972 there were 5 such plans in operation), contractors who have federal or federally assisted contracts in excess of 500,000 dollars or so must agree to make a substantial effort to meet established minority employment goals (covering work in the contractor's private jobs as well as his federal ones) for specified crafts throughout the life of the contract. The strength of the plan lies, of course, in the possibility of barring the contractor from further government work.

²¹The imposed plan was followed by the development of the hometown or voluntary plan (e.g., Indianapolis Plan - by 1972 over 30 of these had received at least tentative approval) with similar objectives, the incentive for the development of such a plan usually being the threat of an imposed plan being implemented. The hometown solution is essentially an agreement among local unions, contractors, and community representatives to increase the participation of minorities, by means of recruitment, training, and job placement, in the construction crafts.

success in terms of significantly increasing minority participation than does the imposed plan because it relies more on voluntary cooperation, puts more emphasis on the training component, and is more concerned with the continued employment of minorities in the community as a whole. However, the success of either plan (and both have had their successes and failures) depends largely on the conditions found in the city where it is implemented. On the basis of these plans and their use, the Department of Labor is now considering some alternative programs.

The remaining approaches to increasing minority participation in construction are sort of a conglomerate of activities, aimed more at the active recruitment and training of minority workers and modifications of normal industry practices in these areas and less at the development of goals and timetables. The programs have been developed, operated, sponsored, and encouraged by various combinations of unions, contractors, minority groups and other organizations, and various levels of government and have had varying degrees of success and potential for success. These activities fall into several groups: (1) adaptations of apprenticeship programs, including apprenticeship information centers, apprenticeship outreach programs (e.g., Joint Apprenticeship Program of the Workers Defense League and the A. Philip Randolph Educational Fund), and pre-apprenticeship programs (e.g., Project Build in Washington, D. C.); (2) non-

apprenticeship training programs (e.g., Project Justice in Buffalo, New York); (3) multi-trade, areawide agreements to carry out the Model Cities Act of 1966 and Housing Act of 1968's requirements that residents of affected areas be involved in construction done under the programs; (4) journeymen upgrading programs; and (5) providing assistance to black contractors who are trying to enter the industry or to expand.

Of the numerous efforts and programs which have been tried and are discussed above, the ones, which have been most successful and seem to promise the most future success in actually increasing minority participation, are those that are concerned with both recruitment and training, do it in a manner that is relatively consistent with the practices and needs of the industry and individual crafts, cover a large enough area so as to ensure continuity of employment, and last but not least involve the active and willing participation and have the cooperation of unions, employers, and minority groups as well as the government. The encouragement and expansion of largely voluntary programs along these lines seems to hold much more promise for success in most instances than does that of those relying on coercion of a legal or extra-legal nature, or at least it seems best to leave coercion as an absolute last resort if the threat of direct public action is insufficient to solicit voluntary

cooperation (for more details on minority groups and construction see Ref. 5, 26d, g, 34, 36, 40, 43, 47, 52, 59, 76, 79).

3.3 The Utilization of the Labor Force

It is a well known fact that the labor force of the construction industry is underutilized, though the degree of underutilization varies among crafts, industry sectors, geographic locations, seasons of the year, and individual workers. Annual average unemployment is generally about twice that exhibited by all industries taken as a whole (see Tables 3.3c and 3.4). Though each spell of unemployment is generally of relatively short duration (also generally being considerably shorter in the summer than in the winter), nearly half of those workers who experience any unemployment experience more than one spell of it in a year (see Table 3.12).

The ratio of an average of 1.8 workers per yearlong job in construction given for 1968 in Section 3.2 has been fairly steady for the last several years, though it was higher than that before the sixties. An average yearlong job is about 2000 hours, so this suggests that workers in construction work only a little over a 1000 hours a year on the average. And in fact, the Bureau of Labor Statistics found the median number of hours a year for all construction

Table 3.12: Incidence, recurrent spells, and extent of unemployment of nonagricultural wage and salary workers as a percent of total wage and salary workers having work experience, by industry of longest job, 1968 (source: Ref. 70).

Status	Non- agricultural Industries	Con- struction	Manu- facturing
With Unemployment	12.0%	24.2%	13.1%
With More Than 1 Spell of Unemployment	3.6	11.8	3.5
With 3 or More Spells of Unemployment	1.8	6.5	1.7
Jobless 15 Weeks or More During the Year	2.5	6.6	2.7

workers included in a study²² it did to be 998.5. Excluding "short-hours" workers and workers not firmly attached to the industry, the average annual hours for the remaining workers was considerably higher, but it was still substantially below 2000²³ (see Table 3.13). The conclusions that one might draw from this are two-fold. First, there is a wide distribution among craftsmen of hours worked at the trade, and it seems that a considerable number of workers in all the trades work in the construction industry for only a relatively short period of time in the course of a year and are likely occupied or employed otherwise for the rest of the year²⁴ while others work in the industry most of the year²⁵.

²²This study (70) was based on the hours of work of individual workers (representing 13 occupations) reported over a 12-month period (the periods falling between December 1965 and October 1967) for four areas (Omaha, Milwaukee, Detroit, and Southern California).

²³"Short-hours" workers are those workers who worked fewer than 700 hours (about 18 full weeks of work) in the 12-month period. Workers not firmly attached to the industry are those who did not have any hours of work reported in January. Not counting the "short-hours" workers, for example, the median number of hours for all crafts in all areas covered was 1535.

²⁴The fact that a very high proportion of all construction workers are employed for only 1 or 2 quarters a year (see Table 3.14) tends to confirm this conclusion as does the relatively high mobility of construction workers (see Table 3.5a).

²⁵Table 3.14 tends to confirm this in that a large proportion of the major earners work for 4 quarters a year.

Table 3.13a: Average number of hours worked in a 12-month period for all workers and those with 700 hours or more of work, by construction occupation (source: Ref. 70).

Occupation	Detroit		Omaha		Milwaukee		Southern California	
	All Workers	Workers with 700 Hours or More	All Workers	Workers with 700 Hours or More	All Workers	Workers with 700 Hours or More	All Workers	Workers with 700 Hours or More
Asphalt Pavers	na	na	na	na	626	1040	na	na
Bricklayers and Masons	934	1470	1042	1471	1031	1486	na	na
Carpenters	1015	1542	1162	1530	na	na	864	1430
Cement Finishers & Cement Masons	777	1510	1024	1474	880	1450	932	1503
Ironworkers and/or Reinforced Steel Workers	888	1524	1010	1590	na	na	1044	1572
Laborers	765	1540	626	1467	590	1416	na	na
Lathers	na	na	1130	1772	1044	1637	na	na
Operating Engineers	1260	1754	987	1525	932	1474	1284	1633
Plasterers	na	na	1032	1756	1055	1611	na	na
Plaster Laborers	na	na	na	na	919	1662	na	na
Teamsters	na	na	728	1778	na	na	961	1647
Terrazzo Mechanics	na	na	na	na	1105	1780	na	na
Terrazzo Skilled Helpers	na	na	na	na	1063	1550	na	na

Table 3.13b: Average number of hours worked in a 12-month period for workers who worked in January and for those who did not work in January, by construction occupation (source: Ref. 70).

Occupation	Detroit		Omaha		Milwaukee	
	Worked in January	Did Not Work in January	Worked in January	Did Not Work in January	Worked in January	Did Not Work in January
Asphalt Pavers	na	na	na	na	889	482
Bricklayers and Masons	1245	734	1356	834	1346	858
Carpenters	1342	768	1455	983	na	na
Cement Finishers & Cement Masons	1203	567	1291	805	1236	704
Ironworkers and/or Reinforced Steel Workers	1316	613	1442	753	na	na
Laborers	1255	527	1067	447	1015	479
Lathers	na	na	1029	1158	1461	978
Operating Engineers	1626	1003	1315	776	1186	862
Plasterers	na	na	1566	851	1526	832
Plaster Laborers	na	na	1067	447	1477	761
Teamsters	na	na	1529	416	na	na
Terrazzo Mechanics	na	na	na	na	1827	1007
Terrazzo Skilled Helpers	na	na	na	na	1444	1014

Table 3.13c: Percent of employees reporting fewer than 400 and more than 1800 hours in a 12-month period, by construction occupation (source: Ref. 70).

Occupation	Detroit		Omaha		Milwaukee		Southern California	
	Fewer Than 400	More Than 1800	Fewer Than 400	More Than 1800	Fewer Than 400	More Than 1800	Fewer Than 400	More Than 1800
Asphalt Pavers	na	na	na	na	38.3%	0.7%	na	na
Bricklayers and Masons	34.2%	11.7%	24.6%	15.6%	26.1	8.6	na	na
Carpenters	31.9	16.0	19.7	24.7	na	na	36.5%	12.5%
Cement Finishers & Cement Masons	46.7	14.4	29.0	17.1	35.1	15.8	34.8	16.3
Ironworkers and/or Reinforced Steel Workers	39.0	14.3	34.9	21.0	na	na	31.1	20.9
Laborers	47.6	14.4	54.5	10.0	55.5	8.9	na	na
Lathers	na	na	31.3	45.4	31.5	27.9	na	na
Operating Engineers	24.6	35.4	31.6	16.6	33.0	17.9	17.4	31.0
Plasterers	na	na	na	na	26.4	23.1	na	na
Plaster Laborers	na	na	39.7	30.1	41.0	22.0	na	na
Teamsters	na	na	57.3	18.2	na	na	36.0	23.2
Terrazzo Mechanics	na	na	na	na	32.0	36.0	na	na
Terrazzo Skilled Helpers	na	na	na	na	27.4	19.3	na	na

Table 3.14: Extent of annual employment in construction, 1964 (source: Ref. 66).

Category of Construction Work	Major Earners ^a in 1964		Percent of Workers by Number of Quarters Worked in the Industry During 1964									
	Number (in thou- sands)	Percent of all Workers	All Workers					Major Earners ^a				
			1	2	3	4	Any Number	1	2	3	4	Any Number
General Building Construction	1269.0	59%	34%	23%	14%	30%	100%	14%	19%	19%	48%	100%
Heavy Construction	919.3	60	34	23	16	27	100	13	20	23	45	100
Special Trades Contractors	1918.8	64	30	20	13	--	100	12	16	16	57	100

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

^aMajor earners, as defined here, are those who earned the highest proportion of their wage and salary income in the industry.

This goes along with the fairly commonly expressed idea that there are sort of two labor forces in construction: one consisting of the key men that a firm employs on a fairly regular basis and uses to supervise and train more temporary help and a second consisting of this temporary help which is employed on more of a job-to-job basis as demand requires. The second conclusion is that not even counting the more temporary workers the construction industry is still underutilizing its labor force in all crafts (somewhat more so in the less skilled occupations) in all areas²⁶.

Such underutilization is not a particularly desirable situation, especially with the tight labor markets in the late sixties and the fear that the future labor supply will be insufficient to meet the demand. Increasing the utilization of the labor force could certainly help to increase the number of available man-hours. It also seems likely that, if job security were thus improved, more of the workers attached to the industry on a temporary basis might become more firmly attached, and unions and workers might become

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This is true at least for the crafts and areas studied, but it does not seem unreasonable to assume that these conditions are fairly standard since other factors and data (e.g., about half of the industry's major earners are employed less than 4 quarters a year (see Table 3.14) and average annual earnings are low relative to those of other industries though hourly wages are high) also indicate underutilization.

less conservative about increasing the supply of well trained workers. Another detrimental side effect of poor utilization is the bargaining power it gives unions to negotiate high wages as compensation for a short work year, and improving utilization might help in this area at least in slowing down the increases if not in cutting back hourly wages in exchange for yearlong employment. There are numerous factors which contribute to this underutilization, and it is the purpose of this section to look at the major ones briefly to determine their contributions and the possibility of lessening them (for more on the extent and consequences of underutilization see Ref. 40, 41, 50b, 70, 75).

Seasonality is a major contributor to the problem of underutilization of the labor force in construction. In fact, an estimated one-third to one-half of unemployment in construction during a year can be considered seasonal unemployment. From winter lows to summer highs, employment²⁷ typically increases 30 percent or so while unemployment generally declines 50 percent or more (see Table 3.15). While reduction in unemployment of construction workers plays a part in the

²⁷ A Bureau of Labor Statistics report (66) claims that "From its low in February to its peak in August, contract construction adds enough workers to staff every mining firm in the country, double the employment in the lumber, furniture, rubber, and stone, clay, and glass industries among others." Myers and Swerdloff (45) claim that it "adds enough workers to staff the entire motor vehicle manufacturing industry."

Table 3.15a: Extent to which employment in August exceeded that in February (source: Ref. 42).

Year	Contract Construction	General Building Contractors	Heavy and Highway Contractors	Special Trades
1968	22.8% ^a	16.7% ^b	55.9% ^c	14.9% ^d
1967	24.6	18.7	50.9	18.7
1966	28.5	24.1	64.8	19.0
1965	31.8	29.2	73.1	19.8
1964	32.6	32.6	65.8	20.9
1963	37.6	40.0	75.5	23.8
1962	35.8	30.0	69.2	21.8
1961	35.0	35.0	65.5	24.1
1960	28.0	25.8	63.9	17.3
1959	35.3	33.9	70.6	24.3
1958	33.4	29.3	67.2	24.2
1957	23.8	17.4	53.6	17.8
1956	32.9	36.8	64.5	19.8
1955	32.8	33.6	61.5	23.5
1954	24.2	24.5	43.5	17.3
1953	19.8	19.0	42.7	12.4
1952	22.2	20.4	50.0	14.0
1951	27.1	28.8	57.0	15.9
1950	41.6	42.9	77.9	28.7
1949	21.8	18.7	53.9	13.1
1948	33.2	31.4	67.0	23.4

^aThis represents 660,000 workers (Ref. 66).

^bThis represents 149,200 workers (Ref. 66).

^cThis represents 290,200 workers (Ref. 66).

^dThis represents 200,100 workers (Ref. 66).

Table 3.15b: Unemployment rates for private wage and salary workers in construction, annual averages^a and for February and August each year (source: Ref. 50b (for 1948 to 1965 data) and Ref. 70 (for 1966 to 1968 data)).

Year	Annual Average	February	August
1948	7.8%	13.5%	5.6%
1949	12.9	16.9	10.4
1950	11.5	21.8	6.7
1951	6.5	13.2	4.3
1952	6.0	10.8	3.9
1953	6.2	8.8	4.4
1954	12.9	19.1	8.7
1955	10.9	17.1	7.7
1956	10.0	17.7	6.2
1957	10.9	17.6	7.6
1958	15.2	24.0	11.6
1959	13.4	25.0	7.9
1960	13.5	19.8	9.5
1961	15.7	26.8	9.7
1962	13.5	22.8	6.9
1963	13.3	25.7	7.5
1964	11.2	19.1	7.4
1965	10.1	19.2	6.0
1966	8.1	13.1	4.9
1967	7.3	13.0	4.3
1968	6.9 ^b	12.5 ^c	4.2 ^d

^aThere is some discrepancy, though it is not too significant, in the annual average unemployment rates given in this table and in Table 3.4. The cause of this discrepancy may be different minimum ages (14 or 16 years of age) considered in the two tables, but from the data sources it is impossible to be sure.

^bThis represents about 247,000 workers (Ref. 70).

^cThis represents about 421,000 workers (Ref. 70).

^dThis represents about 163,000 workers (Ref. 70).

Table 3.15c: Unemployment rates for various occupations, annual averages and for February and August (source: Ref. 70).

Month and Year	All Craftsmen and Foremen	Carpenters	Construction Craftsmen (except carpenters)	All Nonfarm Laborers	Construction Laborers
February 1968	3.7%	10.1%	7.5%	10.1%	18.9%
February 1967	3.6	9.5	8.2	9.5	20.3
February 1966	4.6	11.1	10.2	10.2	17.6
February 1965	5.8	13.2	12.1	14.2	25.7
February 1964	6.5	15.5	13.7	15.9	25.5
August 1968	1.9	4.2	2.2	5.7	6.9
August 1967	1.8	1.7	2.7	5.9	7.6
August 1966	2.0	3.0	3.1	5.8	8.0
August 1965	2.6	4.0	4.3	5.2	8.2
August 1964	3.1	4.3	4.4	8.4	11.5
Annual Average:					
1968	2.4	4.7	4.4	7.2	11.4
1967	2.5	5.1	4.6	7.6	11.7
1966	2.8	6.4	5.2	7.3	11.9
1965	3.6	7.4	6.6	8.4	14.5
1964	4.2	8.4	7.0	10.6	16.5
1963	4.8	9.6	8.7	12.1	20.5
1962	5.1	9.4	8.8	12.4	20.4
1961	6.3	12.3	10.7	14.5	21.7
1960	5.3	10.1	8.9	12.5	19.3
1959	5.3	9.4	8.9	12.4	19.0
1958	6.8	11.7	9.7	14.9	21.3
1957	3.8	8.1	6.4	9.4	12.6

increase in employment in the peak season, actual expansion of the construction labor force with workers from other industries (and perhaps occupations) or outside the labor force is even more significant. Seasonality thus tends to decline during years of high construction demand and generally high aggregate employment. Weather is, of course, the major cause of seasonality, but custom and tradition as well as certain institutional practices²⁸ also make significant contributions. Though there has been a continuing flow of technological developments to facilitate winter construction (in fact, technological barriers are no longer the major obstacle to all-weather construction), efforts have been made to lessen the importance of and/or alter some of the restrictive institutional practices, and there have been natural occurrences (e.g., shift in the regional distribution of employment and in the composition of construction demand in favor of less seasonal conditions), all tending to help reduce seasonality, there has been no significant change in the level of seasonality since 1948²⁹ (24, 27, 40-42, 45, -----

²⁸For example, building codes with unnecessarily strict requirements for winter construction, specifications for only favorable weather conditions, union imposed contractual provisions (such as pay for showup time), scheduling and planning so as to avoid winter work, and renting seasons.

²⁹The late sixties did show a slight decline, but it is too early to know whether or not it is temporary.

50b, 66, 70, 75).

The benefits to be gained by reducing seasonality, such as shorter periods to completion for large structures, stabilization of building activity, and reduction in the size of the work force necessary to produce any given level of construction output, are significant and could potentially accrue to all involved in the industry and even to the public at large. Furthermore, the additional costs associated with winter work, using presently known techniques of winter construction, have been estimated by some (see Ref. 70) to be no more than 5 percent in the case of building structures and may be at least partially offset by savings in materials and labor. Though these are necessarily rough estimates, it certainly seems likely that in the long run the benefits and possible savings should outweigh the additional costs, and because seasonal unemployment is such a large portion of unemployment, reducing seasonality seems to be one of the potentially most promising ways of significantly improving the utilization of the labor force (42, 50b, 70, 78).

The construction industry, however, seems to need some sort of stimulus to get it moving toward reducing seasonality. In the late sixties, several studies looked at what Canada and Europe had done and what the U.S. should do. The Canadian and European programs, by and large, have been impressively successful, but especially so in the countries with the

longest and hardest winters, which tends to confirm the thought that the principal obstacles to winter construction are institutional and perhaps informational, not technological, in character. As a result of a report and recommendations put forth by the Secretaries of Labor and Commerce (75), a federal program (8e) to combat seasonality was recently developed, incorporating several of the approaches which have been tried abroad. Its major features are as follows: (1) promoting the use of existing all-weather construction technology and developing new techniques by means of a technical information program, improved meteorological services, and experimental projects in off-season construction; (2) improving the timing and scheduling of public construction by adopting counter-seasonal contract award procedures whenever possible, requiring that interior activities be done in winter in existing public facilities, developing specifications for all weather conditions, and coordinating federal construction activities and keeping track of advances in reducing seasonality through the Cabinet Committee on Construction; and (3) facilitating the planning and scheduling of public and private projects in light of the local labor market conditions through the development of a construction labor market information system. It is assumed that the approaches which are utilized and the experiences which are gained at the federal level and the increased

availability of relevant information will filter down to the state and local levels and private sector encouraging them to undertake winter construction and related activities. While the program seems like a good start, it is not clear it will be as effective as hoped at the private level. It is true that the federal government is setting an example for others to follow and that the use of winter construction might increase via the contractors who do public construction, but other problems remain to be worked out, such as adapting state and local building codes and specifications to winter construction techniques, working out collective bargaining agreements, and settling questions of how any additional costs are to be allocated. The willingness of contractors, unions, owners, and workers to cooperate is of importance, and they must be convinced of the worthwhileness of reducing seasonality by improved information on its costs and benefits. Some kind of incentive, such as the subsidies used abroad or if possible a nonfinancial one, may also be necessary to encourage increased winter construction, but only as a temporary measure until those involved begin to realize the benefits to be obtained from stabilizing seasonal construction activity and employment and the relatively low cost (8e, 27, 40, 42, 45, 48, 75, 78).

When demand for construction of all types for the nation as a whole is looked at, the fluctuations are rather insignificant, but when demand for a particular type of con-

struction and/or in a particular locality is considered, the fluctuations are considerable (see Figure 2.1). The impact this has on employment is significant, resulting in the industry being plagued by the simultaneous occurrence of labor shortages and significant unemployment in certain crafts and localities. For example, the mix of crafts needed varies from one type of construction to the next, and thus changes in the composition of demand can often result in shortages in some crafts and unemployment in others within a single locality. Furthermore, fluctuations in demand for even a particular type of construction in a particular locality results in shifts in the volume of workers needed in that locality. Increased planning and scheduling of projects to coordinate with local labor market conditions could help alleviate the situation, but owners must somehow be motivated to do this since to date they have shown little interest in such coordination, and improved information on local labor market conditions must also be made available³⁰. Other measures to lessen the fluctuations in demand for construction, and thus for labor, were discussed in Section 2.1, but as was made clear then, what is probably equally important is

³⁰The construction labor market information system proposed as part of the federal government's fight against seasonality and improvements in manpower planning and information in general should be of some help in this.

to try to adapt the industry to these conditions (some such measures will be discussed shortly) (27, 40, 42, 50b, 70, 75).

There are many other characteristics of construction products and processes which result in intermittency of employment. Construction projects are necessarily of short duration, and frequently the employment of particular crafts and/or workers on a particular project is of even shorter duration because the composition of crafts and numbers needed of each craft vary over the life of the project. Furthermore, each particular project requires a slightly different mix of crafts. Because construction workers are often tied to their crafts rather than their employers, there is a continuous shifting from one project to the next in search of work, resulting in some time loss even under the best labor market conditions (see Table 3.16). This situation is not likely to change unless fluctuations in the level of construction activity (composition, locality, and seasonality) are nearly eliminated, making it more possible for employers to maintain more permanent work crews. Still some intermittency of employment would remain, and thus it is best again to try to adapt the labor force to the situation (27, 70, 75, 76).

Various suggestions for helping the industry adapt to this largely inherent instability in employment can be made. First, increasing the availability of job information and speeding up the process of matching workers to jobs should be

Table 3.16: Employment and unemployment of male job changers, by industry of longest job, 1961 (source: Ref. 70).

Employment and Unemployment	Nonagricultural Wage & Salary Workers		
	Total	Construction	Manufacturing
Worked (in thousands)	38,821	3,893	13,209
Job Changers: Number (in thousands)	4,778	972	1,280
% of Persons Who Worked	12.3%	25.0%	9.7%
Total Job Changers	100.0%	100.0%	100.0%
Worked for only 2 employers	63.5%	45.3%	71.3%
Lost no time between jobs	31.4	19.3	36.7
Lost some time between jobs	32.1	25.9	34.6
Did not look for work	5.6	2.8	3.5
Looked for work	26.6	23.1	31.1
1 to 4 weeks	14.1	13.3	17.3
5 weeks or more	12.5	9.8	13.8
Worked for more than 2 employers	36.5%	54.7%	28.7%
Lost no time between jobs	8.2	12.2	6.2
Lost some time between jobs	24.2	28.8	22.0
Did not look for work	1.6	1.0	1.3
Looked for work	22.7	27.8	20.6
1 to 4 weeks	9.9	11.9	8.4
5 weeks or more	12.8	15.9	12.3
Many employers, same occupation	4.0	13.7	0.5

NOTE: Sums of individual items may not equal totals due to rounding.

possible. Advance notice of job termination and posting of job vacancies as well as computerization of this information could be useful and might be most effectively done via a centralized referral system, perhaps patterned after an improved version of today's hiring hall, in both the union and nonunion sectors of the industry. A second suggestion is increasing the mobility of construction workers. Lack of appropriate vesting and reciprocity arrangements for benefits arising from health, welfare, and pension funds and certain union restrictions which impede transferring from one local to another limit mobility, though efforts are being made, and could be expanded, to try to improve this situation. There are, however, certain other factors which impede geographic mobility (e.g., home ownership, community investment, family ties, and inertia) and still others which impede occupational mobility (e.g., construction's requirements of specialization, experience, and development of skill), and their alteration may be less possible if even desirable. Finally, industrial mobility of construction workers is known to be quite high and is sensitive to the level of aggregate unemployment, and in a way it impedes the expansion of mobility within construction itself. Thus, some expansion of the various types of mobility may be possible though perfect mobility is not, nor is it probably even desirable. A third and final suggestion is the use of a

work guarantee, whereby employers as a group guarantee to provide some annual rate of hours of work to an eligible group of journeymen (27, 40, 42, 45, 50b, 70, 75, 76).

Another contributor to the high rate of unemployment, and thus the underutilization of the labor force, is technological unemployment. Changes are constantly being made in construction materials, processes, and equipment as well as in the technology of the product. This results not only in changes in the skills necessary for particular crafts, but it may also result in significant changes in the demand for various crafts. This requires adjustments in the content and size of training programs for workers entering the industry and development of retraining programs for journeymen in the affected crafts (27, 50b).

Finally, there is a variety of situations which can arise on the jobsite and result in intermittency of employment and general underutilization of the available labor force. Work stoppages, for example, result in a fair amount of lost time (see Figure 3.1) though, of course, it is not nearly as significant as that lost due to seasonality. Still, for this reason as well as others, it seems reasonable to make an effort to decrease their occurrence and effectiveness by some of the means discussed in Section 3.1. Accidents on the jobsite are another contributor (see Table 3.17), and though construction is inherently a hazardous occupation, it

Table 3.17: Work injuries in construction and other industries (source: Ref. 8i).

Industry	Injury-Frequency Rates ^a						Injury-Severity Rates ^b					
	1958	1959	1960	1961	1962	1963	1958	1959	1960	1961	1962	1963
Contract												
Construction	30.9	32.1	31.5	30.9	29.5	28.6	2496	2411	2643	2139	2497	2219
Manufacturing	11.4	12.4	12.0	11.8	11.9	11.9	761	752	753	698	698	689
Coal Mining	na	41.2	42.5	44.0	44.1	44.2	na	8168	9170	9384	9476	8942
Motor Freight Transportation and Warehousing	28.9	31.9	32.5	31.8	30.2	31.3	1732	1622	1924	2220	1576	1998

Industry	Average Number of Days of Disability Per Case ^c						% of Disabling Injuries in 1963 Resulting in:				
	1958	1959	1960	1961	1962	1963			Death	Permanent Impairment	Temporary Total Disability
						All Disabling Injuries	Permanent Partial	Temporary Total			
Contract											
Construction	81	75	84	69	85	78	607	18	0.7%	2.7%	96.6%
Manufacturing	63	57	59	55	56	55	381	18	0.3	5.0	94.7
Coal Mining	na	na	na	na	na	na	na	na	2.5	na	na
Motor Freight Transportation and Warehousing	60	51	60	70	52	64	447	17	0.6	1.8	97.6

^aInjury-frequency rate is the average number of disabling work injuries for each million employee hours worked.

^bInjury-severity rate is the average number of days of disability resulting from disabling work injuries for each million employee hours worked.

^cThe average days of disability includes standard time charges for deaths and permanent impairments and number of full calendar days the injured were unable to work because of temporary total disabilities.

is clear that a substantial number of the accidents could be avoided³¹. Aside from the expansion of safety efforts by unions, contractors, trade associations, and safety groups, it would be useful for state safety agencies and the federal government to develop, enforce, and keep up to date more rigorous and effective safety standards and regulations. One final contributor is poor scheduling (e.g., failing to schedule the delivery of materials and equipment so they will be on the site when they are needed) and other inefficiencies on the part of management and labor (e.g., restrictive work practices). A Canadian study, for instance, found that only 55 percent of the time on a standard on-site job was productive, the rest being spent in involuntary idleness, waiting for materials or instructions (50b). Improvements in the general management and organization of construction operations (e.g., use of sophisticated planning, scheduling, and control methods like CPM and PERT) and the joint cooperation of labor and management (e.g., in the introduction of new technologies) could help alleviate the situation and will be considered further in Section 3.5 and Chapter 4 (8f, i, 27, 50b, 71, 76).

³¹For example, accident frequency rates in 1967, as reported by the National Safety Council for a small group of safety-conscious contractors, averaged about half the industry-wide rate (76).

3.4 Construction Wages

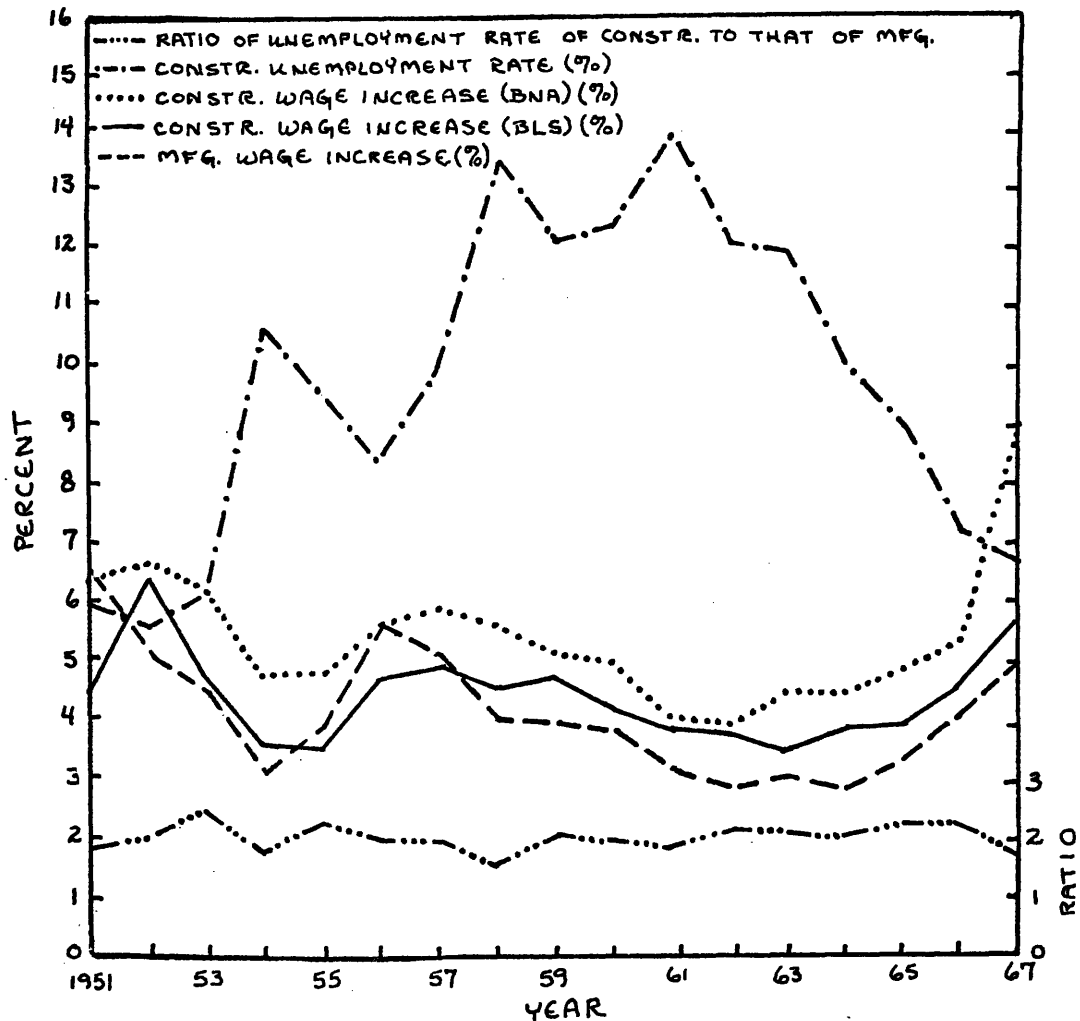
Complaints about the level and rate of increase of wages in the construction industry have long been numerous and were especially thus in the late sixties and early seventies when wage settlements were skyrocketing. The existence of high wages in construction was sufficiently established in Section 2.2, and thus what is of interest here is the identification of the responsible factors. On this, there are several different schools of thought, with nearly every author feeling a different set of factors is responsible and several using regression analyses to look at the relationships among the factors and wage levels. Here an effort will be made to discuss the major factors and then to look at some potential approaches to alleviating this problem. It must, of course, be recognized that there are limitations to looking at rising wages on an aggregate level, for the causes undoubtedly differ somewhat among crafts, localities, industry sectors, and so forth.

The first type of factors commonly looked at are those which are felt to influence changes in wage levels in nearly any industry; i.e., the levels of and/or changes in the unemployment rate in the industry, cost of living in general, productivity in the industry, profit rate in the industry, and wage levels of other industries. Opinions differ, of course, as to the relative importance of these factors. It

seems reasonable to expect that generally rising wage levels are a significant influence on rising construction wages, and Mills (40) finds them to be so. In general, the unemployment rate and/or its changes in the industry is felt not to play too major a role (see Figure 3.2). Changes in the cost of living and in productivity levels both contribute to wage changes, but as Figure 3.3 suggests wage increases in recent years have been far above those accounted for by cost of living and productivity changes. Though change in the consumer price index appears to be positively correlated with wage changes as would be expected, that in productivity really does not. As for profit rates, there is disagreement about their importance, and about all that can be said is that they contribute little if anything of significance to an explanation of wage changes. Thus, though factors in this first group may play some role in influencing wage changes in construction, they are certainly not the full explanation, nor do they account for why wages in construction are higher and have been rising faster than those in other industries (6, 25, 33, 40).

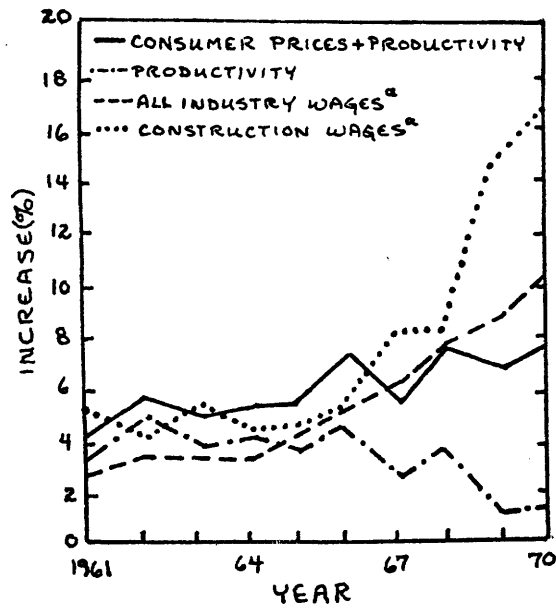
A second set of factors are those which attempt to account for the differences between construction and other industry wages. The relatively higher construction wages are seen as compensation for a variety of conditions in the industry. For example, intermittency of employment is a problem, and in fact annual earnings of those who earn the

Figure 3.2: Wage increases and unemployment rates in construction and all manufacturing (source: Ref. 33).



NOTE: The high level of negotiated wage increases in construction during the 7 years, 1958 through 1965, is noteworthy in view of the high rates of unemployment in construction during that period, though it should also be noted that there does appear to be some small degree of negative correlation between wage increases and unemployment rate changes (lagged a year). The great spread between wage increases in construction (BNA series - this is comparable to the manufacturing series) and all manufacturing from 1958 through 1967 is surprising in view of the fact that unemployment in construction rose slightly relative to that in manufacturing during that period.

Figure 3.3: National productivity increases plus consumer price increases as compared to wage increases in construction and all industries as a whole (source: Ref. 6).



^aMedian increase for the first year.

largest part of their annual income in contract construction are generally below those of their counterparts in most other industries. The level of fringe benefits in construction is also generally below that in other industries though in recent years it has been increasing in importance (see Table 3.18). Moreover, construction is an industry which requires a high proportion of skilled labor. In fact, there are, on the average, slightly more than twice as many skilled manual workers engaged on a typical project as there are helpers and laborers. Finally, no one can deny that construction is often hazardous as well as unpleasant work especially under poor weather conditions (see Table 3.17). Compensation for these conditions, then, is generally recognized as a valid reason for construction wages to be at least somewhat above those in manufacturing, but it does not account for the disproportionate wage increases in recent years. In fact, Foster (26b) claims, and others seem to agree, that by the mid-sixties the existing differentials had already compensated for these factors and that since then there has been no apparent deterioration in the relative position of construction along these lines and thus no reason on these grounds for the relative increases (7, 8g, 23, 24, 26b, 50b, 66).

A factor which arises time and again in discussions of high wages in construction is that of union influence. There are two aspects to this influence: (1) the general and con-

Table 3.18: Supplementary employer payments for unionized production workers in construction and manufacturing, as a percentage of straight-time wages (source: Ref. 26b).

CONSTRUCTION		MANUFACTURING	
Year	Percent	Year	Percent
1965	7.7%	1959	13.0%
1967	9.1	1962	14.0
1969	11.6	1966	17.1
1971 ^a	13.5	1968	18.6

^aOnly the first quarter of 1971.

controversial aspect of union power largely due to its control over the labor supply and (2) the less controversial aspect of work stoppages. It is generally agreed that the occurrence of work stoppages definitely tends to result in higher wage settlements. It would seem that the threat of a stoppage might have a similar effect. As the statistics in Section 3.1 show, construction generally doubles or triples the all-industry average of working time lost due to work stoppages, and a large proportion of these is due to wage disputes. Thus, this seems to represent at least a partial explanation of the long-run wage differentials between construction and other industries. Work stoppages may also be at least partially responsible for the widening of these differentials in the late sixties when the frequency of strikes rose rapidly. Strikes in the full-employment and inflationary economy of that period were felt to be particularly effective weapons in the hands of the unions (25, 40, 66).

It is contended by many that the power of unions in construction is largely responsible for the wage differentials between construction and other industries. That is, unions control the wage rate because of their control over the labor supply through the hiring halls and training programs. Proponents of this theory suggest two explanations of how union power is responsible for the widening of these differentials in the late sixties as well: (1) union power has

steadily increased over the years and (2) unions have recently come to recognize their power even more so and thus have exerted it more strongly. Such control on the part of unions over the labor supply was discussed above, and as was pointed out then, it is true that unions do have some control, but it is limited due to the existence of the nonunion sector, among other reasons. The degree of union influence over the labor supply and wage rates varies over time, space, craft, industry sector, and so forth, making its importance in explaining wage differentials difficult to determine. Mills (40), among others, however, feels that increased union power cannot explain the widening of differentials in the late sixties because the unions have actually lost power over the last 20 years due to increasingly restrictive labor legislation and growing competition from nonunion sectors. The second explanation for increasing differentials is also subject to question. Another point often brought up in relation to union power is the Davis-Bacon Act³². Many supporters of the union power theory contend that this act pushes up wages on government projects

³²This act requires that prevailing wage rates be paid on construction projects funded, assisted, or insured by the federal government. Many supporters of the union power theory believe that this prevailing wage becomes the union wage in the nearest metropolitan area.

and protects high union wages from nonunion competition. While there are arguments both for and against the act on this and other grounds, it seems that it is really not quite as effective as some believe in keeping out lower-than-union rates on federal projects. Furthermore, its repeal or modification would have only a small effect on federal and federally assisted projects and even less on private work. Thus, it seems reasonable to expect that union power may have some influence on wage differentials between construction and other industries, but just how much is unclear, and its influence on recently increasing differentials is questionable (6, 7, 8d, 25, 26b, c, 30, 31, 38, 40, 49, 66).

At this point about the only factors that have not yet been discussed which might affect construction wages are market conditions and industry structure. Market conditions must necessarily be considered on a relatively local scale, for on a national scale supply and demand appear to be uniform and complementary. As for demand, it is the level and composition which are important, for these determine the volume and mix of labor skills needed. A rather sudden high demand for certain skills naturally tends to push up their wage levels. Furthermore, the extent and make-up of supply are important, for they determine whether demand can be satisfied with immediately available labor or if it is necessary to search elsewhere, perhaps in other branches

of the industry or other industries. Depending upon the employment conditions in these various sources, it might be necessary to raise the wage settlements to attract suitable and sufficient labor. Thus, market conditions may help to explain high wage settlements in certain trades in certain localities at certain times, but they do not explain high wage settlements in the industry in general. It is the decentralized bargaining structure of the industry, by the mechanisms discussed in Section 3.1³³, that is felt to be largely responsible for the spreading of settlements from one region to another and from one craft or branch of the industry to another within a limited geographic area over a relatively short period of time. Mills (40) and others (e.g., 6, 44) feel that the particular market conditions in the late sixties in conjunction with the decentralized nature of collective bargaining were largely responsible for the increasing wage differentials between construction and other industries at that time. Thus, this mechanism can likely be used to explain, at least partially, wage differentials in other periods and add to an understanding of wage differentials in general (6, 25, 26c, 40, 44).

The rapidly rising wage levels in the late sixties and

³³ See footnote 7 at the end of Section 3.1 for a detailed explanation.

early seventies slowed down a bit in 1971, with the establishment of the CISC and craft disputes boards early in 1971 and the enactment of strict wage-price controls later in the same year. One of the jobs, among others, of the CISC and craft boards is to approve or disapprove wage settlements on the basis of two basic criteria: (1) economic adjustments must generally be supportable by productivity improvement and cost of living trends but not in excess of the average of the median increases in wages and benefits over the life of the contract negotiated in major construction settlements from 1961 to 1968 (about 5.9 percent) and (2) equity adjustments may be considered over the life of the contract to restore traditional relationships among crafts in a single locality and within the same craft in surrounding localities. Though the CISC and craft boards have been fairly successful in their first two years of operation³⁴, their future success is less clear under the voluntary wage-price controls enacted early in 1973. Government imposed economic controls and programs such as these are necessarily only temporary measures, though there has been some discussion about the craft

³⁴Increases to take effect in the first year of the contract fell from 17.0 percent in 1970 to 11.2 percent in 1971 to 5.5-6.5 percent in the first six months of 1972. The occurrence and size of deferred wage and fringe benefit increases and the incidence and seriousness of work stoppages were also significantly reduced (26e).

boards becoming permanent institutions. Nevertheless, new longer term measures must soon be implemented if the stabilization of even the last two years is to continue (6, 12, 26e, 29, 32, 43, 44, 62).

Because the problem of maintaining construction wages at a reasonable level is such an old and serious problem, numerous suggestions have been put forth as to how to do it, but at the same time many of these suggestions are infeasible or would likely result in undesirable outcomes. It should be borne in mind that wage stabilization is closely related to price stabilization, and thus the discussion in Section 2.2 on the stabilization of construction prices is also relevant here. Some of the more reasonable suggestions (upon some of which work has already begun) for keeping construction wages at a reasonable and stable level in the future are as follows: (1) encouragement of efforts to stabilize demand or at least to avoid generating sudden short-run pressures on labor markets, perhaps by means of improved planning and scheduling of projects by the government and larger industries; (2) improvement of manpower planning in order to adjust training better to future needs and to improve the allocation and utilization of the available labor supply (also of importance along these lines is to look into the current roles of hiring halls and apprentice training programs with an eye toward reforms in these areas as necessary); and

(3) promotion of measures to restructure collective bargaining, in terms of making it less decentralized and of having the nationals more involved at the local level, of strengthening the position of the contractors in bargaining situations, and of improving dispute-settlement machinery (31, 40, 49).

3.5 Labor Productivity

The measurement of labor, capital, and total factor productivity in the construction industry and the associated difficulties were discussed in Section 2.3, and some statistics were given (see Table 2.2 and Figures 2.8 and 2.9). The general conclusion with respect to the value of labor productivity in construction was that it is likely somewhat lower and its growth rate a little slower than that in most other industries and all industries as a whole but not as low or slow as has generally been believed³⁵. It is the purpose of this section, then, to look at what kinds of things make labor productivity over time generally rise, why labor productivity in construction may be low, and what can be done to improve the situation. Just as labor produc-

³⁵ One reasonable estimate of the average annual growth rate of labor productivity in construction for the period 1950-1965 is about 2.0 percent while that for all nonfarm industries for the same period is about 2.5 percent (50b).

tivity differs among crafts, types of construction, geographic locations, sizes of the project, and so forth (see Table 3.19 and Figure 3.4), so will the relative importance of the various influences and effectiveness of the approaches to solution, and it is important to bear this in mind throughout the following discussion which is, of necessity, on an aggregate level.

The factors which influence labor productivity in the economy as a whole depend upon the time period being considered. Short-term changes in productivity in general are strongly influenced by the business cycle because productive capacity, including the work force, is not so flexible that producers can immediately adjust it to changes in demand³⁶. What is of more interest, however, is the long-term trend of productivity change, which is growth. The three major factors that are felt to be largely responsible for long-term productivity growth are: (1) increased availability of capital, e.g., for investment in improved plant and equipment; (2) improvement in the quality of labor,

³⁶ More specifically, as business activity begins to decline, output per man-hour drops as capacity utilization falls below the optimum level, but once cost-cutting efforts get underway and adjustments are made, the decline is stopped or reversed. On the other hand, when business activity begins to rise, output per man-hour increases at a faster rate due to higher capacity utilization, but then after a sustained period of production increase, bottlenecks emerge, less efficient resources are brought into use, and the rate of productivity advance declines.

Table 3.19a: Distribution of man-hours per \$1000 of contract cost for major types of construction, by industry and occupation (source: Ref. 1).

Industry and Occupation	Year and Type of Construction								
	1962	1961		1960		1959			
	Housing Family One- Private	College Hous- ing	High- ways	Civil Works		Schools	Federal Office Build- ings	Hos- pitals	Public Hous- ing
				Opera- tions	Land Dredg- ing				
Total Man-Hours	204	227	224	208	224	223	227	223	236
Construction Industry	84	105	96	89	144	96	107	100	126
On-Site	72	94	91	85	134	86	97	89	114
Administrative and Supervisory	2.1	3.2	9.3	9.3	8.6	3.3	5.8	3.5	4.5
Construction Trades	52.9	59.8	54.5	42.9	62.7	55.1	58.7	60.7	72.5
Bricklayers	3.9	9.4	na	--	--	7.8	5.0	4.8	8.6
Carpenters	24.9	15.8	na	5.4	--	15.7	12.2	11.7	21.8
Electricians	2.0	6.2	na	0.1	--	6.0	8.8	7.8	4.7
Ironworkers	--	3.6	na	2.6	--	2.3	4.1	3.1	2.3
Operating									
Engineers	1.0	1.6	na	20.4	1.5	1.6	2.3	1.4	3.1
Painters	6.9	3.3	na	0.1	--	2.8	2.0	2.5	5.0
Plasterers and Lathers	1.7	3.2	na	--	--	2.3	3.8	5.6	7.7
Plumbers	3.8	9.1	na	0.1	--	7.9	8.5	12.7	8.9
Unskilled and Others	17.1	30.6	27.2	32.5	62.6	25.6	32.6	24.6	36.7
Off-Site	12	11	5	4	10	10	10	11	12
Other Industries	120	122	128	119	80	127	120	123	110
Manufacturing	58	73	66	53	47	75	73	75	64
Trade and Transporta- tion and Services	49	32	44	47	24	41	37	38	36
Mining and All Others	13	17	18	19	9	11	10	10	10

NOTE: Because of rounding and omissions, sums of components may not add to totals.

Table 3.19b: Man-hours per 1000 square feet of living area, by occupation and functional parts, for single family dwellings^a (source: Ref. 26a).

Occupation and Functional Part	Man-Hours Per 1000 Square Feet		Percentage Change 1930-1965
	Absolute Number 1930	Absolute Number 1965	
1. Carpenter	393.9	215.4	- 45.3%
Footings(forms)	13.6	13.2	- 2.9
Framing	139.5	94.4	- 32.3
Exterior walls	30.7	4.0	- 87.0
Wall sheathing	22.0	0	-100.0
Stucco preparation	8.7	0	-100.0
Wood siding	0	4.0	---
Interior walls and Ceilings	20.8	30.8	48.1
Plaster preparation	20.8	0	-100.0
Wood paneling	0	1.8	---
Insulation	0	5.4	---
Drywall(dry-wall installers)	0	23.6	---
Windows	40.2	4.0	- 90.1 ^b
Doors	41.8	8.3	- 80.1
Interior trim	35.7	12.3	- 65.6
Cabinet installation	0	3.0	---
Other	35.7	9.3	- 74.0 ^b
Floors(hardwood floor layers)	41.8	33.5	- 19.9
Roof (shinglers)	20.9	13.4	- 35.9
Stairs	8.9	1.4	- 84.3
2. Cement Finishers (concrete floors)	5.7	2.3	- 59.6
3. Lather	51.1	7.9	- 84.5
Exterior walls (stucco)	18.5	7.9	- 57.3
Interior walls (plaster)	32.6	0	-100.0

(continued)

(Table 3.19b continued)

Occupation and Functional Part	Man-Hours Per 1000 Square Feet		Percentage Change 1930-1965
	Absolute Number 1930	Absolute Number 1965	
4. Plasterer	142.1	16.8	- 88.2
Exterior walls (stucco)	78.5	16.8	- 78.6
Interior walls (plaster)	63.6	0	-100.0
5. Linoleum Layer ^c (floors)	3.5	6.4	82.9
6. Hard Tilesetter (floors)	11.6	2.7	- 76.7
7. General Building Laborer	113.5	19.3	- 83.0
Footings	17.5	3.4	- 80.6
Concrete floors	35.4	2.1	- 94.1
Framing	41.7	12.5	- 70.0
Exterior walls	9.1	0.4	- 95.6
Doors	0	0.9	---
Interior trim	5.9	0	-100.0
Floors	3.9	0	-100.0
8. Hod Carrier	103.5	8.4	- 91.9
Exterior walls	58.5	8.4	- 85.6
Interior walls	45.0	0	-100.0
9. Tile Helper (floors)	12.5	0	-100.0
10. Skilled Only (sum of lines 1-6)	607.9	255.6 ^d	- 57.9
11. Unskilled Only (sum of lines 7-9)	229.5	27.6	- 88.0
12. Integrated Crew (sum of lines 1-9)	837.4	283.2 ^d	- 66.2

(continued)

(Table 3.19b continued)

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

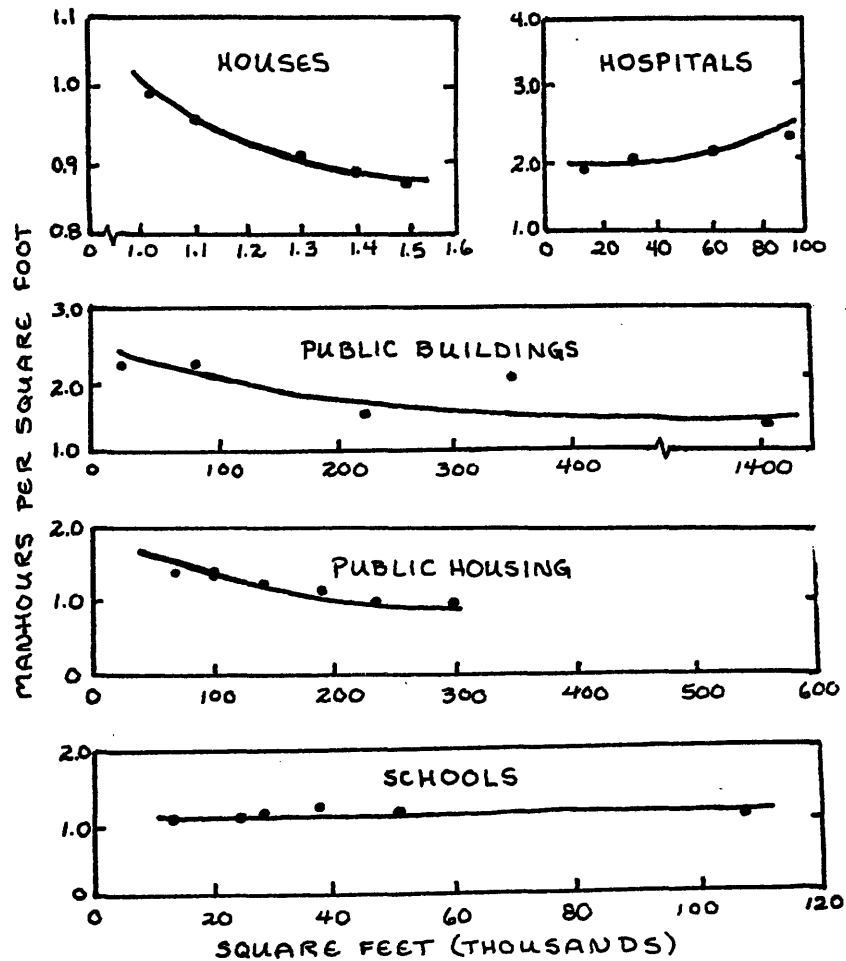
^aBehman selected four representative houses each for 1930 and 1965 and combined them into a typical house for each year. Thus, an accurate evaluation of changes in labor and materials inputs was possible because changes in the quality and type of house built over the 35 years could thus be included.

^bIn 1930, window trim appears under Windows. In 1965, window trim is included under Interior trim. Consequently, the percentage reduction in windows is slightly overstated and that for interior trim is slightly understated. This methodology reflects the shift that occurred by 1965 when all trim around aluminum windows was performed by a finish crew doing the interior trim. Door trim, in contrast, appears under Doors in both years. To be consistent, we should have included door trim in 1965 under Interior trim because tract builders have all trim installed by the same crew so that all of this trim is one operation. The inconsistency does not change the argument, however, for as seen in the table, hours in windows, doors, and interior trim dropped substantially.

^cCarpet, soft tile, and linoleum layers.

^dTotal includes 4.1 hours for trenching machine operators, teamsters, and roofers.

Figure 3.4: Changes in man-hours per square foot of floor space as the size (floor area) of the constructed facility varies, for different types of structures, 1959 to 1962 data (source: Ref. 7).

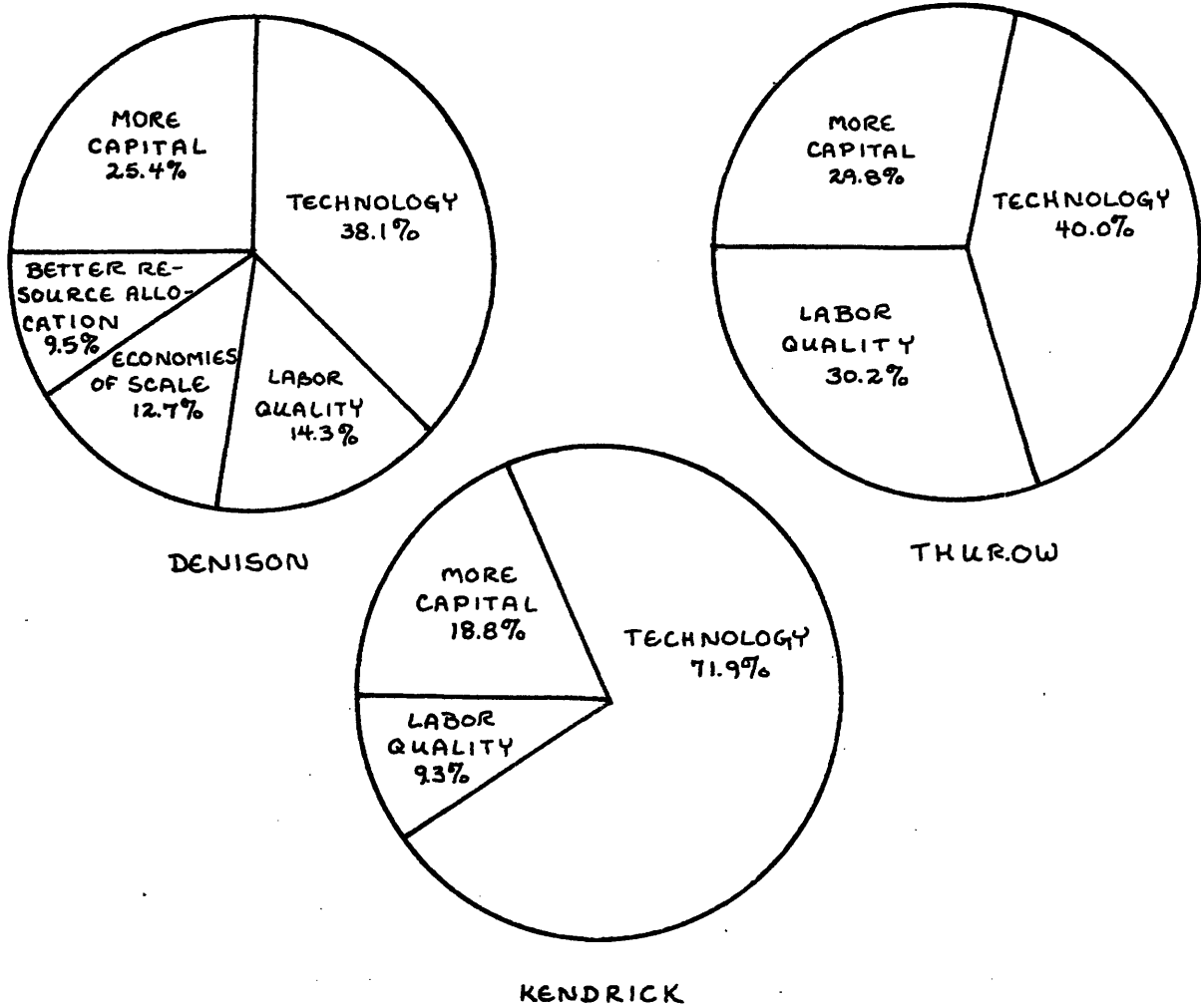


NOTE: Man-hours represent the actual labor input on the construction site and an allowance of man-hours spent by personnel of the contractor off-site in administrative, warehousing, and other supporting activities allocated to each project.

e.g., due to improved education, skills, and worker attitudes; and (3) greater efficiency in the use of labor and capital, e.g., in terms of technological innovations through research and development and improvements in managerial abilities. Other factors, such as improvements in the allocation of resources, increased economies of scale, improved state of labor relations, and increased competitive pressure, also help to improve labor productivity though their actual impacts are often difficult to quantify and measure (see Figure 3.5 for an indication of various economists' opinions as to the relative contributions of some of these factors to productivity growth in general) (14, 69).

Many of these factors are naturally felt to be responsible for the growth of labor productivity in the construction industry. Dacy (9) specifically tried to account for the productivity growth he found between 1947 and 1963 (just over 3.0 percent annually), and the factors which he felt to be responsible are those which are commonly cited as such in construction literature (e.g., 6, 7, 50b, c). He attributed productivity growth to: (1) an increase in capital per worker, in particular in the form of heavy equipment and small power tools; (2) a shift in the construction product mix toward activities which are less labor-intensive (e.g., highways) and in which labor productivity is increasing the

Figure 3.5: Factors affecting productivity as estimated by three economists (source: Ref. 69).



NOTE: Technology here refers to the residual, i.e., the part of productivity growth not accounted for by the other factors measured.

fastest (e.g., nonresidential construction); (3) a shift in the geographical distribution of construction toward areas where productivity is thought to be higher (i.e., the West); (4) an increase in the corporate share in contract construction, thus shifting to a more efficiently sized operation where increased economies of scale come into play; (5) the declining average age of construction workers, particularly in the immediate post-war years, and improved age composition; and (6) the introduction of new techniques of building and the substitution of labor-saving building materials for others, resulting in transferring of labor to an off-site location. Two factors which seem to be missing from this list and which it seems should have made at least some contribution to productivity growth are improvements in the management and organization of the construction process, such as improved scheduling due to some limited use of computerized techniques on larger projects, and improvements in the quality of the labor force, as a result of increased education and the recent increased emphasis on training.

There are several factors which have generally contributed to keeping construction labor productivity at a lower level and slower rate of growth than might be desirable. For example, the technology of the product, and even the product itself, is constantly changing which makes it very hard to gain the expertise and efficiency that are possible in many other industries. Moreover, there are other factors,

such as improved product quality and increased speed of construction, which may be desirable changes, but which do not show up as increasing labor productivity and may even cause it to decline. These are things which really cannot be avoided, but many of the other, yet to be discussed, contributors to low productivity might be avoided at least to some extent (7, 50b, c).

Probably one of the most commonly cited productivity-inhibiting factors is union restrictive practices which encompass a broad range of activities. The ones most frequently discussed today are those³⁷ that impede the introduction and use of technological innovations in materials, equipment, and processes, though the other alleged work rules³⁸ also receive a fair amount of attention. Unions generally justify

37 There are three categories of these: (1) on-site rules which require that certain work be done on the premises and prohibit or limit the use of prefabricated products, (2) restrictions against the use of certain tools and devices, and (3) requirements of excessive manpower on a job including what seem to be irrational limits on the variety of work certain categories of workers may perform.

38 Some of the more commonly cited working rules are: (1) direct and indirect limits on output, (2) limitations on piecework and subcontracting of labor, (3) regulating the employer's right to work with the tools of the trade, (4) requiring the employment of unnecessary men, (5) protecting the jurisdiction of each craft, (6) requiring unnecessary work (quality and/or quantity), (7) regulating overtime work and payment of premium rates, and (8) regulating the right to hire and fire.

these practices by one or more of three basic reasons, job security (employment, wages, and skills), jurisdictional control, and health and safety of workers, the validity of which is often hard to determine. The general conclusions that one might draw from the studies³⁹ of restrictive practices that have been done are: (1) the extent of restrictive practices has, in most cases, been grossly exaggerated; (2) the actual extent varies among unions, communities, projects, time periods, and so forth; (3) the use of these practices is not limited to unions; and (4) the degree of enforcement tends to vary inversely with the volume of activity, with practices being left in contracts so they may be enforced if needed. With respect to productivity then, it seems likely that restrictive practices do have a somewhat detrimental influence but not as much as has commonly been believed; the exact extent could only be determined by studying each practice individually, with respect to various unions over time and space (and likely under actual operating conditions to be reliable). Because

³⁹One recent study (35), for example, found the total labor costs involved in building a house with unionized labor or with nonunionized labor to be about the same. This was attributed to the greater efficiency of the unionized labor (due to high wages weeding out inferior workers and good apprenticeship training) and of the management (due to the high-wage effect and competition); little in the way of restrictive practices of any sort was found. An earlier, more qualitative study (24) had reached similar, though not quite so encouraging, conclusions in finding union restrictive practices might increase total costs to a house buyer by 3 to 8 percent.

job security is one of the main reasons for these practices, improving the utilization of labor and thus increasing job security, as discussed in Section 3.3, should certainly help to reduce the use of restrictive practices. As for the practices themselves, there already is a fair amount of legislation and legal precedent, and it seems that any policy program in this area would have to be very detailed and specific, for there is no single solution or formula which will put an end to all such practices. It seems it would be best for the government to work on improving the utilization of the labor force and let the contractors and unions work out the restrictive practices for themselves, preferably at the bargaining table during contract negotiations rather than on the jobsite during a project. This approach has proved to be successful in the past; for example, many innovations have been peacefully introduced and several agreements among unions, contractors, and manufacturers of prefabricated systems have been arranged by bringing the unions in at the beginning, involving them in the introductory process, and settling potential problems before they occur⁴⁰ (6, 7, 24, 31, 35, 49, 50a, b, 53, 68, 72).

⁴⁰ Moreover, as Mills (40) points out, it is not really in the long-term interests of unions to try to prevent the introduction of innovations, specifically building systems, but rather they want to control the work.

Another factor which influences labor productivity is the overall efficiency of the labor force in terms of physical effort, speed, judgment, and other factors which mainly depend upon the worker himself. Generally as employment rises, the average efficiency of the work force declines because the better workers are hired first. Some authors also contend that the limitation of union membership and the use of the hiring hall serve to reduce the efficiency of the labor force⁴¹. Measures to improve the operation of the hiring hall and reduce the limitations on union membership were extensively discussed in Section 3.2. A major determinant of an individual's efficiency is personal motivation, something which is very hard to stimulate externally. The training of the individual is another important factor in efficiency, for construction is an industry requiring a majority of variously skilled workers. Thus, the quality and breadth of training of the work force and its availability when needed are of considerable importance. Moreover, in order to keep the workers well trained, help them adjust to technological change, and provide opportunities for them to advance, retraining is necessary and is yet another factor influencing effi-

⁴¹That is: (1) during periods of high demand, the union is forced to issue permits to workers with little knowledge of their qualifications in order to supply the needed workers and (2) the contractor who works under an exclusive hiring hall agreement can select workers only to the extent that he can reject the ones the hiring hall sends him.

iciency. Improvements in the area of training, as discussed in Section 3.2, should certainly be possible and should help to increase the efficiency of the labor force and thus labor productivity (6, 24, 38, 50b, 68).

Managerial ineffectiveness in the construction industry is felt to be responsible for quite a bit of the idleness and low productivity on the jobsite. For example, poor scheduling results in workers standing around waiting for materials and/or equipment (or vice-versa), poor supervision results in their waiting for instructions and using outmoded and inefficient techniques, and poor allocation of resources results in inefficient crew sizes and utilization of labor. Much of this poor management and organization of construction operations is a result of the structure of the industry, such as small production units, easy entry/easy exit nature, and extensive fragmentation, as will be discussed in Chapter 4. Improvements in this area are definitely needed, but just how is unclear. With the generally increasing size of the production unit and the increase in the corporate share of the industry, some improvements in management might likely come about, for there will be more room for increased management specialization and training (aside from the benefits to be gained from increased potential for economies of scale). Computerized planning, scheduling, and control techniques, such as CPM and PERT, might also become more widely used and

new and better ones be developed. The managerial aspects of construction operations has not received much attention over the years, but more interest is now being focused on it and will continue to be since it plays an important role in the overall productivity of the industry as well as in labor productivity (50b).

Technological change is of obvious importance in labor productivity. It is generally felt that technological innovations in materials, processes, and equipment in the construction industry have been occurring at a rapid rate. However, the research that has been done has largely been done by a few individuals (e.g., material and equipment manufacturers and suppliers) who lack a sufficiently broad-based focal point, and the results have not really been truly innovative. The research somehow needs to be done with the interests of the industry as a whole in mind and with increased industry and government support of all kinds. Furthermore, the acceptance, and thus use, of technological innovations by the industry has been slow due to a wide variety of constraining factors, such as lack of a formal certification procedure, limited diffusion of information, tradition, building code and zoning problems, production and marketing difficulties, and factors relating to industry structure, as well as the resistance of labor discussed above. It seems that government efforts to date in this area (e.g., Operation Breakthrough) have been mostly

concentrated on increasing research and development rather than dealing with the constraints. This is not to say that the development of new technologies is not important, but just that efforts must also be exerted to ease and increase their acceptance, for only then will they be used and perhaps result in an increase in productivity. Moreover, technological change, more often than not, is in the direction of increased capital investment (which, in fact, is yet another constraint). For a variety of reasons (e.g., custom-built product, product complexity and variety, and fluctuating demand), the construction industry has always been a relatively labor-intensive industry with rather low capital investment. This has naturally tended to keep labor productivity at low levels. Increasing capital investment in equipment and plant, and thus implementing technological change (once the other constraints have been alleviated as well), should help to raise labor productivity in the future (10, 50a, c, 53).

These then are the major areas which over the years have prevented labor productivity from growing faster than it did. Changes in these areas, as discussed above, along with the continuation and perhaps expansion of the trends which have been responsible for the increase in construction labor productivity over the years along with as yet unmentioned factors, like changes in project and product design, should result in improvements in labor productivity in construction in the future.

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CHAPTER 4

MANAGEMENT AND ORGANIZATION IN THE CONSTRUCTION INDUSTRY

This chapter concentrates on those issues which relate to the managerial and organizational aspects of the construction industry. The topics under consideration here include: (1) some structural features of the industry, (2) participants and their interactions in the construction of a project in a conventional manner, (3) contractual arrangements, and (4) management functions in a construction company and its projects.

4.1 Some Structural Features of the Industry

It is a well known fact that the construction industry is fragmented, being made up of a large number of generally small and specialized firms. A project may be initiated in one of three ways: owner-let contract, force account¹, and builders on speculation. Contract construction is the most frequently used approach, and according to the 1967 Census of Construction Industries (1967 Census), such construction accounted for over 90 percent of the industry's total business receipts that year (see Table 4.1). Within the

¹That is, construction work is performed, by an establishment primarily engaged in some other business, for its own account and use and by its own employees.

Table 4.1: Various operational statistics of the construction industry, for 1967 (source: 1967 Census of Construction Industries).

Industry Group and Industry	All Establishments				Establishments without Payroll			Establishments with Payroll			
	Number of Establishments	Number of Proprietors and Working Partners	All Employees (average)	Total Receipts (in thousands)	Number of Establishments	Number of Proprietors and Working Partners	Total Receipts (in thousands)	Number of Establishments	Number of Proprietors and Working Partners	All Employees (average)	Total Receipts (in thousands)
Construction Industries, Total	794,838	696,813	3,436,265	\$101,735,392	426,067	426,302	\$5,809,943	368,771	270,511	3,436,265	\$95,925,449
Contract Construction Industries, Total	762,297	683,465	3,341,452	94,939,184	412,164 ^a	419,869 ^a	4,959,806 ^a	350,133	263,596	3,341,452	89,979,378
General Building Contractors	156,400	128,667	871,705	35,457,912	61,351	62,005	2,007,153	95,049	66,662	871,705	33,450,759
Heavy Construction Contractors	42,839	31,415	884,357	24,648,649	8,844	9,418	179,391	33,995	21,997	884,357	24,469,258
Special Trade Contractors	563,028	523,383	1,585,390	34,830,297	341,939	348,446	2,770,936	221,089	174,937	1,585,390	32,059,361
Subdividers, Developers, and Operative Builders, Total	32,541	13,348	94,813	6,796,208	13,903 ^b	6,433 ^c	850,137	18,638	6,915	94,813	5,946,071

NOTE: Detailed figures may not add to totals because of rounding.

^aContains administrative records for 30 construction establishments not classified to industry detail.

^bData shown for the 13,903 establishments without payroll may include data for an unknown number of cemetery subdividers and developers.

^cThe relatively small number of proprietors and working partners in relation to number of establishments in this industry group is due to corporate establishments without payroll.

contract construction industry there are three broad categories of establishments: general building, heavy construction, and special trade contractors (see Table 4.1 for their relative sizes). Contracting firms generally fall within only one of these categories and usually are even more specialized in terms of doing work in only one branch of the industry, such as residential, nonresidential, heavy, or highway construction, or even in only part of a branch, such as single or multi-family housing. In fact, according to a special report in the 1967 Census, more than four out of five of the construction establishments with a payroll, accounting for more than three-fourths of the total receipts of all employer establishments in the industry, specialized at least 51 percent or more in a given type of construction work in 1967. It should be noted, however, that the larger firms generally tended to specialize less than did the smaller ones.

The construction industry is made up of a very large number of mostly rather small firms. In 1967, 44 percent of all construction establishments had total receipts of less than \$10,000, while less than 1 percent of all construction firms reported total receipts of \$2,500,000 or more, though these latter establishments did account for 38 percent of construction industry receipts that year (1967 Census). In 1972, Bechtel was reported as the contractor doing the

largest volume of business, but its total domestic contract awards of \$3,312,000,000 gave it only 3.6 percent of the U.S. contract construction market (28k) (see Table 4.2 and Figure 4.1 for more statistics and a comparison of construction with other industries). Another way to look at the size of construction firms is to consider the number of employees each has. In 1967, 54 percent of all construction establishments had no employees at all, but at the same time, they accounted for only 6 percent of the total receipts of all construction establishments (1967 Census). This is largely a result of the fact that workers in contract construction often go into business for themselves when opportunities are available and then return to the worker ranks when opportunities decline, or they may be both employed and work for themselves at the same time. Considering only the construction firms that have one or more employees, there was an average of only 9.3 employees per firm in 1967. Establishments with 10 or more employees represented only 18 percent of the total number of employer establishments in construction, but accounted for 75 percent of the total receipts (1967 Census) (for more statistics and comparisons with manufacturing see Table 4.3 and Figure 4.2). Thus, the construction industry is mainly composed of a large number of small firms, but the larger firms that do exist seem to perform a somewhat disproportionate share of the work.

Table 4.2: Various operational statistics of the construction industry, by total receipts size of establishments, for 1967 (source: 1967 Census of Construction Industries).

Industry Group and Industry	All Establishments				Establishments without Payroll				Establishments with Payroll			
	Number of Establishments	Number of Proprietors and Working Partners	All Employees (average)	Total Receipts in (thousands)	Number of Establishments	Number of Proprietors and Working Partners	Total Receipts in (thousands)	Number of Establishments	Number of Proprietors and Working Partners	All Employees (average)	Total Receipts in (thousands)	
Construction Industries, Total	794,838	696,813	3,436,265	\$101,735,392	426,067	426,302	\$5,809,943	368,771	270,511	3,436,265	\$95,925,449	
\$5,000,000 or more	2,035	237	701,029	() ^d	2	2	() ^d	2,033	235	701,029	26,825,796	
\$2,500,000 - \$4,999,999	3,293	532	315,320	38,263,333	11	18	55,046	3,282	514	315,320	11,382,491	
\$1,000,000 - \$2,499,999	10,809	1,929	511,279	16,556,135	117	52	168,321	10,692	1,877	511,279	16,387,814	
\$500,000 - \$999,999	17,456	4,488	420,661	12,411,518	473	192	318,211	16,983	4,296	420,661	12,093,307	
\$250,000 - \$499,999	30,129	12,296	405,897	10,821,538	1,529	1,007	529,345	28,600	11,289	405,897	10,292,193	
\$100,000 - \$249,999	70,746	47,441	472,281	11,270,344	7,407	6,358	1,121,200	63,339	41,083	472,281	10,149,144	
\$50,000 - \$99,999	80,429	68,019	276,004	5,688,418	11,939	11,400	823,529	68,490	56,619	276,004	4,864,889	
\$25,000 - \$49,999	97,602	91,280	188,236	3,447,434	24,061	24,853	819,811	73,541	66,427	188,236	2,627,623	
\$10,000 - \$24,999	130,592	125,999	108,731	2,115,712	67,218	69,077	1,014,986	63,374	56,922	108,731	1,100,726	
Less than \$10,000	351,747	344,592	36,827	1,160,961	313,310	313,343	959,494	38,437	31,249	36,827	201,467	
Contract Construction Industries Total	762,297	683,465	3,341,452	94,939,184	412,164 ^a	419,867 ^a	4,959,806 ^a	350,133	263,596	3,341,452	89,979,378	
\$5,000,000 or more	1,933	219	685,822	() ^d	1	2	() ^d	1,932	217	685,822	25,733,841	
\$2,500,000 - \$4,999,999	3,103	478	308,337	36,506,897	6	12	30,577	3,097	466	308,337	10,742,479	
\$1,000,000 - \$2,499,999	9,937	1,724	497,585	15,212,159	66	40	93,823	9,871	1,684	497,585	15,118,336	
\$500,000 - \$999,999	15,718	4,066	407,473	11,244,503	282	143	190,766	15,436	3,923	407,473	11,053,737	
\$250,000 - \$499,999	27,308	11,471	391,643	9,827,948	1,056	793	365,472	26,252	10,678	391,643	9,462,476	
\$100,000 - \$249,999	65,016	44,991	454,886	10,330,604	6,059	5,756	911,845	58,957	39,235	454,886	9,418,759	
\$50,000 - \$99,999	75,734	65,540	269,082	5,346,005	10,290	10,625	706,880	65,444	54,915	269,082	4,639,125	
\$25,000 - \$49,999	93,296	89,257	185,090	3,297,023	22,036	23,903	748,851	71,260	65,354	185,090	2,548,172	
\$10,000 - \$24,999	126,062	124,085	106,839	() ^d	64,425	67,717	970,447	61,637	56,368	106,839	() ^d	
Less than \$10,000	344,190	341,634	34,695	3,174,045	307,943	310,878	941,145	36,247	30,756	34,695	1,262,453	
Subdividers, Developers, And Operative Builders, Total	32,541	13,348	94,813	6,796,208	13,903 ^b	6,433 ^c	850,137	18,638	6,915	94,813	5,946,071	
\$5,000,000 or more	102	18	15,207	() ^d	1	0	() ^d	101	18	15,207	1,091,955	
\$2,500,000 - \$4,999,999	190	54	6,983	1,756,436	5	6	24,469	185	48	6,983	640,012	
\$1,000,000 - \$2,499,999	872	205	13,694	1,343,976	51	12	74,498	821	193	13,694	1,269,478	
\$500,000 - \$999,999	1,738	422	13,188	1,167,015	191	49	127,445	1,547	373	13,188	1,039,570	
\$250,000 - \$499,999	2,821	825	14,254	993,590	473	214	163,873	2,348	611	14,254	829,717	
\$100,000 - \$249,999	5,730	2,450	17,395	939,740	1,348	602	209,355	4,382	1,848	17,395	730,385	
\$50,000 - \$99,999	4,695	2,479	6,922	342,413	1,649	775	116,649	3,046	1,704	6,922	225,764	
\$25,000 - \$49,999	4,306	2,023	3,146	150,411	2,025	950	70,960	2,281	1,073	3,146	79,451	
\$10,000 - \$24,999	4,530	1,914	1,892	() ^d	2,793	1,360	44,539	1,737	554	1,892	() ^d	
Less than \$10,000	7,557	2,958	2,132	102,628	5,367	2,465	18,349	2,190	493	2,132	39,740	

NOTE: Detailed figures may not add to totals because of rounding.

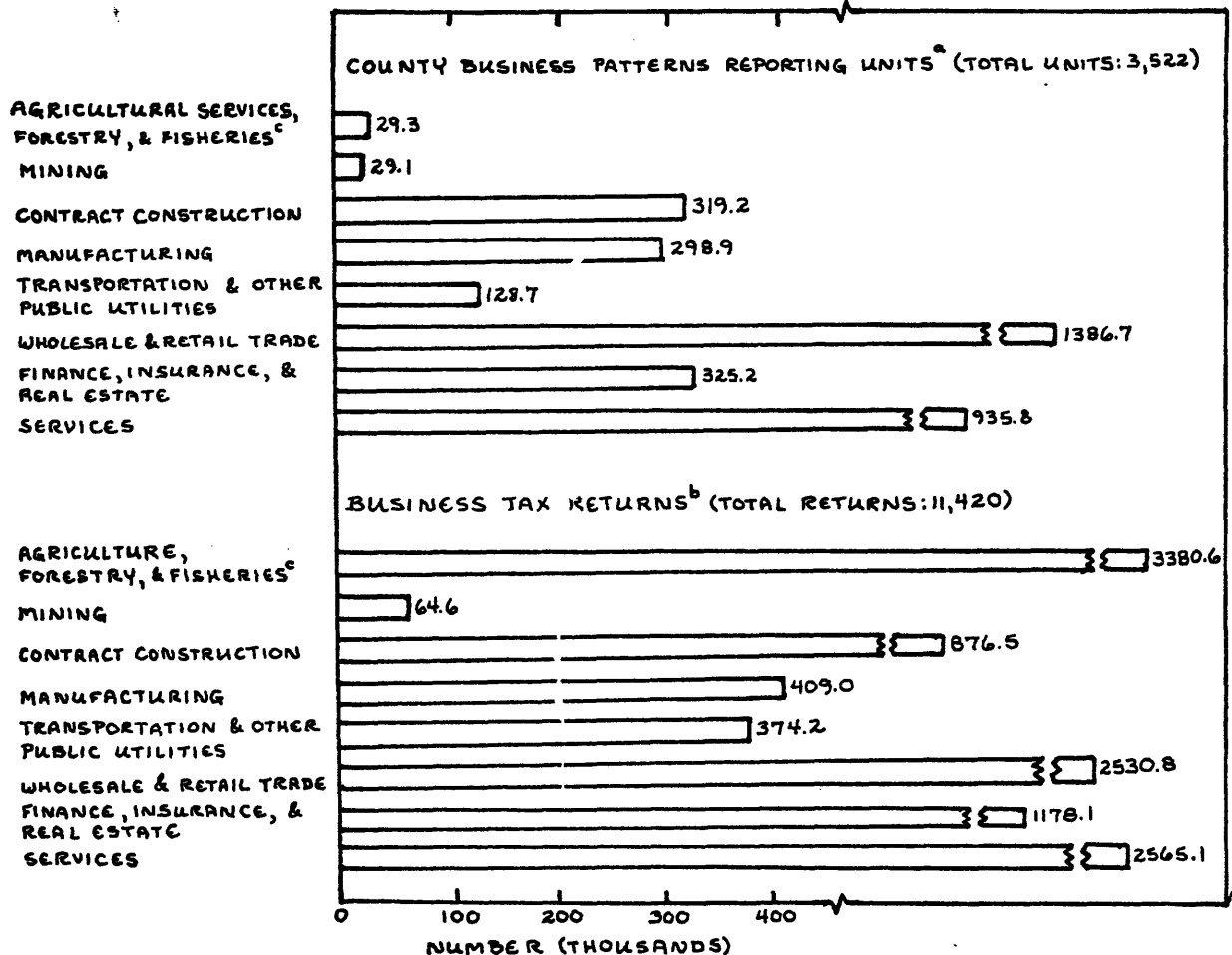
^aContains administrative records for 30 construction establishments not classified to industry detail.

^bData shown for the 13,903 establishments without payroll may include data for an unknown number of cemetery subdividers and developers.

^cThe relatively small number of proprietors and working partners in relation to number of establishments in this industry group is due to corporate establishments without payroll.

^dWithheld to avoid disclosing figures for individual companies; all such figures are included in the underscored figures on an adjoining line.

Figure 4.1a: Number of reporting units and number of returns for contract construction and various other industries, for 1965 (source: Ref. 62).



^a Number of reporting units indicates the number of establishments which have employees (not including self-employed persons) subject to the Social Security program.

^b Number of returns indicates the number of businesses, with and without employees, which file federal business tax returns. The difference between this and the number of reporting units in contract construction is primarily accounted for by the sole proprietorships without employees.

^c County business patterns, unlike business tax returns, include only the agricultural services part of the agriculture sector; agricultural production is excluded.

Figure 4.lb: Business receipts for contract construction and various other industries, for 1965 (in billions of dollars) (source: Ref. 62).

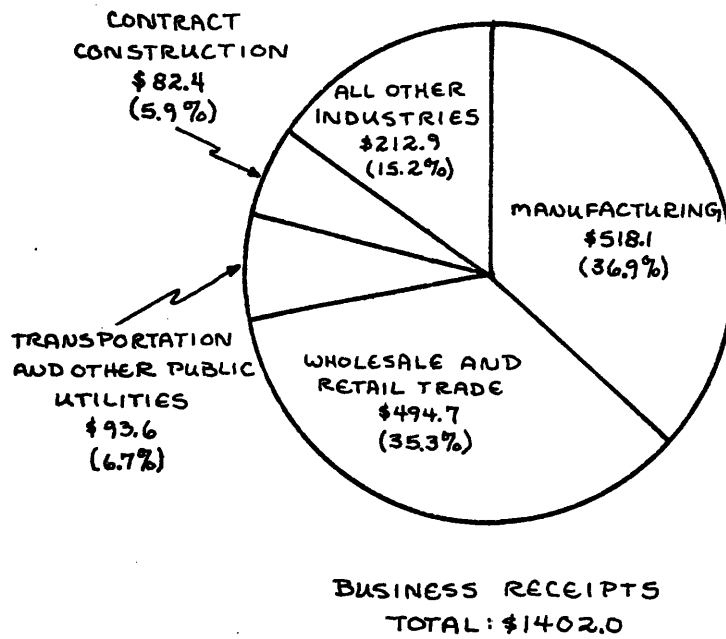


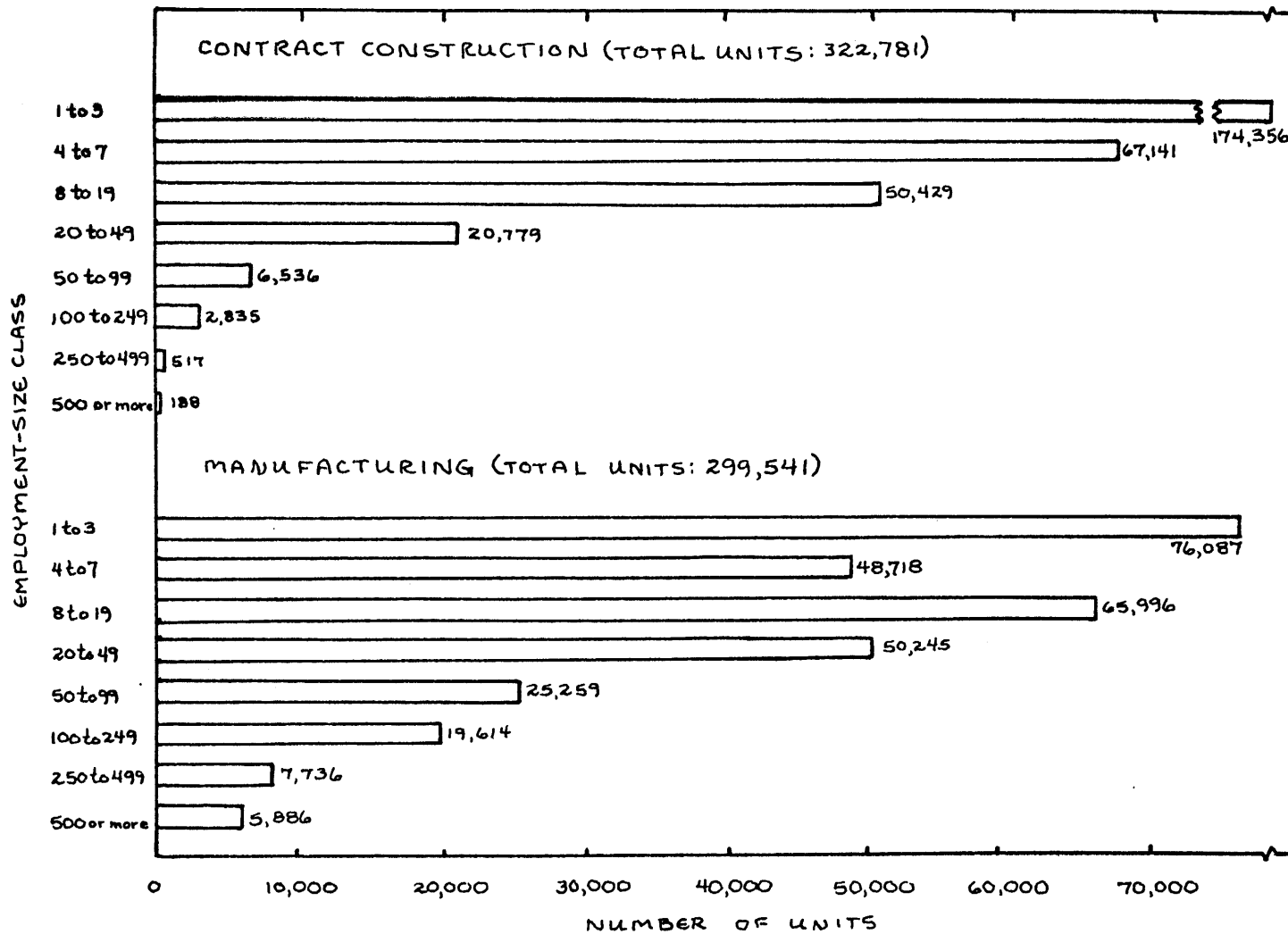
Table 4.3: Various operational statistics of the construction industry, by employment size of establishments with a payroll, for 1967. (source: 1967 Census of Construction Industries).

Selected Statistics	Establishments, Total	Establishments with an Average of:								
		1 - 4 Employees	5 - 9 Employees	10 - 19 Employees	20 - 49 Employees	50 - 99 Employees	100 - 249 Employees	250 - 499 Employees	500 - 999 Employees	1,000 or More Employees
Construction Industries, Total										
Total Number of Establishments	368,771	238,595	62,992	35,148	21,772	6,419	2,996	589	203	89
All Employees (average)	3,436,265	434,528	423,436	488,915	656,842	434,472	437,188	199,397	139,291	222,196
Total Receipts (in thousands)	95,925,449	13,871,912	9,767,696	11,870,946	17,545,454	12,536,740	13,150,806	6,136,163	4,234,670	6,811,062
Contract Construction Industries, Total										
Total Number of Establishments	350,133	224,401	60,434	34,002	21,188	6,323	2,923	577	201	84
All Employees (average)	3,341,452	412,403	406,957	472,516	639,780	428,499	430,798	195,508	<u>354,991</u>	() ^a
Total Receipts (in thousands)	89,979,378	11,651,512	8,752,653	10,989,616	16,687,326	12,190,985	12,878,478	5,997,231	<u>10,831,477</u>	() ^a
Subdividers, Developers, and Operative Builders										
Total Number of Establishments	18,638	14,194	2,558	1,146	584	96	43	12	2	3
All Employees (average)	94,813	22,125	16,479	16,399	17,062	5,973	6,390	3,889	<u>6,496</u>	() ^a
Total Receipts (in thousands)	5,946,071	2,220,400	1,015,043	881,330	858,128	345,755	272,328	138,832	<u>214,255</u>	() ^a

NOTE: Detailed figures may not add to totals because of rounding.

^aWithheld to avoid disclosing figures for individual companies; data for this item are included in the underscored figures in the adjoining column.

Figure 4.2: Number of reporting units for contract construction and manufacturing, by the number of employees the establishment had, in March 1966 (source: Ref. 62).



So far, firms directly connected with the construction phase of a project have been discussed, but there are many other steps to a project, including assessment of need, preliminary planning, design, and operation and maintenance among others. Each project requires the participation of many different people, such as architects, engineers, contractors, subcontractors, and suppliers from many different organizations. It is most common in the U.S. that these participants are independent of one another, and for each project a group of participants is brought together only to be disbanded once the project is completed. The outcome is the dispersion of the management function of a single project among these many independent participants, and this, along with the naturally occurring lack of continuous working relationships, results in the coordination, organization, and operation of projects being considerably less efficient than might be possible if these participants were more closely tied together in a vertically integrated firm. There is, however, an increasing tendency toward some vertical integration, such as architect-engineer design firms and design-construct firms, especially in the larger corporations (13, 25, 34, 44). This topic will be considered more fully in Section 4.2.

The structural characteristics of the construction industry discussed above, as well as many of its other features, have arisen largely in response to the demands

placed upon the industry. The specialization, in terms of different types of construction and different trades, is necessitated by many of the product characteristics, such as complexity, continuously changing technology, and custom-built nature, and by the great variety of product types. The fragmentation, in terms of the various steps and even parts of steps being executed by independent participants and organizations, gives firms much greater flexibility and makes regrouping of participants reasonably feasible. This, in turn, helps lessen the necessity for contraction and expansion of individual firms as they adjust to the frequent changes in the type and level of construction demand. Still other features, like a relatively low level of capital investment (see Table 4.4) and a floating labor force, enable firms to contract and expand to a limited extent if necessary. The fluctuating demand, along with the fact that constructed products are immobile, requires that a firm must be fairly small if it plans to exist on local business only, and this is still the most common situation, although larger national firms which are capable of the necessary mobility are increasing in number. Many of the features discussed above help explain the rather limited degree of mass production in the industry, with the fluctuating demand playing a particularly important role. The fact that economies of large

Table 4.4: Assets of corporate firms in contract construction and various other industries, for 1965 (source: Ref. 13).

Industry	Number of Firms	Total Assets (in millions)	Assets Per Firm
All Industries	1,427,606	\$1,736,349	\$1,316,000
Agriculture	27,582	6,765	245,000
Mining	13,326	19,560	1,468,000
Construction	113,403	26,794	236,000
Manufacturing	186,613	372,583	1,997,000
Transportation and Utilities	59,846	187,390	3,131,000
Trade	441,538	126,945	2,875,000
Finance, Insurance, and Real Estate	389,634	965,042	2,477,000
Services	188,284	33,727	179,000

scale² are not generally realized in the construction industry at present acts as a further deterrent. In fact, diseconomies of scale have been found to exist and have largely been attributed to the current structure of the industry (13, 15, 34, 48).

Yet another rather significant feature of the construction industry is its easy entry/easy exit nature. The rates of entry to and exit from the construction industry are generally much higher than those of other industries, and though the entry rate has declined considerably over the years in construction as well as in other industries, the exit rate has remained relatively stable (see Tables 4.5 and 4.6). The many features of the industry that were discussed above, along with the relatively high growth rate of the industry, the high rate of exit of firms from the industry, and the fact that established firms have little in the way of an absolute cost or product differentiation advantage over potential entrant firms, make entry to the industry quite feasible and easy. Moreover, many of the features of the industry discussed above similarly facilitate exit. It is a rather frequent practice in construction for workers to go into business for themselves when demand is high and then

²Some economies of scale have been found to exist in house construction up to the range of 500 to 800 units per year but not over that (13, 38).

Table 4.5: Rates of entry of firms in contract construction and various other industries (source: Ref. 13).

Industry	1946	1951	1957	1962
All Industries	190.0	80.4	97.6	90.6
Construction	478.0	143.0	122.0	127.0
Manufacturing	238.0	87.0	75.1	79.0
Services	190.0	72.7	87.6	99.2
Retail Trade	152.0	67.5	86.2	83.1
Wholesale Trade	216.5	77.1	75.8	76.5
All Other	127.4	88.7	88.5	87.4

NOTE: Entry Rate = Number of new firms per 1,000 firms in operation.

Table 4.6: Rates of discontinuance of firms in contract construction and various other industries (source: Ref. 13).

Industry	1946	1951	1957	1962
All Industries	64.3	68.0	82.2	81.5
Construction	130.5	116.4	122.4	133.2
Manufacturing	92.0	70.5	87.3	91.5
Services	71.5	63.6	65.4	73.0
Retail Trade	49.9	62.0	71.1	78.1
Wholesale Trade	54.6	50.3	56.1	61.1
All Other	75.5	67.0	67.9	71.6

NOTE: Discontinuance Rate = Number of firms leaving the industry per 1,000 firms in operation.

return to the worker ranks when demand drops, and naturally this results in a high turnover rate. Furthermore, certain organizational practices, such as forming a firm to carry out a single project, and the fact that construction firms are rarely bought or sold as a unit tend to push up the turnover rate. The high rate of turnover of construction firms suggests that competition in the industry is fairly keen which is not altogether bad, but it has the disadvantage of making coordination and organization of firms within the industry difficult (11, 13, 34).

Another contributor to the high rate of discontinuance of firms in the construction industry is the industry's high rate of business failure (see Table 4.7). In 1969, over 17 percent of all business failures were contractor failures, accounting for 15 percent of the liabilities of all failing businesses (27). Though the number of failures in construction, as in all industries as a whole, has been declining significantly since 1960 or so and the size of the liabilities has been declining since the mid-sixties³, it is still a serious problem for the industry. A Dun and Bradstreet study (27) came up with a list of what seem to be

³The proportion of larger firms that fail is increasing (see Figure 4.3), so the liabilities are not decreasing nearly as much as is the number of failures.

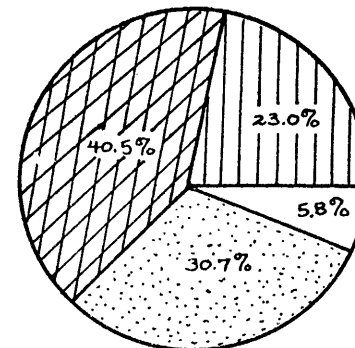
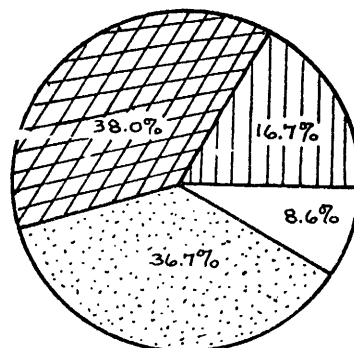
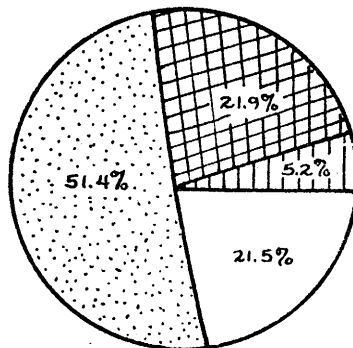
Table 4.7: Number and size of contractor failures (source: various issues of Engineering News - Record (for 1970 to 1972 data) and Ref. 27 (for 1950 to 1969 data)).

Year	U.S. Total		Type of Contractor					
			General Building Contractor		Building Subcontractors		Other Contractors	
	Number (thousands)	Liabilities in thousands	Number (thousands)	Liabilities in thousands	Number (thousands)	Liabilities in thousands	Number (thousands)	Liabilities in thousands
1972	1375	\$193,530	513	\$ 91,914	777	\$85,900	85	\$15,716
1971	1545	222,357	533	123,079	897	81,441	115	17,837
1970	1687	231,533	659	122,713	905	82,818	123	26,002
1969	1590	171,717	626	95,125	860	58,910	104	17,682
1968	1670	212,459	656	135,341	903	58,207	111	18,911
1967	2261	323,700	867	238,900	1243	71,400	151	13,400
1966	2510	326,376	1049	229,737	1326	80,351	135	16,288
1965	2513	290,980	1030	196,633	1329	78,049	154	16,298
1964	2388	262,392	970	171,645	1275	74,762	143	15,985
1960	2607	201,369	1020	110,656	1419	74,177	168	16,536
1950	912	25,651	282	9,235	588	14,407	42	2,009

Figure 4.3: Percentage distribution of the number of contractor failures, by the size of liabilities (source: Ref. 5g).

LIABILITY-SIZE CLASS

- UNDER \$5,000
- ▤ \$5,000 - \$24,999
- ▧ \$25,000 - \$99,999
- ▨ OVER \$100,000



YEAR: 1950
 NUMBER OF FAILURES: 912
 LIABILITIES (\$THOUSANDS): \$25,651

1960
 2,607
 \$201,369

1966
 2,510
 \$326,376

the major underlying causes of business failures in construction and other industries (see Table 4.8). The study shows that, in 1969 in 82.9 percent of the cases, management, due to lack of managerial experience, unbalanced experience, or incompetence, was the underlying cause of the failure. These findings are not surprising since managers in the construction industry, especially in the smaller firms, are often just men who have risen from the ranks of workers. While this may be helpful in the management of the construction projects themselves, these men have generally had little or no training or experience in the operation and management of a business. However, with the trend toward larger firms and the emphasis on the importance of management, there does seem to be a trend toward more professional management, as is necessary, in the industry today. In addition, Shuler (5g) and others have come up with some suggestions for how to begin to reduce contractor failures, and some of these are briefly as follows: (1) a company should allocate funds each year for management training, evaluation of company policies, costs, and procedures, and company improvement studies; (2) efforts must be made to develop a shared understanding and respect among the various participants in construction projects so as to more effectively coordinate the work; and (3) aggressive management should be used at all levels of work (5g, 27, 66).

Table 4.8: Causes behind 1,590 contractor failures in 1969 (source: Ref. 27).

Con- struction	Total All Industries	Under- lying Causes	Apparent Causes	Con- struction ^a	Total All In- dustries ^a	
3.2%	2.8%	Neglect	Due to	Bad Habits	1.5%	0.8%
				Poor Health	1.3	1.3
				Marital Problems	0.1	0.2
				Other	0.3	0.5
0.9	1.2	Fraud	On the Part of the Prin- cipals, As Reflected by	Misleading Name	0.1	0.0
				False Financial Statement	0.1	0.2
				Premeditated Over- buy	--	0.1
				Irregular Dispos- al of Assets	0.6	0.6
				Other	0.1	0.3
5.8	8.7	Lack of Experience Lack of Managerial Experience Unbalanced Experience Incompe- tence	As Evi- denced by	Inadequate Sales	30.8	39.0
	Heavy Operating Expenses			14.1	11.2	
15.0	13.7			Receivables Dif- ficulties	17.9	9.3
				Inventory Problems	0.6	4.2
21.2	19.5			Excessive Fixed Assets	3.5	3.6
46.7	45.6			Poor Location	0.2	2.6
				Comparative Weakness	25.3	21.2
		Other	1.8	1.4		

(continued)

(Table 4.8 continued)

Con- struction	Total All Industries	Under- lying Causes	Apparent Causes	Con- struction ^a	Total All In- dustries ^a
0.3	1.4	Disaster	Such As { Fire Flood Burglary Employee Fraud Strike Other	0.1 --- --- --- 0.1 0.1	0.5 0.1 0.3 0.1 0.1 0.3
6.9	7.1	Reason Unknown	% of All Industry Failures	17.4%	100.0%
100.0%	100.0%	Total			

^aBecause some failures are attributed to a combination of apparent causes, the totals of these columns exceed the totals of the corresponding columns on the left.

Due to many of the industry features discussed above, including specialization, fragmentation, small size, local market orientation, and rapid turnover among others, as well as the intense competition among firms, industry-wide cooperation and organization has been exceptionally slow and difficult. As discussed in Chapter 3, many of the contractors do belong to contractor associations⁴ which do perform a number of valuable services for their members, but these associations are not nearly as effective as they might be (as, for example, the unions are) largely as a result of the industry structure. Recently, there has been a fair amount of emphasis placed on the unity of the contractors and its importance, and new types of organizations⁵ have been springing up in order to try to bring individual contractors, contractor associations, and industry clients together in an effort to unify the industry's management, first in the area of collective bargaining and later in other areas. New management techniques and process effic-

⁴Some such associations are the Associated General Contractors of America (AGC), the National Constructors Association, and the Mechanical Contractors Association, and some of their services are helping in labor negotiations, monitoring local and federal legislation, holding conferences, and acting as a clearinghouse for construction information.

⁵Some of these new organizations are the Contractors Mutual Association (CMA), Regional Congress of Construction Employers, Builders Association of Eastern Ohio and Western Pennsylvania, and Council of Construction Employers.

iciencies have in the past been introduced only very slowly, but perhaps organizations along these lines could help to speed up their introduction and acceptance. Moreover, participants in the industry have been rather slow to adopt new technologies and perform research and development, and it seems this, too, might be somewhat improved through increased industry-wide cooperation and organization (14, 28g, h, i, s, 48, 64).

There are three major legal forms of organization for construction firms: the sole proprietorship, the partnership, and the corporation⁶. Other less common legal forms of organization, such as the limited partnership and subpartnership, may also be used, and on very large and complex

⁶The sole proprietorship is the simplest and most common form, whereby one person is the sole owner of the business and all assets, liabilities, profits, and losses belong to him. The partnership is often developed as the business of the firm grows and the proprietor needs partners in order to spread out the work and responsibility and to obtain new resources. Under this form of organization, all assets, liabilities, profits, and losses are divided among the partners as agreed, the actions of one partner are binding on all of them, all are liable for losses that may occur, and their total individual assets are pledged to the firm. The corporation tends to be developed as building operations grow, the risk of loss of personal assets because of personal liability increases, and the need for capital grows. This organizational form has the advantages of limited liability and continued existence unaffected by the death or withdrawal of principals but the disadvantages of corporate taxes and its activities having to conform to the conditions of its charter.

projects, several construction firms may pool their resources in a joint venture which will be dissolved once the project is completed and the proceeds have been properly distributed. According to the 1967 Census, 76 percent of all construction establishments were sole proprietorships accounting for only 19 percent of the total receipts of all establishments, 6 percent were partnerships accounting for 7 percent of the total receipts, and 15 percent were corporations accounting for 70 percent of the total receipts that year⁷ (see Table 4.9 for more detailed statistics, trends over time, and comparisons with other industries). As the figures indicate, the corporate form of organization has played an increasingly important role in the construction industry in recent years, while that of proprietorships has declined somewhat and that of partnerships even more so. Moreover, conglomerates have recently begun to become more common in the industry. For example, in the area of residential construction, several large nonbuilding corporations⁸ have acquired established building, design, real

⁷ Establishments with other legal forms of organization and those which could not be classified accounted for the balance.

⁸ For example, General Electric, International Telephone and Telegraph, and U.S. Steel are involved in building and selling houses while Chrysler and Gulf Oil are involved in real estate investment and land development (40).

Table 4.9a: Various operational statistics of the construction industry, by legal form of organization, for 1967 (source: 1967 Census of Construction Industries).

Industry Group and Industry and Legal Form of Organization	All Establishments				Establishments without Payroll			Establishments with Payroll			
	Number of Establishments	Number of Proprietors and Working Partners	All Employees (average)	Total Receipts (thousands)	Number of Establishments	Number of Proprietors and Working Partners	Total Receipts (thousands)	Number of Establishments	Number of Proprietors and Working Partners	All Employees (average)	Total Receipts (thousands)
Construction Industries, Total	794,838	696,813	3,436,265	\$101,735,392	426,067	426,302	\$5,809,943	368,771	270,511	3,436,265	\$95,925,449
Corporate Establishments	120,433	0	2,344,139	71,189,608	14,645	0	1,211,514	105,788	0	2,344,139	69,978,094
Noncorporate Establishments, Total	674,405	696,813	1,092,126	30,545,784	411,422	426,302	4,598,429	262,983	270,511	1,092,126	25,947,355
Individual Proprietorships	602,701	602,701	749,125	19,383,672	396,542	396,542	3,964,295	206,159	206,159	749,125	15,419,377
Partnerships	47,057	94,112	220,159	6,683,620	14,880	29,760	634,134	32,177	64,352	220,159	6,049,486
Contract Construction Industries, Total	762,297	683,465	3,341,452	94,939,184	412,164 ^a	419,869 ^a	4,959,806 ^a	350,133	263,596	3,341,452	89,979,378
Corporate Establishments	101,147	0	2,272,990	66,041,922	5,057	0	569,284	96,090	0	2,272,990	65,472,638
Noncorporate Establishments, Total	661,150	683,465	1,068,462	28,897,262	407,107	419,869	4,390,522	254,043	263,596	1,068,462	24,506,740
Individual Proprietorships	595,966	595,966	734,750	18,724,420	394,345	394,345	3,913,890	201,621	201,621	734,750	14,810,530
Partnerships	43,750	87,499	215,143	6,078,972	12,762	25,524	476,632	30,988	61,975	215,143	5,602,340
Subdividers, Developers, and Operative Builders, Total	32,541	13,348	94,813	6,796,208	13,903 ^b	6,433	850,137	18,638	6,915	94,813	5,946,071
Corporate Establishments	19,287	0	71,149	5,147,686	9,588	0	642,230	9,699	0	71,149	4,505,456
Noncorporate Establishments, Total	13,254	13,348	23,664	1,648,522	4,315	6,433	207,907	8,939	6,915	23,664	1,440,615
Individual Proprietorships	6,734	6,734	14,376	659,255	2,197	2,197	50,405	4,537	4,537	14,376	608,850
Partnerships	3,307	6,614	5,016	604,646	2,118	4,236	157,502	1,189	2,378	5,016	447,144

NOTE: Detailed figures may not add to totals because of rounding. The difference between the sum of individual proprietorship and partnership forms of organization and the total for noncorporate is represented by other noncorporate forms and by establishments for which the information available did not permit classification by legal form of organization. This residual category is not shown in the table above.

^aMay also include data for construction establishments not classified to 2-digit industry detail.

^bData shown for the establishments without payroll may include data for an unknown number of cemetery subdividers and developers.

Table 4.9b: Number of businesses engaged in contract construction, by legal form of organization (in thousands)
(source: Ref. 13).

Year	Total Number	Partnerships	Sole Proprietorships	Corporations
1947	395.3	52.6	322.4	20.3
1948	na	na	na	24.8
1949	na	na	290.6	25.7
1950	na	na	na	27.7
1951	na	na	342.3	29.6
1952	na	na	na	31.8
1953	495.6	67.0	393.7	34.9
1954	na	na	na	36.1
1955	na	na	524.9	41.6
1956	674.2	64.8	561.2	48.3
1957	717.9	65.9	598.4	53.6
1958	725.7	60.9	604.9	59.6
1959	779.7	67.1	646.3	66.3
1960	789.8	62.4	655.1	72.3
1961	824.6	62.3	678.5	83.8
1962	835.9	58.1	687.2	90.6
1963	848.5	60.4	691.6	96.5
1964	856.8	57.3	695.3	104.1
1965	876.5	58.5	704.6	113.4

Table 4.9c: Percent distribution of contract construction output and number of firms, by legal form of organization (source: Ref. 13).

Year	Proprietorships		Partnerships		Corporations	
	Number of Firms	Output	Number of Firms	Output	Number of Firms	Output
1945	85.8%	39.2%	9.6%	22.5%	4.6%	38.3%
1947	81.6	35.8	13.3	21.5	5.1	42.7
1953	79.4	32.0	13.5	20.7	7.1	47.3
1958	83.4	27.7	8.4	15.0	8.2	57.3
1962	82.2	24.8	7.0	10.8	10.8	64.4
1965	80.4	23.5	6.7	8.5	12.9	68.0

Table 4.9d: Number of corporate firms as a percent of all firms in contract construction and various other industries (source: Ref. 13).

Year	All In- dustries	Con- struction	Manu- facturing	Trade	Finance	Services
1956	na	7.2%	37.3%	11.5%	33.1%	4.1%
1957	8.8%	7.5	38.4	12.2	31.7	4.4
1958	9.2	8.2	39.5	12.4	32.7	4.7
1959	9.6	8.5	40.0	12.6	33.5	4.9
1960	10.2	9.2	40.9	13.7	32.8	5.4
1961	10.5	10.2	42.1	14.1	33.7	5.8
1962	11.1	10.8	45.0	15.3	33.9	6.1
1963	11.6	11.4	44.5	16.1	33.6	6.5
1964	12.0	12.1	45.0	16.6	32.7	6.8
1965	12.5	12.9	45.6	17.4	33.0	7.3

estate, and/or development firms as subsidiaries. These trends toward the corporate form of organization and formation of conglomerates indicate some potential changes in the industry characteristics discussed above. For example, it is not unreasonable to expect the size of the firm's market area, vertical and horizontal integration, and mass production to increase along with the size of the production unit (13, 14, 25, 39, 40, 43, 46, 48, 51, 62, 71).

These, then, are some of the major characteristics of the construction industry. Many of them are not characteristics one would normally associate with a large and important industry, but, as was discussed, most of them have arisen largely in response to the demands placed upon the industry. Moreover, there may be some trend away from some of them with the increasing importance of corporations and conglomerates in the industry today.

4.2 Participants and Their Interactions in the Construction of a Project in a Conventional Manner

The construction of a facility, be it large or small, is generally a complex process involving a variety of steps and participants as shown in Figure 4.4. The participants, each generally from an independent organization and selected on the basis of price and/or qualifications, are gathered together on a project-by-project basis with little or no

Figure 4.4: The major participants and steps in the construction of a facility, along with the major functions and arrival times of the participants, which characterize most of today's construction.

LIFE-CYCLE PHASE PARTICIPANT	CONCEPTION	ANALYSIS AND PLANNING	DESIGN	CONSTRUCTION	OPERATION AND MAINTENANCE
OWNER	INPUTS: market/needs analyses, feasibility/economic analyses, site evaluation & selection, etc. OUTPUTS: needs statement		monitoring, reviewing, approving		start-up planning & implementation
INVESTOR	studies, schedules, plans, funds		funding		
ARCHITECT, ENGINEER	+	+	INPUTS: arch. & eng. analyses, alternatives, etc. OUTPUTS: plans, specifications, contracts	monitoring, reviewing, approving changes	resolution of operating problems, modernization/upgrading
GENERAL CONTRACTOR, SUBCONTRACTOR, SUPPLIER	+	+	+	INPUTS: site mgt., resources, etc. OUTPUTS: physical facility	alterations, major repairs, deficiency correction
OPERATOR/USER	+	+	+	+	INPUTS: ops. mgt., maintenance & repair OUTPUTS: operating facility

† - Indicates participant has not yet entered the process.

provision for ensuring organizational compatibility and leaving little room for continuity of working relationships. Furthermore, each participant is generally brought into the project only when he is absolutely needed. This serves to curtail feedback from participants and consideration of new alternatives in the later stages of the project and to constrain participants to work within the bounds of decisions in which they had no part. Recently however, there has been an increasing use of architect-engineer and design-construct firms which integrate several of the steps and participants and of the building team concept with a construction manager in the picture from the beginning of the project. It is the purpose of this section to look at the roles and responsibilities of the major participants in conventional construction and how these are changing and at the new participant combinations and concepts which are emerging.

The owner or client, who may be an individual, a corporation, a school board, a development consortium, or any number of other private or public organizations, initiates the project and puts up the money. The owner may have his own staff or have to hire consultants to aid in the initial stages of establishing the need for a new facility, defining his requirements and budgetary constraints, evaluating and selecting the site, and so forth. This process necessarily becomes more complicated when the owner is not an individual

which means he is likely spending the money of others to whom he must report and be responsive, when he is not the user which makes evaluation of user needs more difficult, or when he is not the operator which may result in the costs of operation and maintenance receiving insufficient consideration. Larger clients, clients who build a lot, and many public agencies have an in-house design team or a long-term arrangement with a group of designers, but most others must find an architect and/or engineer to develop a solution to the owner's requirements once they have been established. The owner's responsibilities during the construction phase are numerous and varied, though he frequently delegates many of these, especially those dealing with every-day construction operations, to the architect and/or engineer. He also naturally has certain rights, but one right he does not have and must not try to exercise is that of intruding on the direction and control of the construction work for he may then relieve the contractor of some of his legal and contractual responsibilities. Once construction is complete, the facility is turned over to the owner who proceeds to operate it or turns it over to the operator so it can begin to be used (14, 22, 25, 26, 31, 37, 56, 70).

The architect plays a rather major role in the development of larger buildings, such as commercial, institutional, apartment, and public buildings, while single family housing

and industrial buildings are often built without architectural assistance. The traditional role of the architect is to act as the owner's agent in the design and construction of a facility, but the exact scope of his services varies widely among projects and owners. Some of his major activities include: (1) suggesting ways and means to meet the owner's desires and requirements, (2) developing the design, (3) producing the construction contract documents (i.e., drawings and specifications) and his estimate of construction cost, (4) aiding the owner in the selection of a contractor, and (5) administering the construction contract⁹. To do this, he often needs the assistance of other specialists, in particular that of variously specialized engineers. Again as is true for the owner, the architect must not unreasonably interfere with the conduct of the construction work or dictate the contractor's procedures. A controversy, which has yet to be completely resolved, recently arose over whether the selection of architects and other professionals should be on the basis of qualifications alone (as it had been in the past) or on the basis of price as well as qual-

⁹Administering the contract may include, for example, checking shop drawings and samples, interpreting drawings and specifications, reviewing change orders, approving certificates for payments to the contractor, and making periodic visits to the site to make certain the work is proceeding in accordance with the construction contract documents.

ifications (as had recently begun to occur) (this will be discussed further in Section 4.3). Because architects have been held liable in an increasing number and variety of situations (especially third-party suits), professional liability insurance has become increasingly costly, and this has resulted in some abdication of some of their traditional responsibilities and in some efforts to increase the contractor's responsibility. On the other hand, some architects are offering "expanded services" which might include anything from real estate acquisition to construction management. This latter trend is largely in response to the highly competitive position in which the profession finds itself. For example, the increased appearance of design-construct firms is seen by some as a threat to the architect's position, for in these firms he sees himself as only an employee (2, 9, 12, 14, 25, 28j, r, 36, 37, 56).

Industrial building and heavy and highway construction are predominantly the domain of another professional, the engineer. His services are also required for other types of building, especially in terms of the structural, electrical, and mechanical aspects. In this latter situation, the appropriately specialized engineers act as consultants, being generally hired by the architect rather than the owner, working under the auspices of the architect, and being legally responsible to the architect for their part of the project

(the architect, in turn, is legally responsible to the owner for both architectural and engineering aspects of the project). In the former types of projects where the engineer is in charge, he essentially assumes a position, role, and responsibilities similar to those of an architect as discussed above, and the architect, if needed, takes the position of the consultant. In recent years, it has become increasingly common for architects and engineers to join together in a single design firm, thus enabling them to work together on any project from the beginning (see Table 4.10) (for further discussion see any of the references on the architect).

The primary role of the contractor is that of a resources manager, where the resources include men, materials, equipment, money, and time. O'Brien and Zilly (56) point out that a construction contractor combines the elements of three distinct business types: (1) an agent who sells products he does not own, (2) a manufacturer who buys separate items and combines them into a complete product for sale, and (3) a dealer who buys products in large lots and sells them in smaller ones. The extent of a contractor's participation in one type of business or another determines the nature of his organization. For example, the general contractor, particularly a building contractor, predominantly acts like an agent, the specialty contractor like a manu-

Table 4.10: The number and billings of architect-engineer and engineer-architect firms in the top 500 construction design firms^a in the U.S. (source: various issues of the Engineering News - Record in its annual article "The ENR 500").

Year	Number of Firms	Billings (in billions)
1972	197	\$1.3
1971	198	1.2
1970	218	1.1
1969	215	0.93
1968	210	0.77
1967	205	0.65
1966	192	0.56
1965	190	0.50

NOTE: Though the number of firms has been fluctuating somewhat, their billings have steadily increased.

^aFirms are ranked on the basis of company-reported billings for professional services related to construction.

facturer, and the developer¹⁰ like a dealer.

The general contractor is a person or organization who must be skilled in the methods and techniques of construction and in the management of construction operations. He is hired, often on the basis of competitive bidding, by the owner with the designer's aid generally only once the design is completed, and he often subcontracts most or even all of the work. He is usually paid on the basis of work completed and of this a certain percentage is generally retained by the owner, which frequently makes financing necessary. In his supervision and direction of the construction process, the general contractor must: (1) provide and direct his own forces to do his portion of the actual construction; (2) supervise and be responsible for the work of the sub-contractors; (3) coordinate all parts of the operation; (4) see that work is carried out in accordance with the plans

¹⁰The developer, who may be an individual, partnership, or institution, may play any one or even all of the participant roles in the production of buildings. That is: (1) he may simply buy a tract of land, improve it, and sell the lots; or (2) he may buy the land, improve it, and go through the entire building process of some facility; or (3) he may do anything in between. Furthermore, the scale of his operations may range from small parcels of land to entire industrial parks and new towns (25, 28n, 31).

and specifications¹¹; (5) have the job completed on time; and (6) all the while conform to the laws and ordinances concerning, for example, job safety, licensing, employment of labor, and codes. To do this, the general contractor or a representative must usually be on the jobsite at all times during working hours. In the traditional construction process, the design and construction are separate, with the consequence that new and potentially cost-reducing construction techniques, materials, and equipment are introduced only slowly either (1) because the designer is reluctant to use new technologies for fear the contractor will not want to use them or be familiar with them and thus will not bid or will bid high or (2) because the designer himself is not familiar with the new technologies. There traditionally has been a fair amount of animosity and nearly complete lack of communication between the designer and contractor largely as a result of this separation. It is, however, becoming more common for the contractor to be brought into the picture before the design is completed as designers and owners begin to realize what he can contribute, though some designers

¹¹The contractor is not directly responsible for the adequacy of the plans and specifications, but he may incur a contingent liability for proceeding with faulty work where the defects should be obvious to one in his position.

fear that this broadening of the contractor's role is somewhat at the expense of their own (13, 14, 25, 37, 56).

It is because of the many specialties involved in construction, calling for special crafts and competence, that the practice of subcontracting has developed. Thus, the general contractor, whose operations are usually not extensive enough to permit full-time employment of skilled journeymen in every trade, can keep only a limited nucleus of full-time employees, and the subcontractor or specialty contractor, who can provide full-time employment for journeymen of the appropriate specialty, can retain highly skilled craftsmen and provide the general contractor with their services as needed. With the increasing complexity of constructed products, it seems likely that the practice of subcontracting will expand rather than decline, though some contracts, in particular some public ones, limit the amount of work that a general contractor may subcontract. It is felt by many that subcontracting an excessive amount of the project is detrimental to job efficiency, though the extent to which this is true depends upon the experience and administrative ability of the general contractor. The subcontractor generally operates under a contract with the prime

or general contractor¹², whereby the subcontractor agrees to perform a certain specialized part of the work at the site, is legally responsible for that to the general contractor (who, in turn, is legally responsible for the entire project, subcontracted or not, to the owner), and is paid by the general contractor. Though there is little direct contact between an owner and subcontractor, the construction contract may stipulate that subcontractors must be approved by the owner or designer, a practice which may be a good idea but which also raises the legal question of whether this might not put the designer (or even owner) in the position of sharing responsibility for that portion of the work with the general contractor (14, 25, 37, 56).

Yet another category of participants in the construction process as it is traditionally executed are the materials and equipment suppliers. These suppliers, more often than not, are not the manufacturers of the goods, but rather purchase them directly from the manufacturers or wholesalers and serve as local distributors. The main justification for the supplier's role lies in the discrepancy between the continuous production processes of modern manufacturing (e.g.,

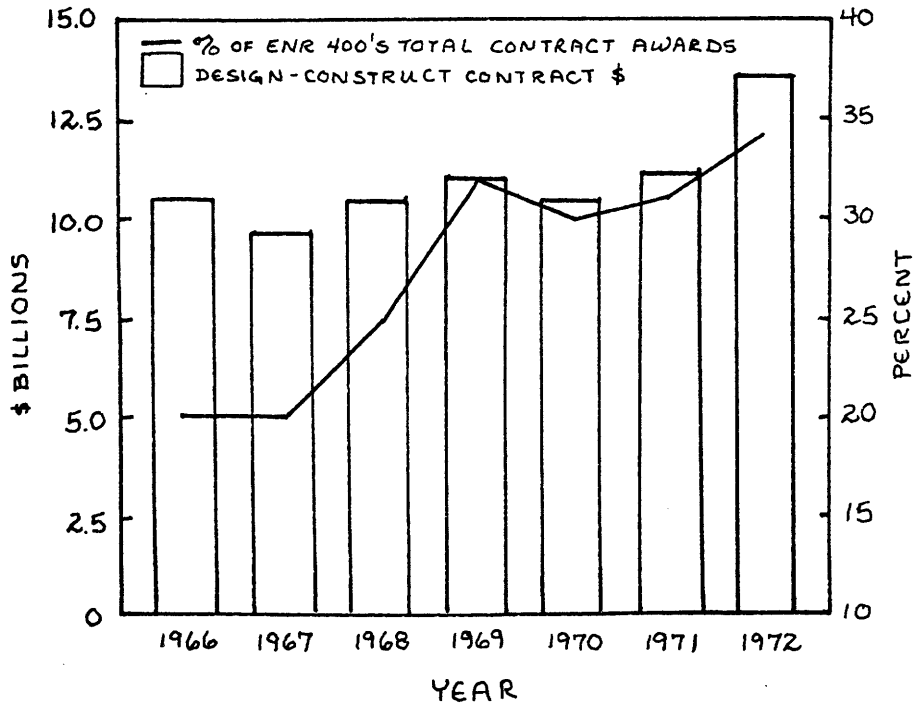
¹²Alternatively, though less frequently, the subcontractor may contract directly with the owner under either the separate or several contracts system, both of which will be discussed in Section 4.3.

the building materials industry) and the discontinuous nature of construction and its requirements (e.g., for materials). Moreover, the supplier provides the small builder with useful technical and commercial information and often assists the contractor or subcontractor financially by extending short-term credit to him. Because he does not always adjust his stock to changes as readily as he might, the supplier often receives some blame for slowing the introduction of technological innovations (17, 18, 25, 70).

The degree of vertical integration may go beyond the architect-engineer design firms to the design-construct firms which may limit their operations to design and construction or may also include site selection and shakedown operation (see Figure 4.5 for some statistics). Such firms are most commonly involved in private industrial projects where the building is often just a shell to enclose the manufacturing processes, though design-construct firms may also be involved in other types of facilities¹³, such as commercial, school, apartment, and institutional buildings. Along similar lines is the turnkey construction contract which is being increasingly used for various types of projects by

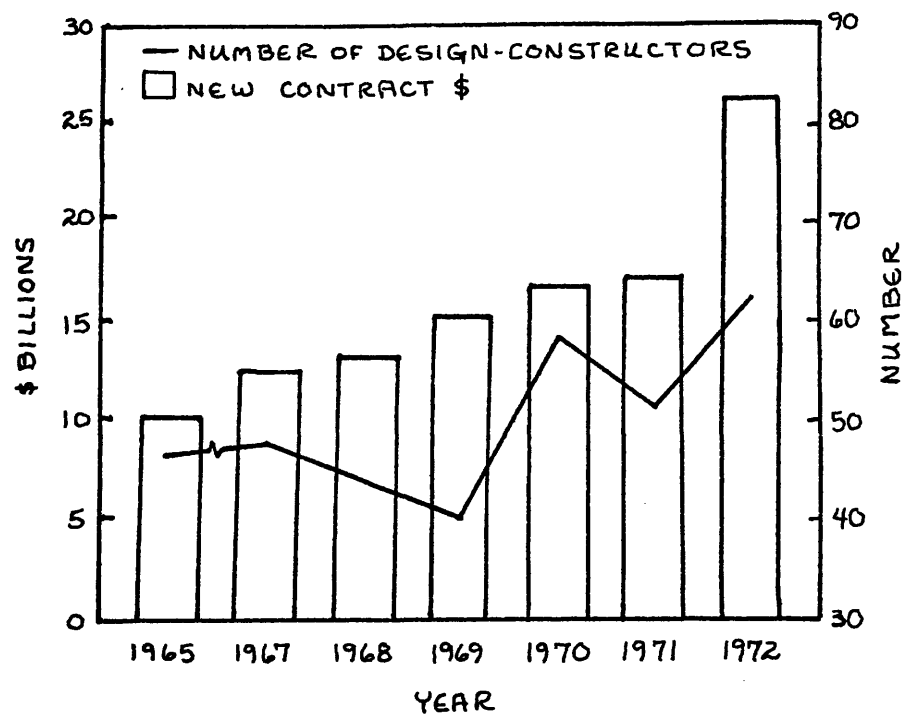
¹³When the firm is associated with residential work, it is generally as a developer who handles all phases of the project.

Figure 4.5a: New design and construct contracts included in the ENR 400's^a contract volume (source: various issues of the Engineering News-Record in its annual article "The ENR 400").



^aTop 400 contractors on the basis of their contract awards with design-construct contracts being included at the erected value of the facility.

Figure 4.5b: New contracts awarded to design-constructors among the ENR 500^a (source: various issues of the Engineering News-Record in its annual article "The ENR 500").



^aTop 500 design firms on the basis of their billings and design-construct firms on the basis of design-construct and design-only contracts valued at the estimated erected cost of the project.

both public and private clients and by which a single entity (e.g., a single party or an association of firms) is held responsible for the design and construction (and sometimes start-up operation) of a specified facility. The major advantages of such design-construct operations are that close cooperation of all segments of the design-production team is possible from the very inception of the project, and construction and ordering of materials can begin before design is complete (i.e., fast track construction). Vertically integrated firms have the additional advantage that their people are used to working together and are in close contact under one roof. Arguments against such design-construct operations are that the architect and/or engineer is then just a member of the organization instead of the owner's agent and is often subordinate to the contractor or manufacturer, and there is some problem with competitive bidding¹⁴. Yet another argument against the vertically integrated firm is that the owner has no flexibility in putting together a design-production team. Opponents of vertical integration point out that there is no reason why the owner cannot bring the designer and con-

¹⁴ASCE's Task Committee on Turnkey Contracts (6), however, seems to have worked out a potentially acceptable procedure for a sort of modified competitively bid turnkey contract.

tractor together at the start of the project himself, and although some of the potential advantages of vertical integration are then lost, this is being done to an increasing extent, particularly on large complex projects (6, 8, 25, 281, 35).

The not-altogether-new concept of construction management is yet another outcome of various efforts directed at trying to improve the construction industry's delivery process (see Table 4.11 for some statistics). Although the approach has several variations, the essence of the concept is the introduction of a new participant, a construction manager, who has construction know-how and management ability and whose role is to serve as the owner's agent and manager from the initial planning stages through the actual construction of the facility. A construction team, made up of the owner, construction manager, and designer, is usually formed and works together on a project from start to finish. There is generally no need for a general contractor, and thus each segment of the work is usually contracted separately with the owner, with the advice of the construction manager who may or may not do part of the construction work himself (see Figure 4.6). The services provided by the construction manager are many and varied depending upon the project and owner (see Table 4.12). Some of the major advantages which arise out of the use of construction management

Table 4.11: Some statistics on construction management (source: various issues of the Engineering News - Record in its annual articles "The ENR 400" and "The ENR 500").

Statistics on construction management (CM) from "The ENR 400" (top 400 contractors on the basis of their contract awards):

Year	Number of Contractors Who Signed CM Contracts	Estimated Construction Cost (in billions)
1972	101	\$2.3 for 89 firms doing CM
1971	78	2.0 for 46 firms doing CM

Some additional comments: In 1972, over 50 percent of the contractors doing CM work were diversified contractors, with general builders running a close second. In 1971, about half of those firms that signed CM contracts had been doing CM work for ten or more years, and only a few had just added it.

(continued)

(Table 4.11 continued)

Statistics on construction management (CM) from "The ENR 500" (top 500 design firms on the basis of their billings and design-construct firms on the basis of design-construct and design-only contracts valued at the estimated erected cost of project):

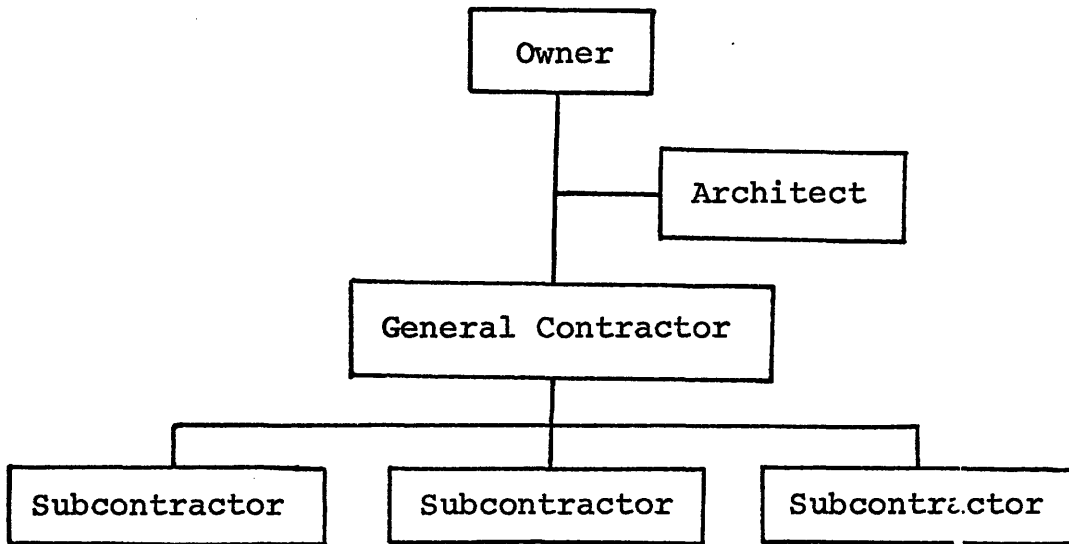
Year	Number of Design Firms	Number of Design Firms That Offer CM Services	Number of Design Firms That Signed CM Contracts	Estimated Construction Cost (in billions)
1972	438	206	128	\$4.6
1971	449	183	90	na
1969	460	153	na	na

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Some additional comments: In 1971 and 1972, most of those doing CM work were engineers and architect-engineers (or engineer-architects); only eight architects did any CM work in 1972 and only six in 1971. In 1971, most firms that do CM work said they had offered these services for three or four years, with a few having offered them for ten or more years and many just starting.

Figure 4.6: The traditional and construction management approaches to the construction process (source: Ref. 22).

TRADITIONAL APPROACH



CONSTRUCTION MANAGEMENT APPROACH

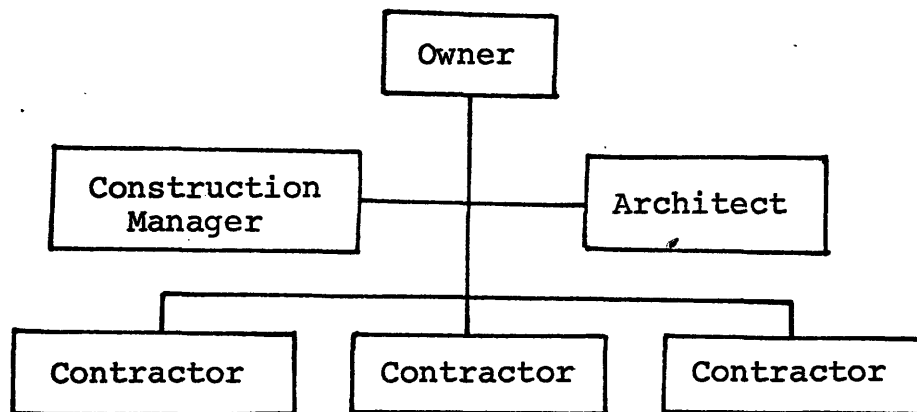


Table 4.12: Some of the services typically provided for the owner by the construction manager (source: Ref. 64).

Market Studies (to help establish the feasibility of a project)
Feasibility Studies - Transportation, Utilities, Site
Preliminary Cost Estimating
Community Relations
Financial Projections and Operating Statements
Real Estate Selection, Analysis, and Acquisition
Programming and Management Information Systems
Governmental Agency Coordination
Master Planning
Design Supervision and/or Design
Construction Contract Negotiations
Construction Scheduling and Reporting
Pre-Bidding of Selected Materials and Labor
Equal Opportunity Regulation Enforcement and Training
Construction Cost Accounting
Construction Cost Control
Expediting
Value Engineering
Detailed Construction Inspection
Tenant Improvements
Start-Up and Testing
Operational Logistics
Training of Owner's Personnel

are briefly as follows: (1) it brings a general contractor's knowledge in during the planning and design stages; (2) it allows construction to be started and materials ordered before design is complete; (3) it puts the system which controls men, money, materials, equipment, and time to work directly for the owner's interests; and (4) it allows the selection of contractors to be based on regular competitive bidding if so desired. Although construction management has been successfully used for a wide variety of projects¹⁵, it is not suitable for every project, and it still has a lot more evolving to do before all of its problems will be ironed out and it will be fully accepted. Some of the questions which still remain to be resolved are: (1) who (i.e., the general contractor, specialty contractor, architect, engineer, or management consultant among others) should take on the role of construction manager; (2) which member of the team should be the leader; (3) whether the construction manager is a professional and on what bases he should be selected and his fee based; (4) to what extent, if any, he -----

¹⁵The size of projects has ranged from the \$355 million Columbia Point campus for the University of Massachusetts to a \$1.7 million parking garage in Annapolis, Maryland; the types have included office buildings, university housing, hospitals, banks, and airports among others; the owners have included state and private universities, banks, corporations, state and local agencies, and federal government (the Public Building Service of the General Services Administration has been particularly active in the area) among others.

should be allowed to do some actual construction work; (5) whether he should work under a guaranteed maximum price; and (6) what is the extent of his liability. Still, the concept of construction management is a promising development in the field of facilities construction and certainly seems to represent a viable alternative to traditional procedures, though it is doubtful it will ever totally replace them, nor should it probably. An interesting thought for the future is the expansion of these services into the later phases of the project, including operation, maintenance, growth, and replacement (16, 22, 28d, e, f, 31, 64, 69).

4.3 Contractual Arrangements

It is a well known fact that the great majority of constructed facilities are erected today under some form of contract. Construction contracts are most often awarded by means of competitive bidding, though they may also be negotiated (see Table 4.13); professional contracts are most commonly negotiated, though there is currently some controversy over how they should be awarded. The basis of payment may be any one of many, such as lump sum, unit price, or cost plus for a contractor and percentage of construction cost, lump sum, multiplier, or cost plus for a designer. One last aspect relating to contracts, which will be briefly con-

Table 4.13: Negotiated building contracts as a percentage of the dollar volume of all building contracts of 333 general contractors^a (source: Ref. 18).

Dollar Volume of Negotiated Contracts As a % of All Contracts	Number of Respondents	Percentage Distribution
none	25	7.5%
less than 10%	101	30.3
10 - 19%	72	21.6
20 - 39%	57	17.1
40 - 59%	39	11.7
60 - 100%	<u>39</u>	<u>11.7</u>
Total	333	100.0%

NOTE: Percentages do not add to 100.0 because of rounding.

^aThese are the results of a mail survey carried out by Cox and Goodman (18) presumably some time around 1962 though the authors do not specify the date.

sidered in this section along with the items mentioned above, is the legal side of the issue, including bonding and insurance.

Nearly all public construction is awarded on the basis of competitive bidding, and the law generally requires that all qualified contractors be allowed to bid on any project, though they may have to undergo prequalification by the agency securing the bids. Much private construction is also awarded on a competitively bid basis, but here the bids may be solicited from all interested contractors or from a selected list which is predetermined by the owner and designer. The basic bid procedure varies little from one project to the next, with the contract generally being awarded to the lowest responsible bidder (required by law in most public construction) who is usually the lowest bidder (14, 25, 37, 56).

A project awarded on a competitively bid basis may be constructed under a single contract or by means of separate or several contracts¹⁶. The single contract system is the commonest and has the advantage of centralized responsibility for management of the construction operation, but it is often criticized because of certain abuses, like bid shopping and

¹⁶A project awarded on a negotiated basis may also, of course, be constructed under any of these three contract systems.

bid peddling¹⁷, which tend to drive out the more competent and responsible subcontractors. One way to cut down on such practices is by the use of a bid depository¹⁸, and some states (e.g., Massachusetts) have a filed subcontract law which works in a similar manner for all public work. Another approach is the use of separate contracts (or multiple prime contracts) in which case prime contracts¹⁹ are usually awarded to a general, electrical, mechanical, and plumbing contractor. This has the disadvantage of dividing up the responsibility for the completed project and of bringing up the question of who has the day-to-day responsibility for the orderly progress in and coordination of the project, a job which the owner and/or his agent are often obliged to assume under this contract system. This approach has the additional advantages of eliminating the general contractor's mark-up on the subbids and of ensuring that the lowest bidders are used. In any case, likely because of the increasing role of the mechanical, plumbing, and electrical components

¹⁷ Bid shopping occurs when the successful general contractor endeavors to obtain subbids lower than those he submitted with his winning bid. Bid peddling occurs when the unsuccessful subcontract bidders offer the successful general contractor lower prices than those he used in preparing his winning bid.

¹⁸ A bid depository is an arrangement whereby the subcontractors submit their bids to a single neutral party and the general contractors use these bids in making up their own.

¹⁹ A prime contract is a contract directly with the owner.

in today's constructed facilities as well as the potential advantages mentioned, the use of separate contracts is becoming more common and is even required by law for public work in some states (e.g., New York). The several contracts system, which involves separate contracts for all the different phases of the work, is generally used in conjunction with a construction manager (as discussed in Section 4.2), and thus it has the same basic advantages as the separate contracts approach while eliminating its major disadvantage (3, 14, 18, 37, 56, 57).

Competitive bidding has long been, and almost undoubtedly will continue to be, the commonest way to award construction contracts, but it has several negative aspects. First of all, the basic tenet, and major claimed advantage, of competitive bidding is that of equal quality at lower price. But this is not necessarily true, for the lowest bid is not always responsible and competing contractors are not necessarily equal in ability. At least three criteria, price, quality, and time, should be important to the owner, but price is really the only criterion in competitive bidding. Secondly, this puts the contractor in an adversary relationship with the owner and designer. The contractor must develop his bid on the basis of what he thinks it will cost him to do the work and add in as much for overhead, profit, and contingencies as he thinks he can and still have the

the lowest bid. Once he gets the job, he has no incentive to do other than to try to minimize his costs so as to maximize his profits and to try to get as much as he can for any changes in the work. Thus, the designer is forced to police the job and to produce exceedingly explicit and accurate plans and specifications. The contractor, of course, runs a very real risk of loss if he is inefficient or unforeseen circumstances arise. Thirdly, competitive bidding necessarily results in the separation of design and construction and its related problems. Fourthly, under a system of competitive bidding, the profit margins are necessarily low, and there can be little allowance for overhead, both of which tend to discourage research and development in the industry.

However, as Park (57) points out, the degree and type of competition brought about by the contractors themselves is probably a major influence on industry profits; that is, he claims that there is enough work for everyone to obtain a fair profit as long as everyone refuses to settle for less on each job, but there always seems to be someone who is willing to settle for a little less than an adequate return. Lastly, competitive bidding does little to encourage a contractor to build up a reputation, for on the next job he will only be selected if he has the lowest bid.

It seems that the rule of selecting the lowest responsible bidder should perhaps not be as rigidly enforced as

it is and that qualifications should play more of a role, but then the selection procedure would no longer be quite so objective. Italy and Scandinavia have tried to solve the problem by rejecting the highest and lowest bid, averaging the rest, and selecting the bid nearest that average, but this in no way guarantees that the all-around best contractor has been chosen. England has added a quantity surveyer, a disinterested professional, to their building team, and then all bids are based on this single list of quantities of materials required. It seems this should have some merit. If competitive bidding is to continue, as it undoubtedly is, the least that should be done to protect all involved is to provide more complete plans and specifications such that exact descriptions of work requirements are provided for the contractor, clarify the substitution clause to eliminate any questions about material standards, and provide objective and impersonal inspection of work during construction (see Ref. 8, 56, 57, 69 for more on the negative aspects of competitive bidding and some possible solutions).

Negotiation is the other major method of contract award, and though these are still in the minority, an increasing number of such contracts are being used (almost exclusively in private construction) perhaps because of some of the problems encountered in competitive bidding and

perhaps because of the rapidly changing economic conditions, such as rising costs, which make it even more difficult for a contractor to bid accurately on a long-term project. A negotiated contract may be used for a variety of other reasons as well, such as it may be impossible to determine the exact extent of the construction operation in advance, many major changes in the work may be expected to arise during construction, or time for project completion may be very short. Negotiated contracts are more varied than competitively bid ones and are largely suited to the particular project at hand. The contractor is selected on the basis of his qualifications²⁰ and the contract negotiated, and if the owner and contractor cannot come to an agreement, the next-most-qualified contractor is selected. Negotiated contracts as compared with competitively bid ones have certain advantages, including: (1) the contractor is brought into the picture before design is complete; (2) he is on the site by invitation rather than lowest bid, generally shares the role of a professional representative of the owner with the designer, and thus is more likely to work in the interests of the owner as well as of himself; (3) a negotiated contract

²⁰For example, relevant experience, technical capability, reputation, and current workload and capacity for more.

allows considerably more flexibility, and thus changes can often be handled more readily; and (4) the relationship between the designer and the general contractor is usually less strained, and the designer has more influence on who are the general contractor and subcontractors. One last, but rather important, point to be made is that the owner does not really completely lose the benefit of competitive bidding with a negotiated contract in that the subcontracts, which often comprise the majority of the work, are still generally awarded on the basis of competitive bidding with the added advantage that the designer can assist the general contractor in their selection (1, 14, 18, 56).

Professional contracts²¹ are executed in the same basic manner as are construction contracts except that they are nearly always negotiated. There are two major arguments against competitive bidding for professionals: (1) it is impossible to define the quality and extent of their services closely enough to provide a real basis for a price comparison and even more importantly (2) the design fee is a relatively small part of the completed cost of the facility, and yet the designer's decisions can have a substantial influence on the total cost of construction, the reliability and

²¹That is, contracts between the owner and architect or engineer or architect-engineer and between the architect and engineer.

potential maintainability of the completed structure, and the suitability of the building for its occupant, and thus the selection of a properly qualified designer is of utmost importance. Until the spring of 1972, in fact, most professional societies had explicitly prohibited competitive bidding in their ethics codes, but at that time several of them had to eliminate such articles²². While the predominant practice for public and private work had long been to negotiate contracts with professionals, it had become increasingly common in recent years for governmental agencies especially to judge professionals on the basis of price as well as qualifications. However, this practice ended in late 1972 when the Brooks bill became law, largely due to the educational and legislative efforts of the professional societies against price bidding for professionals. Thus, the current policy of the federal government (excluding military agencies) is to select an architect or engineer on the basis of demon-

²²In the spring of 1972, several of the professional societies (e.g., American Society of Civil Engineers (ASCE) and American Institute of Architects (AIA)) were enjoined from adopting any course of action that would prohibit their members from submitting price quotations for their services and thus had to eliminate the pertinent articles in their ethics codes, though at least one society (National Society of Professional Engineers (NSPE)) is still fighting the ruling.

strated competence and qualifications for the services required and then negotiate the contract and fee, rejecting him only if they fail to reach a mutually equitable agreement. Efforts are now being made to get similar laws passed at the state and local levels. Thus, at least for the immediate future, it seems that negotiated contracts will continue to be the rule rather than the exception for professionals (l, 12, 26, 28a-c, j, m, o-r).

There are several bases of payment for construction contracts. The commonest method for a competitively bid contract (and thus the commonest overall) is the lump sum, which may also be used for a negotiated contract though generally is not. Under such a contract, the contractor promises to deliver the facility in accordance with the plans and specifications for a fixed price (including his overhead and profit) agreed upon in advance of commencing work. The major advantage of this method for the owner is that he knows what the project will cost before construction starts, though changes resulting in extra costs nearly always occur once construction is underway. Its disadvantages are essentially the same as some of those that go along with competitive bidding, namely the contractor's adversary relationship with the owner and designer and elimination of the possibility of using fast track construction.

Another method of payment commonly used in conjunction

with competitive bidding but which can also be negotiated is the unit price. This is mainly used in projects (e.g., heavy and highway work) which involve large quantities of earth, concrete, or other materials whose exact amounts cannot be determined in advance but can readily be measured during construction itself. In this situation, the owner and/or designer prepare a list of anticipated contract items and estimated quantities, the contractor supplies a unit bid price for each item, and a total bid is prepared. Though the contract is usually awarded on the basis of the total bid, the contractor is paid on the basis of his unit prices and the actual quantities of work he does. Thus, the owner will not know the final cost of the facility until it is complete, and he must keep a rather extensive field force, as must the contractor, for checking the quantities of work. Moreover, this procedure has some interesting implications in that the payments are equal to the bid prices only if the final or pay items and corresponding units are the same as the original estimates, and thus manipulations, involving the items, number of units, unit bids, and sequence and time at which items are executed, may be made to benefit the bidder and/or owner. Unbalanced bidding is a common example of such manipulations.

A cost plus approach to payment comes in a variety of forms and is the basis of payment most commonly used for negotiated contracts. The basic principle underlying such a

contract is that the contractor will be reimbursed by the owner for all costs attributable to the project and will be paid a fee for his services. In order for the cost plus contract to work well conditions must be clearly defined and costs enumerated as to what may be charged against the owner and what must be absorbed by the contractor. Furthermore, careful records of his work must be kept by the contractor, and the owner must generally be allowed to see them as well as keeping his own. The contractor's fee may be determined in any one of a number of ways, the major ones being as follows: (1) percentage of construction cost - this is rarely used now because too many contractors have padded costs and been inefficient, thereby increasing costs to the owner and their fee at the same time; (2) fixed fee - on the basis of a preliminary estimate of total cost, a fixed fee is agreed upon, and the contractor is paid it regardless of the ultimate cost; though there is no real penalty to the contractor if costs to the owner get out of hand, there is no real incentive to let this happen either; (3) bonus and penalty provisions - in order to provide an incentive to keep costs and time down, the contractor is asked to make a target estimate of cost and/or completion date (thus necessitating fairly well developed plans and specifications), and bonus and/or penalty arrangements are tied to this figure in the contract; and (4) fixed fee with a guaranteed maximum cost - the contractor guarantees

that he will construct the project as specified, and the cost to the owner will not exceed some total maximum price (if it does the contractor must pay the excess and if it does not he may share in the savings); this requires complete drawings and specifications, but has the advantage of giving the owner a final maximum cost. These then are the major types of construction contracts for the general contractor and also for the subcontractor. As mentioned above, however, subcontracts are even more often competitively bid, and thus lump sum or unit price contracts, than are general contracts (see Ref. 5h, 14, 25, 37, 56 for more on the various methods of payment in construction contracts).

Payment for professional services may be on any number of bases, regardless of the scope of services to be performed and of whether the contract is between the owner and a professional or two professionals. Percentage of construction cost has long been the most commonly employed method, but it seems to be losing favor. Its major disadvantage is that it gives the designer a financial incentive to maximize, rather than minimize, the cost of the facility. The fixed price or lump sum method of compensation is the second most common approach to design contracts and is frequently used by government agencies. While this approach does away with the disadvantages of the percentage method, it has its own disadvantage which is similar to that of the lump sum construction contract, namely that it gives the designer a financial

incentive to minimize his costs to the possible detriment of the adequacy of the plans, specifications, and contract documents. The remaining, less commonly used, methods of compensation are the multiplier (essentially cost plus percentage of cost), cost plus fixed fee, and cost plus fixed fee with a guaranteed maximum cost, and these methods have the same basic features, advantages, and disadvantages as their counterparts in construction contracts (12, 29, 37).

Construction contracts and subcontracts and architectural and engineering contracts have been thoroughly discussed which leaves just the design-construct or turnkey contracts and the construction management contracts. Award of design-construct contracts may be on a negotiated or competitively bid basis though the exact procedures differ from those of standard construction and design contracts (see Ref. 6 for some proposed procedures), and the method of payment may be on any of the standard bases for construction contracts (14, 281, 35). Construction management contracts are generally considered to be professional contracts and thus are more likely to be negotiated with reimbursement based on one of the methods used for architectural and engineering contracts, though, as mentioned in Section 4.2, this is one of the issues about the construction management concept that has not yet been completely resolved (28e, f, 31, 69).

The surety bond is an almost universal element of the contract construction industry and has been used since the

earliest days of contract construction in the U.S. As related to construction, the bond is an agreement by the bonding company (surety) supplying it to indemnify the owner for nonperformance by the contractor. The extent of indemnity for which the surety is liable is limited by the amount stated in the bond (face value). A bond thus essentially backs up the financial responsibility of the contractor for the benefit of the owner to the extent of the bond's face value. In no way, however, is it insurance for the contractor, for he is required to indemnify the surety against any claim that may be brought against it because of his failure to perform in the prescribed manner. Reputable surety companies have become very proficient in the analysis of contractor's capabilities both financially and technically, and the idea that "bondability is equal to capability" has grown out of this, though it is not always true.

It is common practice to require the contractor to furnish performance and payment bonds²³, especially in connection with competitively bid and public contracts. The performance bond guarantees performance in accordance with the terms of the construction contract, and thus, obligations under the bond are generally identical to those of the

²³The general contractor may similarly require performance and payment bonds from any or all of his subcontractors, but such a bond protects the general contractor only against financial loss directly attributable to a particular subcontractor and does not, nor can it, cover expenses caused by the overall disruption of the project which inevitably accompanies subcontractor default.

the construction contract, and the bond is normally written to cover 100 percent of the contract price. Should the contractor default, the surety is obliged to complete the contract in accordance with the contract documents in any way it sees fit. The labor and material payment bond (or payment bond) serves as a guarantee that the contractor's bills for labor and materials incurred under the contract will be paid, thereby protecting the owner from liens and other claims made after completion of the project and after final payment to the contractor and essentially protecting subcontractors, suppliers, and workmen as well. In this bond, it is rather important to be sure that claimants unreasonably remote from the contractor are excluded, and that the terms labor and materials are explicitly qualified. When one bids on a project, he is often required to furnish bid security in the form of a bid bond or certified check. A bid bond is a guarantee on the part of the surety that the bidder, if awarded the contract, will, in fact, execute the contract with the owner. If the successful bidder fails to do so, the surety is liable for an amount (up to the bond's face value) equal to the difference between the successful bid and that of the next higher responsible bidder. On some work, including that for government agencies, a certified check is acceptable in lieu of the bid bond. In addition to these most commonly used surety bonds, there is a wide variety

of others, some of which are given in Table 4.14. Closely related to surety bonds are warranties which serve to certify that the material, product, or equipment in question will perform in accordance with the specified requirements, but these bind the producer or supplier directly without interposition of a surety (see Ref. 14, 37, 56, 72 for more on bonding).

The topic, responsibility, liability, and insurance, in an important but rather complex issue in the construction industry and can only be briefly considered here (any of several authors, e.g., Ref. 14, 37, 56, 66, 71, discuss it in some detail). At any point in time, construction projects generally have several contractual arrangements in effect, which together establish a complicated structure of responsibilities for damages arising out of construction operations. For example, liability for accidents may fall on the owner and designer as well as on the general contractor and subcontractors whose equipment and employees are actually doing the work. Various professional societies and contractor associations are currently working together in an effort to sort out and distribute fairly these responsibilities, but this is a difficult task. Insurance coverage for participants involved in construction, an industry in which the work is by nature hazardous and accidents are frequent and often severe, must necessarily be extensive, and is expensive, if it is to

Table 4.14: Some of the less commonly used surety bonds
(source: Ref. 14, 37, 56, 72).

Bonds to discharge liens that have been filed against an owner's property or against moneys due and payable to the general contractor by persons who have not received payment for labor or materials supplied.

Bonds, posted by the contractor in advance, to indemnify the owner against liens.

License or permit bonds given by the contractor (licensee) to a public body, guaranteeing compliance with statutes or ordinances and sometimes holding the public body harmless.

Maintenance bonds given by the contractor to the owner, thus guaranteeing to rectify defects in workmanship or materials for a specified time following completion (a one-year maintenance bond is generally included with the performance bond without additional charge).

Bonds to protect owners of rented equipment and leased property, whereby proper maintenance and payment of rental charges are guaranteed and the owner is indemnified against loss, damage, or excessive wear of his property.

Many others too numerous to explain, such as supply bonds, judicial or court bonds, termite bonds, subdivision bonds, self-insurers' workmen's compensation bonds, and union wage bonds.

protect adequately those involved.

A list of the myriad types of insurance protection an architect or engineer might need is given in Table 4.15. For example, in order to protect himself from claims arising from his own errors, omissions, or negligent acts arising from the performance of professional services and those of his employees or others for whom he is legally responsible and to cover the cost of legal defense (e.g., investigation, law suits, and arbitration), the architect or engineer carries professional liability insurance. In recent years, such insurance has become increasingly costly at least partly because of the expansion of the zone of risk in professional practice. For example, liability of the architect and engineer has recently been extended to include third parties. It has also been extended in the area of construction product performance, with this latter trend naturally tending to discourage innovation and use of new materials and methods on the part of the designer. Thus, the need for and the extent and coverage of professional liability insurance as well as the other types in Table 4.15 naturally depend upon changes of this sort, upon the architect or engineer's particular situation, and in some cases upon the circumstances and requirements of the particular project at hand.

The responsibilities and liabilities of the contractor

Table 4.15: A list of the more common insurance and bond coverages which should be considered by architects (though it is applicable in general terms to engineers as well), as suggested by the AIA in its Architect's Handbook of Professional Practice (source: Ref. 37).

A. ARCHITECT'S LIABILITY

1. Professional Liability including Contractual ("Hold Harmless")
2. Comprehensive Personal Liability
3. Comprehensive General Liability - Occurrence Basis
 - a. Premises - Operations
 - b. Elevator
 - c. Contingent
 - d. Contractual
 - e. Completed Operations - Products
 - f. Broad Form Property Damage Endorsement
 - g. Property Damage XCU Endorsement (Explosion, Collapse, Underground Damage)
 - h. Personal Injury Endorsement (Invasion of Privacy, False Arrest, Libel, Slander, Defamation of Character)
4. Excess or Umbrella Liability
5. Comprehensive Automobile Liability - Occurrence Basis
6. Aircraft or Watercraft Liability
7. Fire Legal Liability
8. Water Damage and/or Sprinkler Leakage Legal Liability
9. Nuclear Energy Liability

B. ARCHITECT'S PERSONNEL

1. Workmen's Compensation and Employer's Liability
2. Disability Income - Salary Continuance
3. Major Medical
4. Hospitalization - Surgical Expense
5. Life Insurance-Group, Keyman, Partnership
6. Accident Insurance - Death and Permanent Disability
7. Retirement - Pension - Deferred Compensation

C. ARCHITECT'S OFFICE

1. All Physical Loss - Building or Leasehold Improvements
2. Fire, Extended Coverage, and Vandalism
3. Boiler and Machinery
4. Water Damage - Sprinkler Leakage
5. Collapse
6. Comprehensive Glass
7. Demolition Endorsement
8. Office Contents Special ("All Risk") Form
9. Valuable Documents
10. Equipment Floater
11. Automobile Material Damage and Collision
12. Business Interruption - Loss of Use
 - a. Business Interruption - Fire, Extended Coverage, or All Physical Loss

(continued)

(Table 4.15 continued)

- b. Rental Value - Fire, Extended Coverage, or All Physical Loss
- c. Extra Expense - Fire, Extended Coverage, or All Physical Loss
- d. Boiler and Machinery Use and Occupancy
- e. Water Damage - Sprinkler Leakage Use and Occupancy
- f. Leasehold Interest
- 13. Package Policy
- 14. Theft-Robbery-Burglary
- 15. Broad Form Money and Securities
- 16. Fidelity Bonds
- 17. Forgery Bonds
- 18. Credit Card Forgery
- 19. Blanket Crime Policy - Comprehensive Dishonesty, Disappearance, De-struction Bond

are considerable²⁴, and they may begin before anything is done on the jobsite and may not end until several years after the job is completed. Thus, insurance is of utmost importance for the contractor's own protection as well as for that of others. Some coverages are required by law and some by the terms of the contract, and still others are dictated by prudent business policy. The list of possible construction insurance coverages, as given in Table 4.16, is a long one and covers the major types of insurance that may be needed, though not every policy is applicable to every project and contractor. As for the subcontractors, the general contractor normally requires that each provide and maintain certain insurance coverages along similar lines because, if a subcontractor's insurance is faulty or inadequate, the responsibility may devolve to the general contractor.

Over the last several years, wrap-up insurance programs,

²⁴For example: (1) he is responsible for the safety not only of his own workers but also for that of the public and persons other than his own employees involved in the project; (2) he must provide protection to prevent damage or loss to work in place, materials and equipment not yet incorporated but stored at the site or elsewhere, and other property at the site or adjacent to it; and (3) his contract with the owner may require that he "hold the owner harmless" by accepting any liability that the owner may incur because of operations performed under the contract.

Table 4.16: A list of the major construction insurance coverages which should be considered by general contractors (source: Ref. 14).

A. PROJECT AND PROPERTY INSURANCE

1. Builder's Risk Fire Insurance. This insurance provides protection for projects under construction against direct loss by fire or lightning.
 - a. Extended Coverage Endorsement. This covers property against all direct loss caused by windstorm, hail, explosion, riot, civil commotion, aircraft, vehicles, and smoke.
 - b. Vandalism and Malicious Mischief Insurance. Protection of this type may be obtained by endorsement to the builder's risk policy.
 - c. Water Damage Insurance. This can be purchased as an endorsement to the builder's risk policy; it does not include damage caused by sprinkler leakage.
 - d. Sprinkler Leakage Insurance. Protection against all direct loss to a building project as a result of leakage, freezing, or breaking of sprinkler installations may be obtained as an endorsement to the builder's risk policy.
 - e. Earthquake Insurance. This coverage may be provided by an endorsement to the builder's risk policy in some states. Elsewhere, a separate policy must be issued.
2. Fire Insurance on Contractor's Own Buildings. This coverage affords protection for offices, sheds, warehouses, and stored contents. Endorsements for extended coverage and for vandalism and malicious mischief are also available.
3. Contractor's Equipment Insurance. This type of policy, often termed a floater, insures a contractor's equipment regardless of its location.
4. Bridge Insurance. This insurance is of the inland marine type and is often termed the "bridge builder's risk policy." It affords protection during construction against damage that may be caused by fire, lightning, flood, ice, collision, explosion, riot, vandalism, wind, tornado, and earthquake.
5. Motor Truck Cargo Policy. This insurance covers loss by named hazards to materials or equipment carried on the contractor's own trucks.

(continued)

(Table 4.16 continued)

6. Steam Boiler and Machinery Insurance. A contractor or owner may purchase this form of insurance when the boiler equipment of a building under construction is used to heat the structure for plastering, floor laying, or other purposes. This policy covers any injury or damage that may occur to or be caused by the boiler during its usage by the contractor.
7. Burglary, Robbery, and Theft Insurance. This form of insurance protects the contractor against the loss of money or negotiable securities through burglary, theft, robbery, destruction, disappearance, or wrongful abstraction.
8. Fidelity Insurance. This policy affords the contractor protection against loss caused by dishonesty of his own employees.
9. Dishonesty, Destruction, and Disappearance Policy. Items 7 and 8 above, together with forgery insurance, can be grouped together in a single dishonesty, destruction, and disappearance policy.
10. Valuable Papers Destruction Insurance. This policy protects the contractor against the loss, damage, or destruction of valuable papers such as books, records, maps, drawings, abstracts, deeds, mortgages, contracts, and documents. It does not cover loss by misplacement, unexplained disappearance, wear and tear, deterioration, vermin, or war.
11. Installation Floater Policy. Insurance of this type provides protection for property of various kinds such as project equipment and machinery (heating and air conditioning systems, for example) from the time that it leaves the place of shipment until it is installed on the project and tested. Coverage terminates when the insured's interest in the property ceases, when the property is accepted, or when it is taken over by the owner.
12. Consequential Loss or Damage Insurance. This insurance covers loss caused by the shutdown of public utility service resulting from fire or windstorm. Contractors who depend on uninterrupted power service or the service of a material supply plant and who might be penalized for failure to complete contracts on time because of such failure may purchase this form of protection.

(continued)

(Table 4.16 continued)

B. LIABILITY INSURANCE

1. Employer's Liability Insurance. This insurance is customarily written in combination with workmen's compensation insurance. It affords the contractor broad coverage for personal injury or death of an employee in the course of his employment, but outside of and distinct from any claims under workmen's compensation laws.
2. Contractor's Public Liability and Property Damage Insurance. This insurance protects the contractor from his legal liability for injuries to persons not in his employ and for damage to the property of others, which property is not in the contractor's care, custody, or control, when such injuries or damage arise out of the operations of the contractor.
3. Contractor's Protective Public and Property Damage Liability Insurance. This protects the contractor against his liability imposed by law arising out of acts or omissions of his subcontractors.
4. Contractual Liability Insurance. This form of insurance is required when one party to a contract, by terms of that contract, assumes certain legal liabilities of the other party. The usual forms of liability insurance do not afford this coverage.
5. Owner's Protective Liability Insurance. This insurance protects the owner from his contingent liability for damages arising from the operations of the contractor or his subcontractors.
6. Completed Operations Liability Insurance. This form of insurance protects the contractor from damage claims stemming from his alleged faulty performance on projects since completed and handed over to the owner. The usual forms of liability insurance provide protection only while the contractor is performing his work and not after it has been completed and accepted by the owner.

C. EMPLOYEE INSURANCE

1. Workmen's Compensation Insurance. This insurance provides all benefits required by law to employees killed or injured in the course of their employment.
2. Old-Age, Survivor's, and Disability Insurance. This

(continued)

(Table 4.16 continued)

all-federal insurance system operated by the United States government provides old-age benefits to an insured worker and his family, survivor's benefits to his family when the worker dies, and disability benefits.

3. Unemployment Insurance. This federal-state insurance plan provides workers with a weekly income during periods of unemployment between jobs.
4. Disability Insurance. This insurance, required by some states, provides benefits to employees for disabilities caused by nonoccupational accidents and disease.

D. MOTOR VEHICLE INSURANCE

Various forms of insurance are available in connection with the ownership and use of automobiles and trucks. Liability coverages protect the contractor against third-party claims of bodily injury or property damage involving the contractor's vehicles or nonowned vehicles that are used in his interest. Collision insurance, together with comprehensive fire and theft coverage, indemnifies the contractor for damage to his own vehicles.

E. BUSINESS, ACCIDENT, AND LIFE INSURANCE

1. Business Interruption Insurance. This insurance is designed to reimburse the owner for losses suffered because of an interruption of his business.
2. Sole Proprietorship Insurance. A policy of this type provides cash to assist heirs in continuing or disposing of the business without sacrifice in the event of death of the owner.
3. Accident Insurance on Partners or Keymen.
4. Life Insurance on Partners or Keymen. This insurance reimburses the business for financial loss resulting from death of a keyman in the business. It also builds up a sinking fund to be available on his retirement.
5. Group Life Insurance. Contractors often purchase life insurance for their employees. This affords protection for each participant at a low group cost, the premium for which may be paid wholly or partly by the contractor. Additional amounts can often be purchased by the employees at their own expense.

(Table 4.16 continued)

6. **Group Hospitalization Insurance.** Such insurance covers hospitalization and surgical expenses incurred by covered employees. Policies are often written to include the families of the employees. A portion of the premium may be paid by the employer and the balance by the individuals insured.

whereby the owner, architect, engineer, general contractor, and subcontractors are protected under a single insurance package, have been used with increasing frequency to insure large projects²⁵. This approach can benefit the owner by reducing overall insurance costs through mass purchasing power and elimination of the coverage duplications inherent in separately purchased insurance policies, but each individual participant in the building process must check to make certain it provides him with adequate coverage.

4.4 Management Functions in a Construction Company and Its Projects

Whether a construction company is a small one-man firm or a large corporation, a diverse collection of functions, including, for example, general office administration and executive duties, accounting and payroll, purchasing, estimating and bidding, planning and scheduling, monitoring and control, and field supervision of construction, must be performed (see Table 4.17). In a small organization, these responsibilities rest on only a few people, at least some of whom (e.g., owner) must have a broad range of capabilities, or perhaps some of the duties (e.g., accounting and quantity

²⁵For example, the UN Building, Lincoln Center, Boston's Prudential Center, and Chicago's John Hancock.

Table 4.17: A representative list of the duties involved in the conduct of a contracting business regardless of its size (source: Ref. 14).

A. EXECUTIVE

1. Banking
2. Construction loans
3. Financial structure
4. Legal matters
5. Business organization
6. Management organization
7. Auditors and audits
8. Public relations
9. Industry associations
10. Labor negotiations
11. Contract negotiation and execution
12. Investment
13. Personnel relations and policies
14. Long-range planning
15. Salaries, bonuses, pensions, and profit sharing
16. Legislative matters
17. Capital improvements
18. Scope of operations
19. Approval of major expenditures
20. Operating procedures and policies

B. ACCOUNTING AND PAYROLL

1. General books of account
2. Subsidiary records
3. Cost records and reports
4. Financial reports
5. Tax returns and payments
6. Payments of invoices
7. Billing
8. Collections
9. Assignments
10. Bank deposits
11. Personnel records
12. Payrolls and records
13. Wage and personnel reports to public agencies
14. Office services

C. PROCUREMENT

1. Requisitions
2. Purchase orders
3. Subcontracts
4. Change orders
5. Inventories
6. Ordering and control of stores
7. Expediting
8. Routing shop drawings
9. Licenses
10. Insurance, project and company
11. Subcontractors' insurance
12. Owners' contract bonds
13. Bonds from subcontractors
14. Releases of lien
15. Guarantees and warranties
16. Routing and scheduling materials
17. Building permits
18. Checking and approval of invoices
19. Information on prices and sources of supply
20. Verification of quantity and quality of deliveries

D. ESTIMATING

1. Decision to bid
2. Visiting the site
3. Obtaining bidding documents
4. Mailing out bid invitations
5. Pre-bid conferences
6. Quantity take-off
7. Subcontract and material quotations
8. Pricing
9. Checking estimate
10. Preparation of proposal

(continued)

(Table 4.17 continued)

11. Bid Bond
 12. Delivering proposal
 13. Bills of materials and subcontractors
- E. ENGINEERING
1. Project planning
 2. Construction schedules
 3. Project monitoring
 4. Project cost breakdowns for pay purposes
 5. Periodic project pay requests
 6. Checking shop drawings
 7. Project cost reports
 8. Field and office engineering
 9. Safety policies and procedures
 10. Accident reports to insurance companies
 11. Relations with owners and architect-engineers
 12. Labor relations
- F. CONSTRUCTION
1. Hiring and firing labor crews
 2. Supervision of construction
 3. Coordination of subcontractors
 4. Timekeeping
5. Project cost data
 6. Project accident reports
 7. Safety program
 8. Project progress reports
 9. Construction methods
 10. Storage of materials on project sites
 11. Scheduling construction equipment
- G. YARD FACILITIES
1. Receipt, storage, and warehousing of project materials
 2. Maintenance and repair of construction equipment
 3. Storage of construction equipment
 4. Maintenance and issue of stores
 5. Issue, receipt, and repair of hand tools
 6. Transportation
 7. Equipment rental
 8. Prefabrication and subassembly
 9. Spare parts

take-off for estimating) may be carried out by outside consultants, whereas in a large organization, there are many people among whom to divide these duties (see Figure 4.7). A major difference between a construction firm and a manufacturing firm or any of many other types of firms is that construction work is so project oriented. And thus, the majority of management's functions are directly related to individual projects, and these are what are of interest here (14, 23, 26, 71).

The first step in a contractor's consideration of a project is to decide whether or not he wants to do the job, for bid preparation is a costly and time-consuming process if it is done properly. Once this is decided, the estimate and bid must be prepared. The different types of estimating (e.g., budget, package, and bid estimating) and the basic procedure, including quantity take-off, pricing, and sub-bids, are discussed in detail by numerous authors (e.g., 14, 30, 56, 57, 63, 66). Some contractors, probably most in fact, take a straightforward approach to bidding and thus estimate their total costs (generally on the basis of past experience), add a certain amount for overhead and profit, and submit their bid. Others, however, prefer to analyze the market and their competitors and present a bid that is oriented to the competitive situation rather than solely to their actual costs. There has been a lot of discussion about

Figure 4.7a: Typical organizational scheme for a small sole proprietorship (source: Ref. 14).

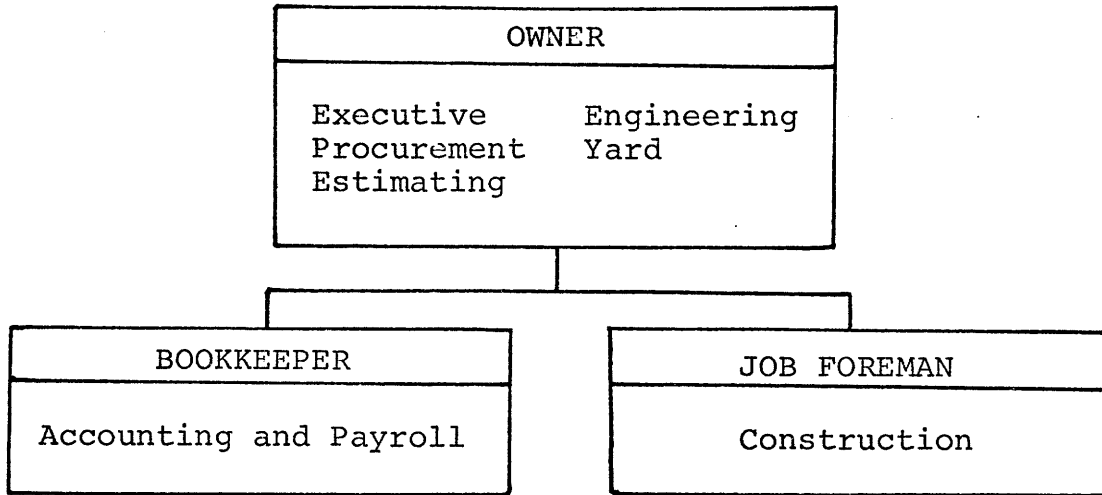


Figure 4.7b: Typical organizational scheme for a small partnership (source: Ref. 14).

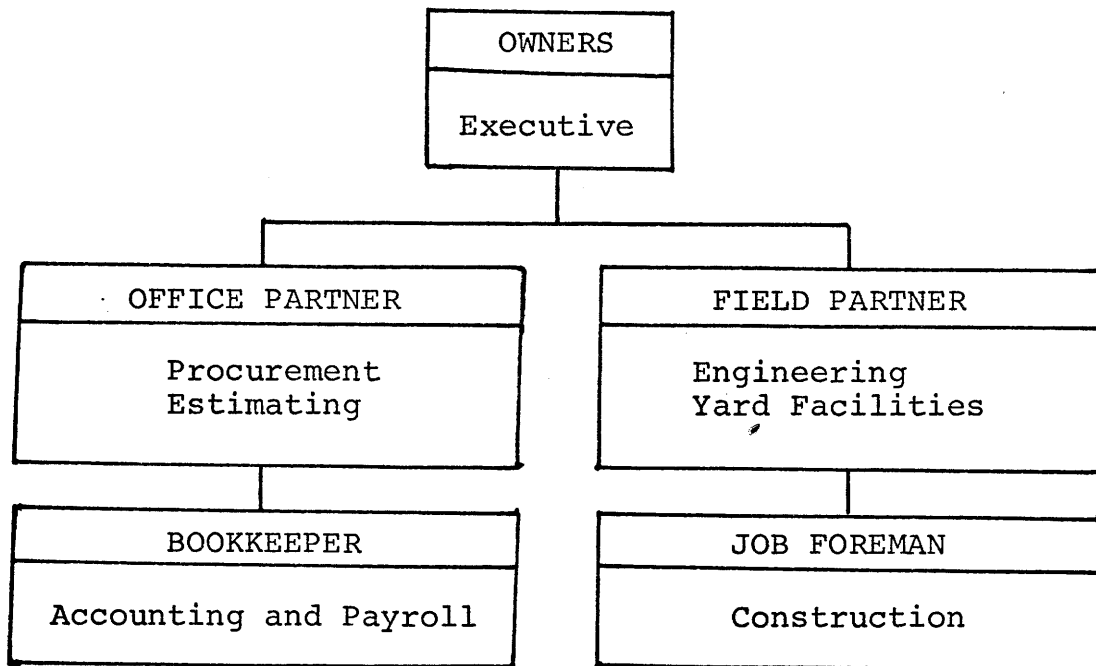
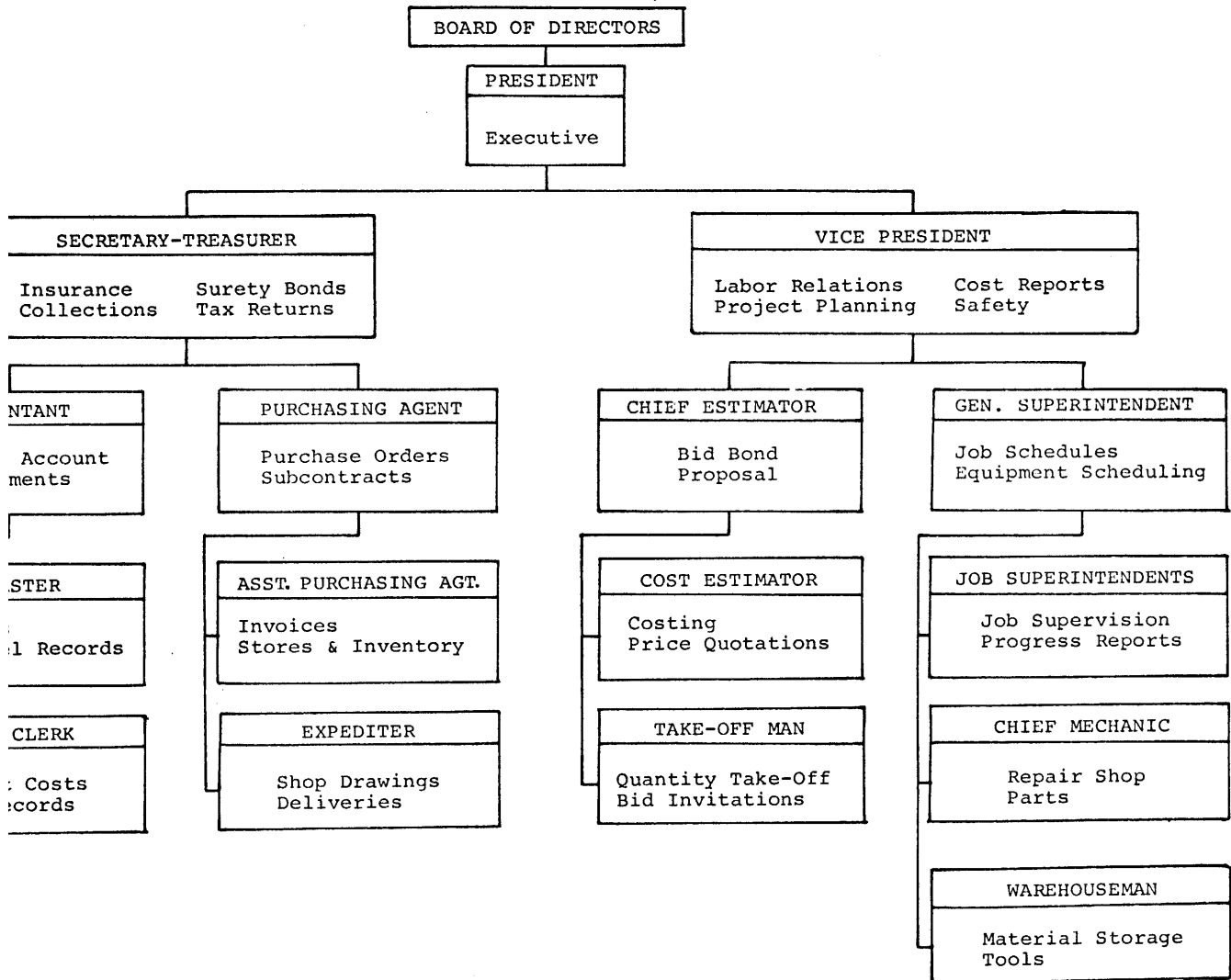


Figure 4.7c: Possible organizational scheme for a moderately large corporation (source: Ref. 14).



bidding strategy, and a number of competitive bidding strategy models and approaches have been developed (see Ref. 5a, h, 14, 32, 41, 52, 53, 57, 65-67), but their actual use in the construction industry is generally believed to be rather limited, and in fact, some of them may not even be generally applicable in the industry.

Once the bid has been submitted and the contract awarded, it is time to begin planning and scheduling the project, though likely some preliminary work was done in this area during the previous phase in order to get at least a rough idea of project duration and scheduling²⁶. There are two basic tools, bar or Gantt charts and network techniques, which may be used as aids to planning and scheduling. Bar charts are simply graphical representations of work versus time without any indication of the interrelationships and interdependencies among operations and of the critical activities²⁷. Thus, their limitations in planning, scheduling, and control are considerable, but they are still widely used because of their simplicity and visual control value (24, 25, 33, 45, 55). Network techniques, such as Critical Path

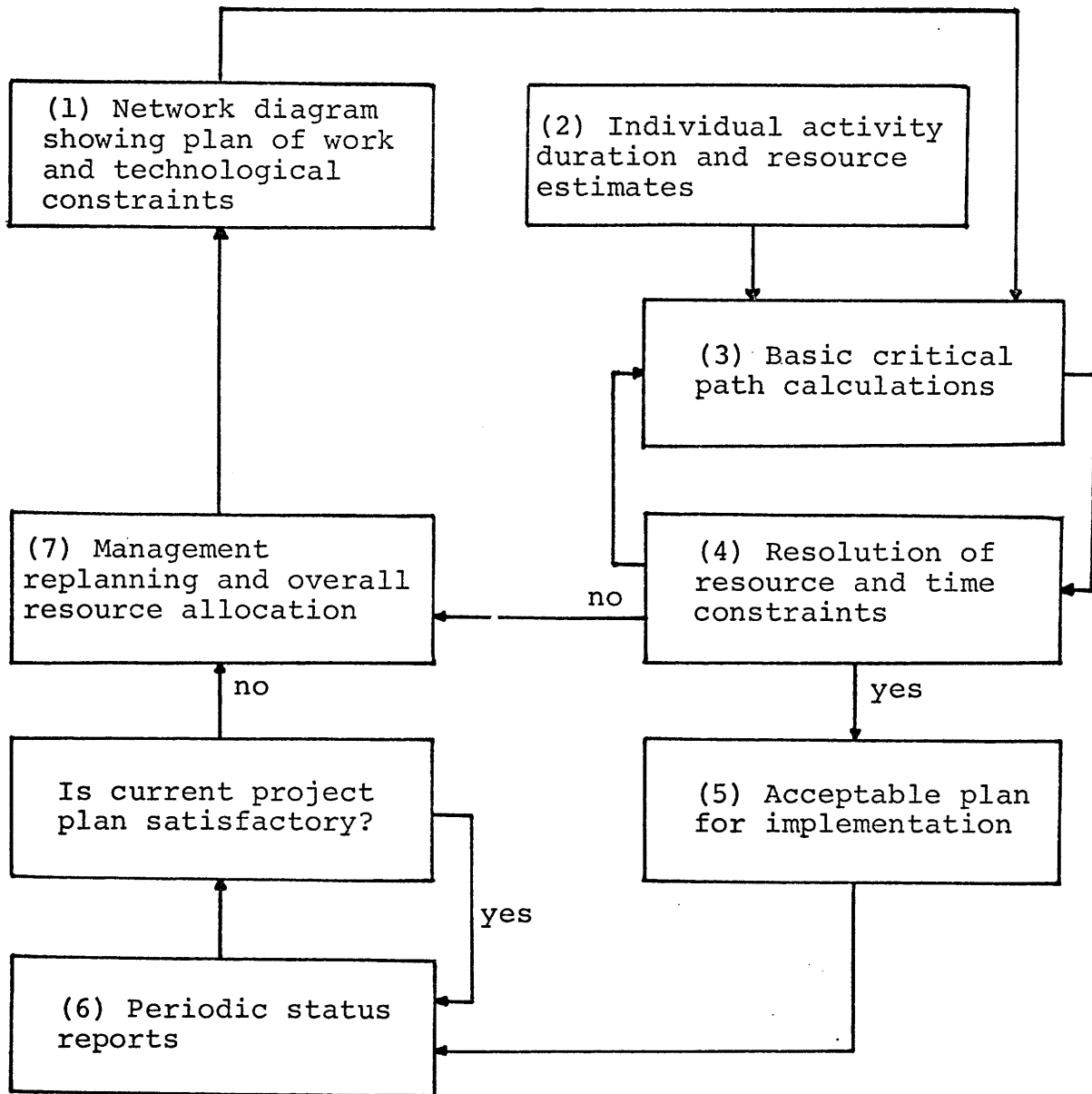
²⁶In fact, a completion date and even a rough schedule often must be submitted with a bid today.

²⁷That is, those activities in which a delay will bring about a delay of the entire job.

Method (CPM) and Program Evaluation and Review Technique (PERT), which were designed to correct some of the deficiencies of the bar chart, are based on network diagrams which graphically portray the interrelationships and interdependencies among all project tasks and an arithmetic procedure which identifies the relative importance of each task in the overall schedule and may be used manually or in conjunction with a computer. Though the adoption of this tool by the construction industry has not been as widespread as was first expected, the majority of large construction firms are using it on at least some projects but mostly only for the planning and scheduling phases. Such limited application is surprising because of the logical benefits associated with integrated planning, scheduling, and control systems for which network techniques are so well suited (see Figure 4.8) (4, 14, 21, 24-26, 33, 45, 49, 50, 55, 56, 66).

Project planning is of utmost importance in project management in that it is concerned with the development of a general scheme of action for the many tasks comprising the project. Out of this phase comes: (1) a project plan which indicates what is to be accomplished, the basic methods to be used, and the basic order of operations and (2) some preliminary consideration of resource requirements and approximate durations for the various tasks. If network techniques are used, then a sequential plan of operations in the form of a network diagram is produced, but if bar charts are used

Figure 4.8: Integrated planning, scheduling, and control using network techniques (source: Ref. 49).



then this order is only intuitively suggested by means of a preliminary bar chart. Scheduling, then, converts this plan into a working schedule which may be in the form of a bar chart, a dated network diagram, or a computer listing of tasks with the associated early and late start and finish dates and float figures. If network techniques are used, then resources, durations, and early and late start and finish dates and float figures are assigned to tasks in the network and adjusted until the best schedule is achieved, in terms of time and cost and within the technological and resource constraints. Consideration of such time-cost trade-offs and resource leveling is essentially impossible with bar charts and even with network techniques can be immensely time-consuming and difficult if a computer is not used (see Ref. 5e, 63 as well as any of those referenced under bar charts and network techniques).

Purchasing, which naturally accompanies planning and scheduling, is an important element in construction management since a contractor adds such a small value to the goods he handles. For a specific job, materials and subcontractors must be purchased, though larger contracting firms may stock some items. As for equipment, particularly the larger pieces, decisions about whether it should be leased or bought are generally made on the basis of the firm's general workload rather than on the basis of any one project, but in either case arrangements must be made so that it will be available

when it is needed (24, 56, 66, 71).

The extent and type of construction work and the conditions (e.g., contractual arrangements and geographic location) under which it is being done determine the general form of a contractor's field organization. On large projects under a cost plus contract and located far from the home or area office, for example, a substantial field management team might be used, and some or all of the associated office functions, such as accounting, payroll, purchasing, and engineering, might be carried out in a field office on the jobsite. Smaller projects, however, which generally cannot support such additional overhead expenditures, would have more of a skeleton crew on the jobsite in order to supervise the construction, and the associated office functions would be performed in the area or home office. Currently, there seems to be an increasing tendency to centralize control at the company level rather than the job level even on large projects (14, 23, 26, 56, 63, 71).

Once construction of the project has begun, monitoring and control of its progress, in terms of time and cost, must be begun. Project cost accounting is an important part of the contractor's overall accounting system. Though its degree of sophistication varies greatly from one contractor to the next, cost accounting and control essentially consists of gathering production figures (labor and equipment times and quantities of work accomplished on various tasks) from the field, using

this data to determine actual costs, and comparing these costs with the estimated or bid costs. If this is done frequently enough, then potential trouble spots (i.e., cost overruns) can more likely be observed and effective corrective action implemented before it is too late. A cost accounting system is also a useful way to accumulate field costs in a form usable by estimators when bidding future projects (14, 56, 73). Network techniques could potentially be very useful in project cost reporting and control, but to date have not been used much for this purpose, probably at least partly because a cost system based on network activities is not consistent with traditional estimating and cost accounting procedures.

Project progress in terms of time must also be monitored and controlled by: (1) periodically comparing actual project progress with the schedule, be it a bar chart, network diagram, or whatever; (2) implementing measures, such as re-scheduling some activities, in order to alleviate trouble spots and keep the job basically on schedule and within its time limit; and (3) occasionally updating the schedule to adjust for major changes. Again, network techniques can be rather useful, for they facilitate the application of the principle of management by exception, by identifying the most critical elements on the plan and thus allowing management to focus its attention on only ten to twenty percent of the project activities (those which most constrain the schedule).

Moreover, they aid in the evaluation of corrective procedures. Updating of network diagrams, however, is time-consuming, especially if a computer is not used. A useful and necessary by-product of these time and cost progress monitoring procedures is the data needed for payroll determination and for the periodic progress reports required by the owner (for more on project monitoring and control in general see Ref. 5d, e, 63 as well as the references listed for bar charts, network techniques, and cost accounting).

The construction industry is generally considered to be rather slow in its acceptance of new management techniques, more so than most other industries. Network techniques, as discussed above, comprise probably the most significant management advance to date in the industry, but even these are not being used to their fullest possible extent. Other sophisticated techniques which are still talked about more than they are used in the industry and which appear to be generally sound and likely applicable to the construction industry are, for example: bidding strategies, time and motion studies, methods engineering, value engineering, resource allocation, operations research, advanced estimating techniques, and systems management techniques. The construction industry is also beginning to use the computer.

To date, the use of computers has largely been limited to large contracting firms because of the high cost of system and program development. However, time-shared remote access

systems and small business computers are becoming increasingly common, more user-oriented languages and programs designed specifically for use by the construction industry are being developed, and the general use of computers is increasing quickly while their cost is decreasing, all of which should make computer use more possible and common for contractors in general in the relatively near future. The computer has long been used to aid contractors in accounting, payroll, and even purchasing procedures, and more recently its use was extended to aid in project planning, scheduling, monitoring, and control through network techniques. Most recently, computer applications in the area of estimating have been developed on the basis of these network techniques. Due to an increasing interest in integrating the many project oriented activities of a contracting firm into a flexible and responsive total management system, some computer-based systems²⁸ are currently being developed which integrate many of these operations within the framework of a network approach.

²⁸For example, Civil Engineering Systems Laboratory (CESL) of the Department of Civil Engineering at the University of Illinois in Urbana is working on a time-shared remote access system which integrates payroll, accounting, estimating, and CPM (5b, 10), and Project Software and Development, Inc., Cambridge, Massachusetts, has extended the M.I.T.-developed ICES PROJECT-I and developed PROJECT/2 which integrates many of the above functions and is particularly sophisticated in the area of project monitoring and control (20, 60, 61).

Much research still remains to be done in this area in terms of improving existing systems, developing new ones, and convincing the industry of their merit (some perhaps in terms of reduced costs but others in terms of improved management control). Of course, each contractor must decide for himself the extent to which computer methods are or are not appropriate on the basis of what they can do for him in his particular situation; the same is true as well for the other new and more sophisticated management techniques beginning to be applied to the construction industry (see Ref. 4, 5b, f, 7, 10, 19, 20, 33, 42, 45, 49, 55, 56, 58, 60, 61, 66 for more on recent and potential advances in the management of construction).

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CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

FOR FURTHER RESEARCH

5.1 Summary and Conclusions

Throughout the course of this thesis, numerous issues facing the construction industry in the fields of economics, labor, and management and organization are presented and some of their causes, effects, and interactions noted along with some solutions proposed to alleviate the undesirable situations. The issues that are raised are topics of considerable concern to the construction industry and warrant substantial further consideration and investigation in order to ascertain: (1) whether the industry is doing the best it can under the circumstances and (2) whether conditions external and/or internal to the industry can and/or should be altered somehow to improve the industry's operation.

Within the field of economics as related to the construction industry, the first issue raised is that of a fluctuating demand market, a situation which has long confronted the industry and is a pervasive influence throughout the industry's operations. Prices of construction products are another area of concern, for these generally tend to rise

faster than those in the rest of the economy, especially in recent years. Whether productivity (labor, capital, and total factor) is really as low as reputed is subject to question because of the difficulty of measuring this index with any accuracy. The least that should be done is to try to develop improved measuring techniques, though it does seem that productivity and its growth rate in construction are at least somewhat behind those of other industries and need attention in this respect as well. Still other issues facing the industry in the economics area are whether the construction industry is growing as quickly as it could and/or should and whether the profitability of the industry needs to be quite as low as it is. Finally, the financing of construction projects, both while they are being built and once they have been completed, is a unique feature of the industry and an important issue, particularly with regard to the availability and cost of money and its impact on the industry.

Construction is still a comparatively labor-intensive operation, and for this reason labor and the issues associated with it are rather important to the industry. Though collective bargaining is generally designed to, and does in many respects, help in labor relations, it may be directly or indirectly associated with certain problems. For example, the construction industry is confronted by innumerable strikes

which occur as a result of a breakdown in the system of industrial relations. Furthermore, the decentralized nature of collective bargaining along craft, geographic area, and industry sector lines has some undesirable side-effects. For various reasons, the major one being that demand for construction is so unstable, the industry has always relied upon a floating labor force, and thus the availability of labor is a matter of constant concern to the industry. Closely associated with this is the industry's utilization of its labor force and the serious problem of intermittency of employment which is a consequence of under-utilization. One of the major contributors to the rising prices of construction products is rising wages without corresponding rises in labor productivity to offset them, and thus concern over wages and labor productivity comprise the final two issues confronting the industry in the area of labor.

The first issue considered in the field of management and organization is concerned with various features of the construction industry, many of which arise in large measure in response to the requirements placed upon the industry but which are not necessarily best for its continued existence. An agglomeration of small and specialized firms (which, for example, serve a local market, lack vertical integration, rely on low capitalization, do little mass production, ex-

hibit little in the way of economies of scale, and are transient) comprises the construction industry, which is often not even recognized as an industry because of this diverse nature. There is, however, some trend away from these characteristics with the increasing role of the corporate form of organization and the formation of conglomerates in the industry. Such changes and their potential impacts are certainly of concern to the industry and need to be evaluated. Another matter facing the industry in the area of management and organization concerns the roles, responsibilities, and interactions of participants (e.g., owners, architects, engineers, general contractors, specialty contractors, and suppliers) in the construction process and how these are changing and should change along with the development of new participants (e.g., architect-engineers, design-constructors, and construction managers). Because the process of competitive bidding is often blamed for many of the industry's difficulties, this, in conjunction with the variety of contractual arrangements and necessity of bonding and insurance in the industry, is yet another topic of interest. Finally, construction is a project oriented business, a feature which sets it apart from many other industries, and thus management's functions are also largely project oriented. Managerial efficiency and how management's operations can be improved are of considerable concern to the

industry, especially since a frequent, and often justifiable, claim is that site inefficiency and other industry problems are a consequence of poor management.

5.2 Recommendations for Further Research

Although manifestations of many of the issues discussed above and of technology issues have long been recognized by the industry, the undertaking of research, experimentation, and other strategic investments directed toward their comprehensive analysis and resolution have held little appeal for those in the industry. The research that has been done has mostly been in the area of technological innovations and has been undertaken mainly by individual industry segments, such as material and equipment suppliers and manufacturers, whose objectives are narrowly defined and self directed. The lack of research at the firm level is rather understandable given the practice of competitive bidding which leaves little room for such overhead expenditures, the overall generally small and fragmented nature of the industry, and the fact that there is little government support. Moreover, the industry's extensive fragmentation makes it difficult to do meaningful research within the industry, for it is virtually impossible to identify an appropriately objective and broad-based internal focal point. Nevertheless,

the industry could, and should, do some research, certainly more than it does now, especially in the area of technological change, but it seems some sort of incentive is needed as well as significant improvements in the procedure for acceptance of innovations and in the system of collecting, digesting, and disseminating research results. More broad-based research should be done at the university or government level, but the industry must also have a part in it if the research is to be assured of relevance and if the industry is expected to accept the results and perhaps change in accordance with them.

Yet another impediment to increasing research in the field of construction is the paucity of usable industry statistics. Although there actually is a fair amount of statistical information about construction available from a variety of sources, there is a lot more that would be useful to have and really is necessary if the industry's problems are ever to be studied and hopefully resolved (see Table 5.1). Furthermore, much of the available data is too aggregate, and much is also incompatible. Thus, the collection of data must be increased and at the same time its compatibility improved, and the best way to do this seems to be to do the collecting, correlating, and disseminating of the data through a central agency, perhaps as a part of the government. Research results might also best be handled in

Table 5.1: Summary of construction statistics needed, as recommended by the Subcommittee on Construction Statistics (of the Cabinet Committee on Construction) in late 1970 (source: Sol Swerdloff, "Surveying the Gaps in Construction Statistics," Monthly Labor Review, Vol. 94, No. 2, Feb. 1971, pp. 33-37).

- A. Compensation and industrial relations statistics
 - 1. Survey of straight-time hourly earnings by occupation in the contract construction industry
 - 2. Survey of union wages and hours in the heavy construction industry
 - 3. Quinquennial survey of annual earnings and hours in the contract construction industry
 - 4. Analysis of union contracts and constitutions to obtain statistics on union practices
 - 5. Examination of the major characteristics of collective bargaining agreements
 - 6. Analysis of information on work stoppages and examination of dispute settlement machinery
 - 7. Analysis of health insurance and pension plans in the industry

- B. Price and cost statistics
 - 1. Development of output price indexes for major types of construction activities
 - 2. Development of price indexes for mobile homes
 - 3. Development of price indexes for construction materials

- C. Financial statistics
 - 1. Public construction: Development of a series of statistics to measure flows of intergovernmental payments to aid construction
 - 2. Private construction: Development of an exploratory series to show the sources of financing for new private multifamily and nonresidential construction

(continued)

(Table 5.1 continued)

- D. Employment, manpower requirements and supply, training, and safety statistics
 - 1. Additional studies of labor and material requirements
 - 2. Analysis of supply of and demand for construction manpower
 - 3. Development of data on the number and types of work injuries and their causes and costs

- E. Statistics on inventory of structures and inventory changes
 - 1. An annual housing inventory
 - 2. An inventory of nonresidential buildings and structures and the uses of land
 - 3. Development of measures to identify substandard housing
 - 4. Development of data on housing vacancies
 - 5. Studies to measure the use, durability, and life cycle of mobile homes

- F. Output statistics
 - 1. Improvement of data on value of new construction put in place
 - 2. Surveys of characteristics of new nonresidential construction projects
 - 3. Review of series on the outlook for housing construction
 - 4. Development of information on new methods or systems of construction
 - 5. Surveys of maintenance and repair of nonresidential buildings
 - 6. Survey of geographical location of new mobile homes

- G. Industry statistics
 - 1. Annual survey of construction firms

this manner.

As for recommendations for further research arising more directly out of this thesis, there are four. The first is the identification of the issues related to technology, thus completing the picture of the industry in terms of the issues facing it.

The second is the need to do research on a micro level. That is, to narrow the scope and do an in depth analysis of a single issue or a few related ones. Such an analysis would encompass studying the relevant causes, effects, and interactions, both internal and external to the industry. This should lead to an increased understanding of the industry and its functioning and perhaps to the proposing, testing, and eventual implementing of various means for improving some features of its operation.

Such a micro analysis by itself, however, may not be sufficient because the issues facing the industry are so intertwined that a picture of the overall industry dynamics may additionally be necessary. Thus, the third recommendation is to do research on a macro level, whereby the inner-workings of the industry as a whole can be studied along with the influences from the industry's environment. Micro analyses done in conjunction with a macro analysis seem to provide the most promise of producing meaningful and useful results, though each alone has merit as well. A tool that

would likely prove to be most useful in analyses of either sort is a variety of modeling techniques.

The final recommendation is a study of the possibility of developing a national policy toward construction planning. As was repeatedly emphasized throughout the thesis, fluctuations in the demand for construction are a pervasive influence and result in many of the industry features which are perceived as undesirable. Control over construction volume is now totally haphazard, and in fact, some of the government's actions, such as monetary policy, serve to augment the fluctuations. Thus, the idea of a national policy toward construction planning is an interesting one and merits serious contemplation and study. And, if it turns out to be feasible, desirable, suitable, and potentially effective, such a policy might even be implemented and thereby at least partially alleviate many of the industry's problems, hopefully without creating too many new ones.