RICE UNIVERSITY

The Architect and Time-Cost Factors in the Construction Industry

by

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ABSTRACT

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Although architects may never again completely regain their past image as Master Builders, they must recognize a new and broader scope of practice or lose their viability in the construction marketplace. By taking a new and broader view of project scope, the architect will begin to see the total meaning of creative cost control management. He will begin to appreciate the total financial support required for project completion, rather than emphasize a relatively meaningless preoccupation with per square foot costs of construction. With that total picture, he can then respond creatively and definitively—using his newly found knowledge as a key to project control.

In an attempt to define and analyse the total project cost problem, with special emphasis on architectural practice implication, the following items are discussed:

1. The trend in construction costs and the need for management control.
2. A description of architectural services and types of architectural firms in existence today.
3. A survey of innovative architectural office practice management techniques as they affect fees and total costs, and a discussion of total personnel involvement in future creative management practice.
4. The implications of total scheduling, including a case example showing the effect of increased costs on investment quality.
5. Investigation of new client/contractor/owner relationships in total project planning and management.
6. Investigation of contract bidding and award factors
Abstract cont.

The Architect and Time-Cost Factors in the Construction Industry

with time-cost implications, including bidding climate, seasonality, bid-rigging, and phased scheduling.

7. A survey of other major time-cost factors over which the architect has little or no control.

8. A case study of the effects of time condensation on total project financing.

In this thesis, it is also shown that non-design factors may have far greater influence on total project costs than materials and methods selections. These same factors have an amplified impact on a project's investment quality.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF ILLUSTRATIONS</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>v</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER ONE: ELEMENTS OF CONSTRUCTION COST CONTROL</td>
<td>2</td>
</tr>
<tr>
<td>CHAPTER TWO: THE IMPORTANCE OF MANAGEMENT</td>
<td>9</td>
</tr>
<tr>
<td>CHAPTER THREE: ARCHITECTURAL PRACTICE TODAY</td>
<td>12</td>
</tr>
<tr>
<td>CHAPTER FOUR: INNOVATIONS IN OFFICE PRACTICE</td>
<td>17</td>
</tr>
<tr>
<td>- Budgets</td>
<td></td>
</tr>
<tr>
<td>- Direct Costs</td>
<td></td>
</tr>
<tr>
<td>- Indirect Costs</td>
<td></td>
</tr>
<tr>
<td>- Fees</td>
<td></td>
</tr>
<tr>
<td>- Creative Management</td>
<td></td>
</tr>
<tr>
<td>CHAPTER FIVE: TOTAL SCHEDULING</td>
<td>40</td>
</tr>
<tr>
<td>- Financial Planning</td>
<td></td>
</tr>
<tr>
<td>- Office Production</td>
<td></td>
</tr>
<tr>
<td>- Network Scheduling</td>
<td></td>
</tr>
<tr>
<td>CHAPTER SIX: NEW CLIENT/CONTRACTOR/ARCHITECT RELATIONSHIPS</td>
<td>52</td>
</tr>
<tr>
<td>- The Architect and the Owner</td>
<td></td>
</tr>
<tr>
<td>- The Architect and the Contractor</td>
<td></td>
</tr>
</tbody>
</table>
**Table of Contents Cont.**

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHAPTER SEVEN:</strong></td>
<td>CONTRACT AWARDS</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Climate—Seasonality and Bidding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bid-Rigging</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Types of Contracts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staged Contracts</td>
<td></td>
</tr>
<tr>
<td><strong>CHAPTER EIGHT:</strong></td>
<td>OTHER TIME-COST FACTORS</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Governmental Factors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Labor Unions and Productivity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depreciation During Construction</td>
<td></td>
</tr>
<tr>
<td><strong>CHAPTER NINE:</strong></td>
<td>TIME AND COSTS</td>
<td>92</td>
</tr>
<tr>
<td><strong>SUMMARY</strong></td>
<td></td>
<td>99</td>
</tr>
<tr>
<td><strong>FOOTNOTES</strong></td>
<td></td>
<td>102</td>
</tr>
<tr>
<td><strong>BIBLIOGRAPHY</strong></td>
<td></td>
<td>109</td>
</tr>
</tbody>
</table>
# LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Diagrammatic Illustration of Feasibility Study</td>
<td>43</td>
</tr>
<tr>
<td>2.</td>
<td>Linear and Fast-Track Scheduling</td>
<td>60</td>
</tr>
<tr>
<td>3.</td>
<td>Office Building Income and Expenses</td>
<td>94</td>
</tr>
<tr>
<td>4.</td>
<td>Office Building Financing—48-Month Construction Period</td>
<td>95</td>
</tr>
<tr>
<td>5.</td>
<td>Office Building Financing With Partial Occupancy During Last 12 Months of Construction</td>
<td>96</td>
</tr>
<tr>
<td>6.</td>
<td>Office Building Financing With Construction Period Reduced to 36 Months</td>
<td>97</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table: .................................................. Page

I. Fifteen (15) City Building Cost Index
   Comparison, 1961-1970........................................ 3
II. Overtime: Actual Cost vs. Payroll Cost................... 28
III. Comparison of Investment to Illustrate
     Impact of Construction Cost Increases.................... 44
IV. Comparison of Investment to Illustrate
     Impact of Construction Cost Increases (cont.).......... 46
V. Comparison of Investment Profitability
   Figures with Increased Capitalization-
   Loan Rate................................................... 47
VI. Building Equipment with Average Useful
    Life of Fifteen (15) Years or Less....................... 90
VII. Office Building Financing.................................. 93
INTRODUCTION

"The future has a habit of suddenly and dramatically be¬
coming the present."—Roger Babson

To say that the architect's role has changed over the past
100 years is an obvious redundancy; but, the fact remains. A
century ago, the architect was hired as a status symbol to surround
his clients with cultural trappings, and to veneer building
exteriors with ornament. The architectural profession today is
struggling to discover its identity and define its future role
in the construction industry.

The present overlap of activities and professions in the
industry, with the attendant redefinition of responsibilities has
created a situation that demands a new analysis and definition of
traditional architectural parameters of practice. In other words,
the architect must seek to define his professional identity.

—Forrest Wilson, editor of Progressive Architecture, ex¬
presses the challenge:

The question is not whether the architect should in¬
volve himself in all facets of his profession, from
finance to construction management; he cannot avoid
this involvement. The very enormity of today's
urban affliction forces him to assume a new set of
responsibilities having little or nothing to do with
his basic professional training in the art of building. 1

Unless the architect searches for—and finds—his role in the
market place, he may be in danger of losing completely his posi¬
tion as a decision-maker in the construction process.
CHAPTER ONE
ELEMENTS OF CONSTRUCTION COST CONTROL

"Experience is a good teacher but a queer old soul; she gives the test first, then explains the lesson."—Wesleyan Methodist

In spite of traditional jokes to the contrary, architects have usually considered the ability to determine and control costs as one of their prime responsibilities. Historically, "over-the-budget" projects have been few compared with the total volume of building construction. But today's facts and figures tell a different story.

During the last four decades, the building industry has experienced the gamut of economic ups and downs. The joy ride to the dizzy heights of the late 20's was followed by the precipitous drop into the Depression years. After a brief recovery in the late 30's, World War II brought building construction to an almost complete standstill. Since 1947, with the exception of the Korean War, construction volume has gradually increased. So have costs—but at a highly progressive rate of increase in recent years. That this rate of increase in building costs is, in fact, alarming in an "historical context" can be illustrated by comparing building cost indexes since 1961. Fifteen U. S. cities have been selected for comparison, representing a broad range of population size and geographical location. (See Table I)

From Table I, it is obvious that building costs have increased markedly over the past decade in all cities cited, ranging from a low of 25% in Des Moines to a high of 37% in Detroit. Looking at the average figures for the fifteen cities, it is apparent that the largest increases have occurred in the last several years. In fact, almost two-thirds of the cost increase during the last decade has occurred in the past three years. Even more definitively, one-third of the 10-year increase has taken place during the last year.

Phrasing it differently, the 1960 construction dollar was worth 90¢ in 1965. By 1970, it had shrunk to only 68¢.
<table>
<thead>
<tr>
<th>Year</th>
<th>Boston, Massachusetts</th>
<th>Burlington, Vermont</th>
<th>Chicago, Illinois</th>
<th>Cincinnati, Ohio</th>
<th>Dallas, Texas</th>
<th>Denver, Colorado</th>
<th>Des Moines, Iowa</th>
<th>Detroit, Michigan</th>
<th>Houston, Texas</th>
<th>Kansas City, Missouri</th>
<th>Los Angeles, California</th>
<th>Miami, Florida</th>
<th>Minneapolis, Minnesota</th>
<th>Portland, Oregon</th>
<th>St. Louis, Missouri</th>
<th>Average (15 cities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>100</td>
<td>100</td>
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<td>100</td>
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<td>1962</td>
<td>102</td>
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<td>101</td>
<td>103</td>
<td>102</td>
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<td>103</td>
<td>104</td>
</tr>
<tr>
<td>1966</td>
<td>109</td>
<td>108</td>
<td>112</td>
<td>108</td>
<td>112</td>
<td>109</td>
<td>112</td>
<td>112</td>
<td>112</td>
<td>112</td>
<td>112</td>
<td>112</td>
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<td>114</td>
<td>112</td>
<td>113</td>
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<td>112</td>
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<td>116</td>
<td>122</td>
<td>121</td>
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<td>127</td>
<td>119</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>1969</td>
<td>118</td>
<td>114</td>
<td>121</td>
<td>116</td>
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<td>125</td>
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<td>125</td>
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<td>130</td>
<td>129</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td>1970</td>
<td>120</td>
<td>114</td>
<td>121</td>
<td>118</td>
<td>121</td>
<td>119</td>
<td>129</td>
<td>120</td>
<td>120</td>
<td>131</td>
<td>127</td>
<td>130</td>
<td>132</td>
<td>130</td>
<td>135</td>
<td>133</td>
</tr>
</tbody>
</table>
Historically and traditionally, materials and labor have been emphasized as the two prime building cost components. Architects have spent their professional lifetimes judging the relative merits of various materials and methods of construction, then selecting and specifying the most "economical" for incorporation in the building. The constructors, on the other hand, have spent their respective business lifetimes trying to find—and substitute—less costly materials and methods. In the process of designing, selecting, specifying, bidding, submitting, approving, buying, and building—the industry has continued to emphasize labor and materials cost components almost exclusively. As a result, some very major construction cost factors have been largely ignored.

As illustrated in the 10-year fifteen-city building cost study (Table I), inflation has struck the building industry. Newspaper and magazine articles are filled with news of "inflationary" wage settlements in the construction industry. Although construction materials and equipment are not escalating as fast as labor's 15% to 20% annual rate of increase, materials will climb at an accelerating pace in the next two or three years if only because industrial unions will emulate construction trades in bargaining for bigger pay hikes. Contractors and architects agree that soaring general building prices are the result of such increases. Turner Construction Company and George A. Fuller, two of the nation's largest building contractors, reported 9.2% and 8.3% general building price increases, respectively, for the year ending April, 1970. Smith, Hynchman, and Grylls, a large A-E firm bases in Detroit, calculated the general building price rise at 11.2% for the same period.

The forecasts are chilling: inflation seems to have become a permanent fact of life in the construction industry. Chief estimators for 30 leading construction contractors forecast increases of up to 1.5% per month for 1971. Three-year construction labor contracts already negotiated indicate a similar, or increased, rate of cost acceleration at least into 1973. In fact, Engineering
News Record predicts that "the first three years of the 70's will shrink the construction dollar as much as did the whole decade of the 60's." 3

In facing the almost certain fact of continued inflation, the factor of Time as a cost component becomes increasingly important. For years, the construction industry—and, particularly, the architectural profession—has repeated the "timely" aphorisms—"time is money" and "time is of the essence". These two slogans deserve more than lip-service; they very well may provide the key to the future of the industry. As an industry, and especially within the design professions, little meaningful attention has been given to the implications of Time. In dollars-and-cents building cost terms:

If the current rate of annual increase is sustained, building costs will double in eight years or less. Today's multiple-story office building that costs $30.00 per square foot was $10.00 in 1941 and will be $60.00 per foot in 1978. The same arithmetic applies across the board: today's costs are three times the 1941 level and will be six times that level by 1978 unless the rate of increase is curbed. 4

To put it simply, a client will get more building per dollar by using the least amount of elapsed time in the total project—planning, design, and construction. Certainly, any Chicago client/owner would prefer paying $6.55/hour for a bulldozer operator today than $11.05/hour (the projected wage rate under already negotiated contracts) in 1973. 5 Yet, chances are, using present industry methods, a large-scale building project started today will probably not be completed by 1973. In fact, many projects in the preliminary planning discussion stage now, will probably be finished at the doubled construction costs predicted for 1978. It would also seem possible—if not probable—that any management method that could yield substantial time reduction would also yield cost savings far greater than any material selection or labor method employed.
Another construction cost component that has been virtually ignored by the industry, and particularly the architectural profession, is the **cost of financing**. During the past several years, however, thanks to the news media, interest rates, mortgage loans, and other financial investment terms have become almost household words. But the implications to the construction industry are just starting to be investigated.

Traditionally, the architect has chosen to divorce himself from the more mundane aspects of the business marketplace. "Financing" was a distasteful word and duty relegated to the Owner/Client. "Profit" was a word acknowledged as a part of the business community, but **not** as a prime requisite to successful architectural practice. The picture of the slightly seedy (but genteel) private practitioner, complete with pipe, bow tie, and imaginary beret was too often an accurate caricature of the professional architect of yesteryear.

But today, the profession is faced with "money" reality. No longer is "profit" considered an epithet. Today's architect is becoming increasingly involved in financial planning and total project financing. It is an unfortunate statement of fact that few—with the notable exceptions of the Charles Luckmans, Victor Gruens, and Robert Hastings of our profession—have grasped the total impact of genuine involvement in money planning. Even more sadly, there has been little or no training given—or available—for architects in the financial field. As a result, owner/client requests for mortgage loan source information, economic project studies, and financial feasibility presentations have sent the profession into a mad scramble for information. Seminars, articles, case studies, and practice profiles, describing the "professional-ethical" implications of business emphasis have almost inundated the profession. This initial deluge has made one fact perfectly clear: The subject of project financing is a broad one, demanding explicit expertise. It would therefore seem that the architect's greatest service to the owner/client would be in a technical
advisory capacity, leaving the detailed financing problems to the already-established financing experts.

This does not mean, however, the architect has no opportunity or responsibility in the financial planning of a total project. On the contrary, the financing aspects of the total building process demand his acknowledgment, attention, and accommodation. The implications of loan interest rates, construction financing, cash flow, equity return, and depreciation are only a few of the possible problems that may affect the total cost of a project far more profoundly than the more traditional ones of materials and methods of construction. (As an example, a recent article in the AIA Journal states that 43% of the cost of housing is in financing.) Therefore, the ramifications of financial management to total project planning would seem to be a highly logical area of interest and investigation—and familiarity with financing methods and terms to be almost mandatory for the business-oriented professional practitioner.

Should today's architect "dirty his artistic hands" in the financial aspects of total project planning? Or should he remain aloof in hopes that such problems will somehow go away? Or should he assume that old traditional attitude of "let George do it"? Bernard J. Grad, FAIA, and a partner in the architectural firm of Frank Grad & Sons, Newark, New Jersey, gives the following answer—and challenge:

In recent months, the press has reported project after project which has exceeded its budget, some by as much as 100 per cent. These escalations have literally shocked public officials as well as those responsible for the original cost estimates.... What should be of the greatest concern to all of us who make up the construction industry is that we are on the inevitable road to economic unfeasability if the present trend (of runaway costs) continues.... They (clients) are fast reaching the day when they will not be able to afford the cost of erecting new buildings.
In the cold light of reality, it is time to act—not talk—about costs... What a calamity it would be that with all of our knowledge and ability, we would be contributing to an entirely unnecessary economic collapse of our basic industry because of default.
CHAPTER TWO
THE IMPORTANCE OF MANAGEMENT

"Civilization advances by extending the number of important operations we can perform without thinking about them."—A. N. Whitehead

While construction costs have been increasing at an alarming rate, the complexity of the building industry has kept pace. The construction "team" has been expanded to include new members involved in the total building process. Traditionally, the industry has acknowledged the Owner (public or private), the Design Professionals (architects, engineers, and other technical personnel) and the Constructors (contractors, subcontractors, suppliers, producers or manufacturers, and building trades) as the primary elements in the building process. Belatedly, the industry has finally acknowledged the importance of other "team" members and their meaningful contributions to total project planning. These include the mortgage and finance agencies (savings and loan associations, banks, and some insurance companies), real estate services (brokers, operators, appraisers, counsellors, and building managers), and governmental agencies (building officials, planning and zoning boards).

That the architect must find a new and expanded role on today's construction team is all too apparent if facts are honestly faced. Charles Luckman, FAIA, long a proponent of expanded architectural services and business-oriented professional practice states the problem very succinctly:

How far the "architect as designer" concept has failed... might be measured by the fact that in 1966 architects took part in only one-third of the $72 billion worth of construction in the United States. The remaining two-thirds, or $48 billion, was done by package dealers, contractors, engineers, and by designers who possess poetic license but not architectural license. It is not difficult to pin down the responsibility for this, but, like a hot poker, nobody wants to grab it.
Long before Luckman's challenge in 1967, the A.I.A. had already tried to grab the "hot poker". Since that time, the institute has financed studies and published numerous guides on the need for expanded, comprehensive services by the architect. In attempting to describe the architect's new role as a reflection of the industry's demands today, the A.I.A. made the following statement in 1963 as a part of their guidelines to "Comprehensive Services":

Changing times have created conditions in which the assembly of land, the financing of construction, the operations to be housed, and similar considerations often determine whether a project will be undertaken; as well as determining in large degree the nature of the design and construction of the project. If the architect is not involved in these considerations, he may have to design and build according to decisions developed previously by others. Architects may not actually perform services in such fields as these, but they may well act as the agents of their clients in procuring and coordinating the necessary services, thus retaining the required quality, esthetic control, and coordination necessary to assure the client of correct and unified results.

Since this 1963 statement, the A.I.A. has proceeded to reinforce their views regarding construction costs. The new Standards of Professional Practice state that an architect "shall keep his client informed with competent estimates of probable costs." This step can be interpreted as a move on the part of the architectural profession toward completely responsible control of costs, efficient cost estimating, and full disclosure of the facts to clients. For the first time in its history, the A.I.A., speaking for the architect through its organizational standards, states that the architect "expects to be the master of the costs of construction and that he expects to keep construction costs within a reasonable range."

George Kassabaum, former president of the A.I.A. and partner in Hellmuth, Obata, and Kassabaum, a successful St. Louis architectural firm, admits to the charge that architects sometimes have "too little regard for their client's dollars. We often fail to
consider carefully enough the potential costs of a project, or we simply don't take seriously enough our responsibility for predicting and controlling construction costs."

Too often, the charge to "control costs" evokes an image of stifling limitations to architectural practice. But perhaps the architectural profession has been too narrow in its views regarding cost management. It just may be possible that truly creative cost control could make a budget work for an architect, not against him; ensure quality, rather than compromise it. Charles Luckman says:

It is clear that what we desperately need to do today is to embrace the concept of "creative cost control". I use the word "creative" in this regard because we should make the budget work for us, not against us... Among successful clients—meaning those able to afford architects—it would be difficult to find a case in which budgeting, estimating, projections, record-keeping and analyses of costs are not highly developed, considered of utmost importance and handled in a manner consistent with their importance. For the most part this is not currently true in architecture.

But it should be, for the results of such a process can be better design, better planning, more efficient professional services and more satisfied clients—in a phrase, better buildings; buildings that come within their budgets, not through arbitrary decisions made just before or after bidding, but because of the application of creative cost control from the very beginning of services right through to the certificate of occupancy. Nothing could add more to our (the architectural profession's) luster, to our volume, to our profits.

Therefore, using Luckman's statement as a foundation, it shall be the proposition and purpose of this thesis to investigate the professional's role in controlling "time-money" costs—and quality—through effective management; to probe the role of the professional in total project involvement; and to substantiate, insofar as possible, that the implications of certain factors heretofore largely ignored by the professional may have by far the greatest effect on total project costs.
"In all science, error precedes the truth, and it is better it should go first than last." — Havelock

Many architectural firms have already expanded their services beyond what is usually thought to be the accepted area of architectural practice. These services range from the simplest combination of varied talents to many forms of complex joint ventures. Although the concept of expanded comprehensive services by architects is not new, the American Institute of Architects has, during the past several years, attempted to define and categorize those services being offered by the profession. To imply that most, or even many, of these services are being offered by existing architectural firms would be a misrepresentation. But, the fact cannot be avoided that the leading edge of professional practice today is oriented toward expanded comprehensive services.

The A.I.A. has classified these services into six groups as follows:

1. Project Analysis Services
2. Promotional Services
3. Design and Planning Services
4. Construction Services
5. Supporting Services
6. Related Services

Project Analysis Services—Feasibility studies, financial and location analysis, and programming form the basis for an architect's design services. Although programming has long been considered as an essential aspect of contemporary architectural practice, it has only recently reached a status of separate emphasis as an additional service justifying additional fees. In recent years, feasibility and locational studies have also become
customary additional services for many firms.

Promotional Services—Providing assistance in promotional services for a project has been a common practice among architects. The architectural firm is uniquely qualified to render services in connection with promotional designs, drawings, brochures, and special exhibits involving real estate and land assembly, financing, promotional design and planning, public relations, and communications. Slide show presentations, educational lectures, guest editorials, and discussion panels represent some of the tools available to the architect-promoter.

Design and Planning Services—These include, in part, the familiar basic architectural services: schematic design, design development, working drawings and specifications. In addition, since the architect is trained in the organization of functions and the spaces they require, he very often can offer exceptionally clear insights into a client's operations, procedures, systems and processes. More and more architects are being hired as systems engineers and management consultants for the manufacture of new products in the building industry.

Construction Services—Again, many of these have been traditionally considered as basic services. However, recent trends have indicated that the architect must assume additional responsibilities and provide additional construction services to preserve control in matters of esthetics and quality during construction. So—in addition to the traditional services of assisting in the contract bid and award of contracts, job visitation, administration and accounting—the architect is now being called on to provide an ever-increasing range of construction management services and responsibilities.

Supporting Services—Many of the "supporting" services have grown so fast that they now justify an emphasis as a full-time professional activity. Formerly hidden under the architect's all-inclusive umbrella of services, such areas as engineering,
urban and regional planning, landscape architecture, site planning, fine arts and crafts, interiors and furnishings, sanitary and utility planning, acoustics, lighting, and traffic design—to mention only a few—now demand full and equal status as contributory planning services. Due to the complexity of today's building projects, many special consulting services may also be required involving special building types, economics, market analysis, and merchandising analysis—especially in the rental-real estate field.

Related Services—Architectural services are very often demanded in fields other than those directly concerned with individual buildings or environmental projects such as educational and industrial consultation, research and testing, products design, architectural graphics, and prefabrication processes.

In order to provide the range of comprehensive services outlined above, the A.I.A. has attempted to define and describe the various firm organizations and operations now existing.

Basic Firm—This is the traditional organizational form of most architectural offices. With an emphasis on a broad and generalized practice, these basic firms have hired special consultants as required to answer building problem requirements.

Specialist Firm—This type of firm specializes in rendering basic services for particular building types—hospitals, schools, office buildings, etc. However, specialization by function is becoming more and more common, i.e., offering programming and design, or production and construction administration, as specialized services to the client.

Consulting Firm—This type of firm is a natural outgrowth of the specialist firm described above. Very often, architects will engage other architects to reinforce their own services or provide missing talents in particular areas. Firms that have built their reputations as functional specialists in programming, design, production, cost controls, or construction management find
themselves devoting an increasing amount of time as Specialist
Firms in consultation with other architects.

Cooperative Firm—Demands of large projects have led some
firms to band together in a cooperative—or joint venture—status,
sharing overhead costs, office facilities, and personnel without
complete disruption of existing office policies and procedures.

Comprehensive Firm—Usually representing the "giants" of the
profession in size, at least, these firms stock their organiza-
tions with the personnel talents necessary to perform all archi-
tectural services.

The A.I.A. also describes how the smaller Basic Firm can
provide a range of comprehensive services on a par with the larg-
est firm by using the "core" concept. This concept involves a
series of working agreements with outside consultants to the
Core Firm comprised of a minimum number of highly creative and
productive people who perform most of the purely architectural
functions.

With the plethora of expanded and comprehensive architectural
services described, and the range of existing architectural firm
types available to provide them, it would seem that the profession
has the situation well in hand. But the imaginative
use and application of the tools and methods available have been
sadly lacking. Architectural management methods have not kept
pace with business demands.

Even the federal government, notoriously slow to react to
prevailing conditions, has recommended sweeping changes in build-
ing contract procedures. The Department of Health, Education,
and Welfare, for instance, wants to abandon as quickly as possible
the "government's traditional method of buying buildings: com-
pletion of plans and specifications down to the last door knob,
followed by a call for bids and finally the award of a contract."¹
H.E.W. recommends bids on a performance basis, phased design and
construction, and consultant-contractor site management in lieu
of more traditional methods. Although such contracting and management ideas are not foreign to the industry, it is disappointing that such working ideas and concepts are not commonly found in today's architectural practice.
CHAPTER FOUR

INNOVATIONS IN OFFICE PRACTICE

"Only the wisest and stupidest of men never change."—Confucius

The problems of construction management are demanding a "new hat" for the architect. In a profession that already wears several, this urgent cry for new and diversified services is indeed frightening. A recent workshop on "Construction Management" started its panel discussions with the understanding that "On any project, the activities of programming, cost planning, design, scheduling, contracting and the expediting of construction must be considered interdependent factors of a total design and construction process. Owners and users of buildings are demanding it—and demanding that architects conduct their services accordingly."

Traditional management methods are no longer adequate. More and more clients are looking for a centralized project management that will rigidly control cost, time, and quality while giving each of these its proper priority and attention. Anthony Vilar, Editor of Building Design and Construction, states the problem clearly in his April, 1970 editorial:

Overall the increased complexities of the responsibilities in building design will have to be honored—the mobilization of materials and products will have to be handled with an equitable grasp of the competitive process—and the labor and business aspects of the project will have to be handled in accord with the most enlightened principles of business management.

Although innovations in architectural office practice are not the panacea for all the ills of the profession, they certainly can't be ignored in any study of time-money controls. For years, architects have helped clients design and build complex buildings, but most have avoided the complexities and mysteries of their own practices. Recently, however, an awakening in the profession and the media has brought about an atmosphere of innovation and change.
Architects, traditionally secretive about "in-house" ideas and procedures are just now beginning to exchange and share mutual problems—and the solutions to them.

Generally, the myriad of problems and considerations that comprise architectural cost management fit within four categories:

1. **Budgets.** Control systems for keeping a project within the budget and on schedule.
2. **Direct Costs.** Methods of controlling and reducing the costs of doing a job.
3. **Indirect Costs.** Methods of controlling and reducing overhead.
4. **Fees.** Means of objectively determining the correct fee.

**Budgets**

Project budgeting problems must be faced at the earliest possible stage. The all-too-typical client with "champagne tastes and beer budget" can be spotted almost immediately with the most simple precautions. Program requirements must be continually checked against accurate budget allowances. This can often be done even before large expenditures of time and money are invested in drawings. By converting program requirements into estimated space figures and applying current unit costs from similar completed projects, the too-ambitious program can be easily spotlighted at an early date in the planning process. Financial arrangements—the ability of the client to pay or an offer of assistance to secure such financing—should also be openly discussed at the earliest possible date.

After preliminary drawings are completed, the architect can either make a "guestimate" of costs himself, or avail himself of more skilled estimating services. Some firms have prevailed on cooperative contractors to provide this service—usually with little or no reimbursement involved other than a promise of nebulous friendship and possible "future favors". As a result, many
architects have found—to their sorrow—that the results of such estimates were worth just about what they paid for them—and for obvious good reasons. Contractors are not usually trained—or equipped—to prepare preliminary estimates based upon relatively incomplete information such as is usually contained in documents at this stage. Subcontract bids, which comprise such a large part of the final building proposal, are not usually available at this time. The architect's design personnel may also inadvertently forget to relay or emphasize vital information regarding costly design items due to ignorance of the construction building process. (Exposed concrete architectural finishes and treatments, difficult formwork, exotic mechanical and electrical systems, and inadequate site information are examples of items causing preliminary estimating problems.)

Corrective preliminary estimating procedures are not simple, but they would seem to be almost mandatory as building projects become more complex. The first step must be that more complete information should be provided by the architect. This can only be done by providing far more complete Design Development Documents than has been the case in most offices. A well-executed set of Design Development Documents should provide a complete and accurate "shorthand" picture of project scope. To do so requires plans, elevations, sections, details, site information, structural and mechanical layouts, schedules, and outline specifications. In fact, D.D.D. must include a complete miniature set of construction documents in order to provide an accurate basis for estimating purposes.

At this point, the question of who does the estimating becomes almost moot. The designer is usually not qualified and the scope of information is now too detailed to expect a "free" contractor estimate; therefore, the only other choice is the cost control consultant. These firms may be called quantity surveyors, professional estimators, or estimator-consultants, but their
capabilities are especially applicable to preliminary estimating from Design Development Documents. As a result, the economic impact of labor contracts, alternative materials, contractors' overhead costs, and inflation can be included as an acknowledged part of the cost control problem. In order to update the preliminary figures, an additional estimate by the cost consultant based on the actual Construction Documents can also be requested. This information would usually confirm the original estimate or revise it to reflect current construction market conditions.

**Direct Costs**

"Direct Costs" are defined as the costs chargeable to a specific job. These include technical salaries, consultants' fees, and contract administration. (Fringe benefits, sick pay, etc. are generally charged to overhead or "indirect costs".)

The control and reduction of direct costs involves more planning than most architectural offices have done. As more and more architectural fees are set on a negotiated—rather than a scheduled percentage—fee basis, it becomes imperative that architectural firms must understand their own "in-house" costs, especially pertaining to a specific project.

Several years ago, the A.I.A. circulated to its membership a cost estimating guide which included "profit planning". Much of the calculation involved in direct cost estimating was based upon the fee itself. This would seem to be exactly backwards in regard to the prevailing trend toward negotiated fees. In other words, if the architect is to negotiate from a position of strength, then he must certainly have a knowledge of his costs before the fee is agreed upon.

There are wide variations in staff efficiency between different offices. Some complete large jobs with three or four men, while others have crews of twelve or more struggling with a
comparable work load. A survey of ex-employees from several low-efficiency offices listed "poor employee relations" as the major reason for lack of productivity, i.e., higher direct costs. In approximate order of frequency, their list of complaints were:

a. No future; no recognition; no way of knowing if you were advancing or standing still within the office.
b. Confusion over delegated authority; indecision and buck-passing by the bosses.
c. Ambiguity in job requirements, deadlines, and budget; secretiveness and intrigues.
d. Boredom; no way of getting suggestions through.

To combat such problems, increase efficiency, and reduce direct costs, the following recommendations should be considered:

a. Integrate time and production records so that supervisory personnel can compare amount of work produced with hours spent by each man.
b. Pay bonuses based on job-by-job output, using individual time-production records as a basis.
c. Provide a forum for complaints and suggestions through regularly scheduled meetings for all personnel.
d. Schedule private informal personnel reviews to discuss the individual's production, progress, problems, and future in the firm.

Since employees' salaries represent approximately 50% of direct costs, their production efficiency is paramount in reducing time-money costs in the architectural office. However, there are other direct cost considerations that can also realize potential savings:

a. Once employee morale is assured, business-like production techniques can assure output. The use of "mini-drawings" to lay out construction drawing sheets, free-hand rather than drafted details,
specific directions and assignments to drafting personnel, reduction of overdetailing, and modern drafting reproduction techniques can increase production from ten to fifty per cent above average.  

b. Consultants' and engineers' fees take the second largest portion of direct costs. Although it may not be possible to reduce such fees by table-pounding negotiation, it may be possible to create a more favorable time-cost climate that could accrue benefits—and savings—to all parties concerned. By making maximum use of reproduction techniques to save re-drafting time, by involving the consultants at an early date in the planning process (and paying them for their earlier design participation as it is received) to avoid later conflicts, and avoiding, insofar as possible, last minute changes without ample time allowance to the consultants for their corrections, may result in more favorable consultants' fees, on a negotiated basis, due to obvious benefits received.

c. Offices that have compared job records agree that overtime is productive only if well-supervised and limited to an hour or so a day, plus a maximum of half days on weekends. Otherwise, fatigue-produced failures of judgment create so many errors that net daily production decreases as hours are increased. This matches similar findings in other industries.

Pre-design:

When Direct Costs are discussed, the construction document phase is usually the chief target for savings. Very few architects seem anxious to lock horns with the "Sacred Cow" of architecture,
CHAPTER FOUR—INNOVATIONS IN OFFICE PRACTICE

the design phase. Some architectural designers, secure under their
berets and artistic-esthetic cloaks, have loudly claimed that
any time-cost controls would "inhibit creativity" and "risk
quality". However, the facts are just the opposite, in most
cases.

Programming information systems have now been refined to the
point where many of the time-consuming design questions can be
answered by systematic pre-design analysis. This analysis, when
properly organized, with or without computer assistance, can give
the designer realistic boundaries for creative exercise. Basic¬
ally, however, it involves research and knowledge of items here¬
tofore considered foreign and distasteful to the "creative"
design process. Pre-design, therefore, is the process of organ¬
izing (and clearly stating) the parameters for schematic design.
To clearly state these given boundaries or limitations requires
all, or at least most, of the following information, before em¬
barking on schematic design:

a. Complete building code information defining
criteria for particular site and occupancy re¬
quirements.
b. Complete information regarding specific govern¬
mental licensing requirements.
c. Preliminary discussion and decisions regarding
structural system choices.
d. Complete and accurate site survey, including
utility information.
e. A definitive program including specific details
and requests for special features by the owner/
client.
f. A report of preliminary findings regarding choice
of heating, ventilating, and vertical transporta¬
tion systems, interior partition options, and
interior finishes, with the best combinations
recommended for further exploration by the designer.


To make the above information even more valid and useful, pre-design discussion sessions should include responsible owner, engineer, and consultant representation and involvement. The big time savings result in avoiding dead-end research, impossible structural-mechanical conflicts, needless antagonism of the client on points of personal preference, and an early knowledge and appreciation of building rules that must be observed.

Theoretically, the designer is supposed to make all the above cross-checks and collect all basic design information, and some can—sometimes. But whether the decisions are made by a principal, partner, owner/client, designer, computer, or combination of all, the big time savings lie in having the confidence that the resulting schematic design solution is a valid one based on solid facts rather than arbitrary assumptions. By involving the client/owner at this early stage, the architect also gains his knowledge, concurrence, and confidence that "perhaps some other approach!" would be pointless and wasteful.

Indirect Costs

As one manager of a large architectural/engineering corporation states: "Overhead (indirect costs) includes all those items that can't be charged to individual jobs. They include rent, heat, insurance, paper, clips, toilet paper, and so on." And it is the "and so on" or "etc." that often balloons indirect costs to the point where an architectural firm must either increase its fees, close its doors, or review its management policies. Obviously, the latter would seem to be the logical choice.
The area of overhead is one that most architects have ignored; however, it does present a plethora of potential cost savings items:

a. **Rent**, a major cost item in any office, has been reduced and even eliminated by architects who become landlords. If certain engineers and other consultants are used regularly, they may be agreeable to space-sharing and receipt of fees in the form of rent credits. The potential of value and tax advantages from the acceptance of rental space in lieu of fees should also be investigated.

b. **Correspondence and postage** are also becoming increasingly expensive. A nationwide IBM survey and analysis reveals that the current average cost of a business letter is $3.00. Greater use of the telephone, tighter editing of letter content, and complete elimination of some letters would greatly reduce correspondence costs. The use of private express services for transmittal of bulky plans and specifications can effect a substantial cost savings in postage.

c. **Job-printing costs** may often be sliced in half by the use of offset presses and setting up in-house printing facilities. In any case, negotiation of printing services on large—or even medium-sized projects, can result in a 25-30% reduction in costs.

d. **Coffee breaks**, set by most offices as two daily fifteen-minute periods, can represent a gigantic cost factor in overhead. For instance, in one 75-man firm, the two coffee breaks per day were costing approximately $350 daily ($85,750 per year!) not to mention additional conversational overtime requiring constant, and embarrassing, reminders.
The solution was "constant coffee"—keeping the pot hot all day with no scheduled coffee breaks. (Eastern firms have also reported at least initial increased production efficiency and net time savings by adopting the 4½-day, 36-hour week, attributing the positive results to better employee morale. Now, discussions are centering on other revised work-week possibilities, including the 4-day, 40-hour week. Perhaps, most surprisingly, employees are finally being asked to state their preferences!) 9

e. Storage of prints and old tracings in an older established firm can become a real space and retrieval problem. Reduction of older tracings to microfilm and reduction of reference and file prints to half-size conserve space and save time in retrieval.

f. Sick-time can usually be reduced by the simple expedient of a phone call from the job captain or project manager inquiring about the employee's well-being. (The genuinely ill welcomes such calls of solicitous interest; the malingerer dreads them.) Hiring policies can also help to curb absenteeism. According to federal government studies, smokers have twice the absenteeism rate of non-smokers. Alcoholics are sometimes talented and high-powered workers, but commonly accompanying habits of tardiness and absence may be a high price to pay for a doubtful level of creativity.

g. Time itself may be the most neglected cost item of all. In the interests of "efficiency", one
office adopted a policy whereby each employee ran his own check prints. Due to varying levels of dexterity and various delays due to simultaneous printing demands, the time per print averaged two to three minutes, or approximately 60¢-90¢ per sheet for actual direct-indirect costs.

b. **Overtime** has traditionally been the architect's last trump card to be played only when all other mis-management has "succeeded". In last-minute efforts to meet impending due dates, many practitioners have totally ignored several facts about overtime. In the first place, overtime usually indicates a previous lack of production management and time budgeting. In more and more cases, even in architectural offices where overtime rates have been taboo, time and a half (for week-day) and double-time (for holiday) hourly rates are being demanded—and paid—for overtime hours. And finally, overtime is not usually efficient or effectively productive time. Not only do excessive overtime hours drain a worker's efficiency, but they can also affect productivity following a crash deadline, for continuing reliance on overtime can become a crutch for both employer and employee. As an illustration of how continuing long periods of overtime affect productivity, the following chart (Table II) shows the actual cost of overtime compared with payroll cost: 10
TABLE II
OVERTIME: ACTUAL COST VS. PAYROLL COST

<table>
<thead>
<tr>
<th>Days per Week</th>
<th>Hours per Day</th>
<th>Total Hours</th>
<th>Actual Productive Hours</th>
<th>Production Efficiency</th>
<th>PAYROLL COST</th>
<th>ACTUAL COST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Overtime</td>
<td>Overtime</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>after 40 hrs</td>
<td>after 40 hrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@ 1½x</td>
<td>@ 2x</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>40</td>
<td>40.0</td>
<td>100.0%</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>45</td>
<td>42.7</td>
<td>95.0</td>
<td>118.8 125.0</td>
<td>125.0 131.5</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>50</td>
<td>45.6</td>
<td>91.2</td>
<td>137.5 150.0</td>
<td>150.8 164.5</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>48</td>
<td>46.4</td>
<td>96.7</td>
<td>130.0 140.0</td>
<td>134.5 144.8</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>54</td>
<td>49.5</td>
<td>91.7</td>
<td>152.5 170.0</td>
<td>166.4 185.4</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>60</td>
<td>49.5</td>
<td>82.6</td>
<td>175.0 200.0</td>
<td>212.1 242.4</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>70</td>
<td>54.6</td>
<td>78.0</td>
<td>212.0 250.0</td>
<td>271.8 320.5</td>
</tr>
</tbody>
</table>

The most depressing factor about overtime is that it must usually be classified as an indirect or overhead expense, since it is seldom recoverable from the client.

Obviously, the reduction of costs by effective office management involves constant effort in relatively mundane matters. But the results can be truly creative—and rewarding. As one successful architect describes his management education:

When I left college I didn't know beans about business. I thought "profit" was something no honest man would think about. "Efficiency" meant speeded-up assembly lines. "Management" meant dividing time between filling in ledgers and being a prison guard. Through trial and error, and some good advice, I've learned that there's a lot more to it. Good management means less regimentation. Efficiency means getting better and more production with less effort. The measure of efficiency is profit. Mies is right, in this case less is more!
Fees

From most indications, it would seem that the percentage method of computing architectural fees is rapidly fading. To most traditional practitioners, the loss of this conventional "crutch" is a frightening one. However, reliance on this method of computing fees has probably done more than any other single factor to compromise good management practice in architectural offices. Few firms exercise cost controls or time budgeting, and fewer still use any effective business-like method to compute fees. Most must still rely on A.I.A. Recommended Minimum Fee Schedules or, even worse, guess at—and match—competitors' fee quotations. Profit planning, as an alternative method, can provide a basis for fees that will include a profitable return.

The following represents a simplified guideline as to the process involved. A single proprietorship type firm is used for illustration:

1. Profit Target: The planned profit is the total amount the partner will have available to withdraw from or reinvest in the business as compensation for his time and effort, as a return on any money he has invested in the firm, and for the business risks he assumes. Net worth of a firm can be considered as capital investment and the proposed rate of return on that figure should approximate returns from other investments such as savings certificates or common stocks:

<table>
<thead>
<tr>
<th>Principal</th>
<th>Investment</th>
<th>Expected Return on Investment</th>
<th>Time &amp; Effort Income (Salary)</th>
<th>Total Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>John R. Architect</td>
<td>$50,000</td>
<td>$5,000</td>
<td>$30,000</td>
<td>$35,000</td>
</tr>
</tbody>
</table>
2. **Direct Labor Cost Estimate**: List each employee and his projected annual salary, including principals. An estimate of unusable hours (percentage of utilization) must also be included for each employee, depending on the percentage of time that he spends on projects that can be directly chargeable to clients. This estimate may vary widely between principals, whose time may be extremely difficult to allocate specifically, and draftsmen, whose only "lost" time would be coffee breaks, vacations, general filing, etc. that could not be allocated to a specific project:

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Name</th>
<th>Annual Salary</th>
<th>Annual Hours</th>
<th>Percent of Utilization</th>
<th>Annual Direct Cost</th>
<th>Annual Usable Hours</th>
<th>Hourly Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal</td>
<td>John R. Architect</td>
<td>$30000</td>
<td>2200</td>
<td>25%</td>
<td>$7500</td>
<td>550</td>
<td>$13.60</td>
</tr>
<tr>
<td>Designer</td>
<td>U. Piper Dreamer III</td>
<td>15000</td>
<td>2080</td>
<td>80</td>
<td>12000</td>
<td>1664</td>
<td>7.20</td>
</tr>
<tr>
<td>Job Capt.</td>
<td>Simon L. Driver</td>
<td>15000</td>
<td>2080</td>
<td>85</td>
<td>12750</td>
<td>1768</td>
<td>7.20</td>
</tr>
<tr>
<td>Draftsman</td>
<td>James T. Square</td>
<td>10000</td>
<td>2080</td>
<td>90</td>
<td>9000</td>
<td>1872</td>
<td>4.80</td>
</tr>
<tr>
<td>Draftsman</td>
<td>I. M. Graphite</td>
<td>9000</td>
<td>2080</td>
<td>90</td>
<td>8100</td>
<td>1872</td>
<td>4.35</td>
</tr>
<tr>
<td>Secretary</td>
<td>Lola Sexhauser</td>
<td>5000</td>
<td>2080</td>
<td>20</td>
<td>1000</td>
<td>416</td>
<td>2.40</td>
</tr>
</tbody>
</table>

\[ \text{Annual Direct Cost} = \text{Annual Salary} \times \text{Percentage of Utilization} \]
\[ \text{Annual Usable Hours} = \text{Annual Hours} \times \text{Percentage of Utilization} \]
\[ \text{Hourly Cost} = \frac{\text{Annual Direct Cost}}{\text{Annual Usable Hours}} \]

**Notes:**

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\[ \text{Annual Usable Hours} = \text{Annual Hours} \times \text{Percentage of Utilization} \]
\[ \text{Hourly Cost} = \frac{\text{Annual Direct Cost}}{\text{Annual Usable Hours}} \]

3. **Profit Plan**: With the above information, a profit plan can be formulated:

**Planned Partner Income:**

- **Return on Investment**: $5000
- **Time and Effort Income** (included in Direct Labor Estimate)
Planned Direct Costs:

Salaries $84,000

Indirect Costs (Overhead):

Rent, utilities, telephone, postage, automobile, office supplies, interest, insurance, promotion, books and periodicals, legal and accounting fees, professional fees, contributions, hospitalization and insurance, etc. $42,000

TARGET REVENUES (from firm's own operations) $131,000
Estimated Consultant's Fees and Reimbursable Charges 65,000

TOTAL BILLINGS TARGET $196,000

4. Calculation of Multiple: Billing rates should be used for billing clients when the contract provides that the firm's charges will be based on the cost of services performed, or "time-card", basis. The billing rate is also extremely useful for in-house accounting procedures to control costs and expenses for all projects. Since the only "commodity" the architect can "sell" is time, the computation of a multiple factor that can be applied to the hourly salary cost to ensure coverage of other expenses and assure a profitable return is a most important step in time-cost accounting. This multiple factor is determined from the information already gathered by dividing the Target Revenues from the firm's own operations ($131,000) by the total annual Direct Cost ($50,350) or 2.6. Billing rates for each individual in the firm can then be computed, using the Multiple Factor of 2.6. (Billing rates are usually "rounded off" to the nearest half dollar):
CHAPTER FOUR—INNOVATIONS IN OFFICE PRACTICE

<table>
<thead>
<tr>
<th>Name</th>
<th>Hourly Cost</th>
<th>Billing Rate/Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>John R. Architect</td>
<td>$13.60</td>
<td>$35.00</td>
</tr>
<tr>
<td>U. Piper Dreamer III</td>
<td>7.20</td>
<td>17.00</td>
</tr>
<tr>
<td>Simon L. Driver</td>
<td>7.20</td>
<td>17.00</td>
</tr>
<tr>
<td>James T. Square</td>
<td>4.80</td>
<td>11.50</td>
</tr>
<tr>
<td>I. M. Graphite</td>
<td>4.35</td>
<td>10.50</td>
</tr>
<tr>
<td>Lola Sexshauer</td>
<td>2.40</td>
<td>7.00*</td>
</tr>
</tbody>
</table>

* Secretaries' salaries are very often considered as an overhead or indirect expense; however, certain portions of any secretary's time can be allocated directly to a project, especially in such tasks as typing specifications. Please note, however, the low percentage of utilization assigned to secretarial time, since most of her time would be too fragmented or generalized for specific job allocation.

Calculation of fees can now proceed with some fairly solid objectives and guidelines. For instance, projects that will generate approximately $196,000 billings must be secured for the coming year in order to guarantee profits, salaries, and overhead at the target level anticipated. If each man in the firm can be utilized at the level indicated, and if estimates of overhead costs were reasonably accurate, then John R. Architect should be able to actually receive his $35,000 total income "profit" target. (In order to further assure this level of return and protect against other contingencies, it might be advisable to provide for a contingency item in his cost budget, or to increase his multiple factor to 2.75)

The whole objective of Profit Planning is the attempt to put the practice of architecture into a business perspective. When this process is started, then, and only then, can calculation of fees on other than a percentage fee basis proceed. As a result, savings in time and cost for architectural services may be based on efficiency of production and effective management—terms only
too familiar to the rest of the business community—rather than related to a cost of building. In the process, the ancient—and unfounded—charge of an architect increasing building costs in order to increase his fees (based on a percentage rate) is automatically rebutted.

Although the "time-card" method of computing fees is becoming increasingly common, there is still a demand for total fee computations on some basis. This may take the form of a fixed fee quotation, a guaranteed maximum fee, or as a comparative cost to a percentage fee where it is required as a basis of computation. The following will illustrate one possible alternative method for time-cost budgeting. (Production phases refer to A.I.A. divisions):

1. **Schematic Design**: Negotiate with client on a time-card and expense basis, with a guaranteed maximum fee based on A.I.A. percentage for Schematic Design (15% of the total fee based on a "reasonable" estimated cost).

Upon completion of the Schematic Design phase, the scope of project can be more easily defined as to complexity and cost. Therefore, a much better basis is available for accurate time-cost budgeting.

2. **Design Development**: In order to produce design development drawings and specifications sufficiently detailed to "fix and illustrate the size and character of an entire project in all its essentials... and form a basis for construction documents", requires far more effort and time than normally allocated for this phase in most architectural offices. However, by studying the schematic design drawings in relation to design development objectives, an
actual index of drawings that will be necessary can be projected. On the basis of past experience and judgment, an average number of hours necessary to produce each sheet can then be estimated. Other costs must also be included to arrive at a final phase budget. Such a budget for a simple $500,000 project might appear as follows, using personnel "assignments" and hourly rates computed previously:

## INDEX OF DRAWINGS (24"x36")

<table>
<thead>
<tr>
<th>Sheet Title</th>
<th>Estimated Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Plan</td>
<td>40</td>
</tr>
<tr>
<td>First Floor Plan</td>
<td>50</td>
</tr>
<tr>
<td>Second Floor Plan</td>
<td>35</td>
</tr>
<tr>
<td>Third Floor Plan</td>
<td>35</td>
</tr>
<tr>
<td>Elevations</td>
<td>40</td>
</tr>
<tr>
<td>Building Sections</td>
<td>50</td>
</tr>
<tr>
<td>Schedules and Details</td>
<td>50</td>
</tr>
<tr>
<td><strong>TOTAL HOURS</strong></td>
<td><strong>300</strong></td>
</tr>
</tbody>
</table>

(Note: Structural, mechanical, and electrical drawings by others.)

A. Client conferences (10 hours @ $35.00) --- 350.00
B. Research and management (20 hours @ $17.00) --- 340.00
C. Interior design consultation:
   (8 hours @ $17.00) --- 136.00
D. Design development drawings (from Index):
   (180 hours @ $11.50) --- 2070.00
   (80 hours @ $17.00) --- 1360.00
E. Outline specifications:
   (12 hours @ $17.00) --- 204.00
F. Specifications Typing

(3 hours @ $7.00)------------------$ 21.00

G. Contingencies------------------------200.00

Total Estimated Design Development

Architectural Budget------------------$4561.00

Consultants' fees should also be included for total billing. If the structural engineer's fee were computed on the basis of 3/4 of 1% of total estimated cost, his estimated fee for this phase would be:

$500,000 x .0075 x .20 (based on 20% A.I.A. recommended design development phase fee allocation) = $750.00. The mechanical-electrical consultant fee could also be figured in a similar way. Estimating that approximately 30% of the total building cost would be allocated to mechanical-electrical, and using a 4% fee rate, the M-E fee for the design development phase would be:

$500,000 x .30 x .04 x .20 = $1200.00. Therefore, the total estimated design development phase fee would be $4561.00 + $750.00 + $1200.00 = $6511.00. As a check only, this figure could then be compared to the A.I.A. computed percentage for design development: $500,000 x .07 x .20 = $70,000.00.13 Some sources suggest reversing the process if the percentage fee is used. Thus, the $5050 phase fee ($7000 less consultants' fees) would be divided by the average hourly rate to determine the number of hours that should be expended during this phase. Using an average hourly rate of $16.50, this method would yield an answer of 316 hours available for "expenditure." However, dividing the $4361.00 time cost budget (excluding the $200 contingency factor) by the $16.50/hour
"average" hourly rate would give a 262 hour "allowance", far less than the 313 hours actually estimated. This would seem to illustrate the inherent danger in using "average" hourly wages in computing fees, and the need for further estimating refinements in the estimating procedure if at all possible.

3. Construction Documents: Time-cost budgets for this phase can be estimated in the same manner as for design development. However, it is usually possible to find a better basis for estimating time per sheet of drawings, since many firms have kept better records regarding this phase of architectural practice. Estimates of time per sheet range from 60-80 hours for a 24" x 36" sheet to 80-100 hours per 30" x 42" sheet, the actual time depending on the sheet complexity involved. The figure per sheet allows for a certain amount of checking and redrawing time, but the best and most accurate basis can only come from individual office records, past and present. With computer availability, there should be no excuse for not having complete and detailed time information as a basis in the future.

4. Receipt of Bids: No "speed-up" potential may be present here. In fact, this "phase" is one of the most neglected by architects, and is too often cut short of badly needed bidding time because of poor time management by the architect. Time estimates for this period should allow adequate time for pre-bid conferences, questions, checking, revisions, and issuance of addenda.

5. Construction Administration: In estimating costs
for this phase, the architect must be able to judge approximate time required to construct a building for which plans have not been drawn, to be built by an unknown contractor at some future date. If any phase of an architect's services is suited to per diem charges, construction administration would be that phase. However, if an estimated figure is required, the architect should remember to include time allowances for travel, job-site and office conferences, materials selections, shop drawings, color selection and material presentations, as well as site observations and contingencies. The latter factor may completely out-weigh all others in certain cases where poor time-cost management, weather delays, and poor quality contractor workmanship combine to make the construction period one of misery rather than joy.

The list of existing innovative architectural management methods is almost endless. As noted in the beginning, the adoption of each and every one would not solve the overall project management problem. It would, however, help ensure that the profession begin to think in business-like terms about solving its own office internal management problems. Then, and only then, can they presume to assist owner/clients in solving theirs.

**Creative Management**

"To most architects, administrative matters hardly rank high on any priority list of interesting subjects. Administrative ability is commonly looked upon in the same light as sex appeal and humor: everybody assumes he has it." So David Scott begins his article on the "The Organization of Architects' Offices", published in a 1970 issue of a Canadian architectural journal.
He continues:

Moreover, many architects are afflicted with an ethos which regards as "creative" the ability to design a superb physical environment, but which considers routine and uninteresting the art of actually directing and coordinating people.

Perhaps the most difficult part of management is the problem of viewpoints: the employer's and the employee's. The traditional authoritarian, hierarchica1 type of professional organization heightens this conflict to a point where truly creative design results may become impossible due to non-creative management policies.

Most of today's administrative managers find it difficult to think in other than a conventional pyramid of authority, with rank and status carefully equated, with reporting lines spelled out, and with the whole structure remaining static. And the man who finally gains a position of power to change the structure no longer wants to since it now would weaken his own authority.

Such "tail-chasing" arguments for perpetuating archaic management methods and authoritarian organizations can cause only antipathy in today's younger generation. The young architectural graduate can hardly be expected to respond favorably to a system that automatically rewards age and experience with little regard for ability. His disenchantment with status-quo organizational structure may be even more pronounced since he has been selected and trained to be forward-looking, perceptive, innovative, and socially aware.

The "founding fathers" of most architectural firms have usually worked hard, sometimes in the face of great adversity, to build up a successful practice, and they are understandably reluctant to share either authority or rewards. However, if an architectural firm hopes to attract a continuing stream of life-giving
young creative talent, then it would do well to continually question—and up-date—outmoded management practices and policies. For today's bright young graduate will not subject himself to an authoritarian, non-participatory structure if there is any option. Therefore, creative management must be a part of tomorrow's architectural practice if for no other reason than to assure a viable continuity of professional existence.

As noted previously in this chapter, accounting, administration, overhead, and fees are major problems requiring study and emphasis. However, the effective utilization of potential and talent within an architectural firm still presents the greatest challenge of all. The solutions of the former can only have application and effect if considered in the context of total creative management involving creative personnel in a creative—and productive—architectural practice.
"A great society is a society in which men of business think greatly of their functions"—Alfred North Whitehead

The well-worn, age-old adage—"time is money"—could never have more meaning than when applied to total project planning and scheduling. As stated earlier, the implications of time to total project costs is one that has seldom concerned architects. However, it must become an area for their interest and concern if they are to involve themselves and the profession in the economic mainstream; otherwise, they will be ignored or passed by.

Financial Planning

—William G. Lyles, FAIA, in the A.I.A. handbook publication Comprehensive Architectural Services, makes the following statement on the architect's responsibility in financial matters:

Certainly architects, both for themselves and their clients, should know at least enough about the financial aspects of projects to recognize one that is obviously unsound financially and to recommend against services that do not appear warranted or advise their clients when additional professional studies appear to be needed.  

The economic feasibility of a project is usually determined by three factors: project cost, cost of financing, and return on investment. The last involves the first two.

There is an inclination on the part of most architects to consider project cost and construction cost as synonymous. This is far from true when the financial aspects of a project are being considered. In addition to the construction cost of a building, the project cost includes the costs of land, equipment, professional fees (architects, engineers, consultants, attorneys,
etc.), taxes and insurance during construction, interest during construction, and many other items required for project completion and use.

There are two primary financing requirements for private project development: debt and equity. "Debt capital is borrowed at a fixed rate of return for a fixed period of time and its lenders have first claim to any net income from annual operations. Equity capital is the investment of the owners and is the difference between the borrowed debt and the total project cost." 2

Debt capital is supplied by various sources: Savings and loan associations (for individual homes and other residential construction), life insurance companies (the principal loan source for non-residential construction), mutual savings banks (one and two-family houses), commercial banks (interim construction financing with local orientation), and pension funds (public and private—for all types of construction).

Equity capital sources are more diverse and less organized: Land sellers (equity interest or deferred installment payments), development team members (architects, lawyers, contractors, and real estate brokers using their fees as equity), clients, business associates, private investors, mortgage money lenders (by offering total financing in exchange for an equity interest with the developer), and corporations. 3

The architect, as advisor to his client, should also have the rudimentary knowledge to figure the financial feasibility of a project. Calculating the return on investment requires the following steps:

1. Determine per square foot rental charge for net leasable space (for example—$6.00/sq.ft.).

2. Multiply the rental rate by the total leasable area to determine gross income ($6.00 times an assumed 10,000 net square feet is $60,000).
3. Subtract the annual operating expenses—including a vacancy allowance—from the gross income to determine net income, i.e., the amount available for debt service and return to equity ($60,000 minus an assumed $20,000 equals $40,000). Initially, this may be expressed as a percentage of gross rents.

4. Divide the result of step 3 by a number between 1.2 and 1.5 to determine the amount available for debt service (assume $32,000 as the result). Mortgage money lenders recommend that net income be 1.2 to 1.5 times the debt service—the greater the risk, the higher the ratio.

5. Find or select the debt service constant from an amortization table (assume a 9½, 25-year loan, with a debt service constant of 0.1018).

6. Divide the amount of cash available to pay off the mortgage as determined in step four by the debt service constant ($32,000 divided by 0.1018 equals approximately $320,000). Thus, $320,000 is the amount of the loan that can be retired from earnings at a 9½ interest rate over 25 years.

7. Finally, add the equity investment to the loan amount to calculate the maximum project budget. The equity amount may be determined by dividing the cash left for the equity investors ($40,000 less $32,000 equals $8,000) by the rate of return desired by the investors (assume 15½ before taxes). Thus, equity invested in the assumed project should be approximately $55,000, and the total project budget should not exceed $320,000 plus $55,000 or $375,000.

Figure 1 shows a diagrammatic illustration of the feasibility steps outlined above.
Figure 1: DIAGRAMMATIC ILLUSTRATION OF FEASIBILITY STUDY
CHAPTER FIVE—TOTAL SCHEDULING

The cost figures thus obtained can then be used as investment measuring sticks. And the use of such comparisons becomes mandatory in any revenue producing investment project in order to determine the real effects of relative building costs on the owner/client. As an example, most architects feel exceptionally proud of their accomplishments when the costs of buildings they have designed are within 5-10% of their cost estimates. What this relatively "minor" cost variation can mean to the investor/owner is an entirely different matter. Table III is an example of what small percentage variations in project costs actually mean to the owner in terms of investment return:

TABLE III

<table>
<thead>
<tr>
<th>COMPARISON OF INVESTMENT TO ILLUSTRATE IMPACT OF CONSTRUCTION COST INCREASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project: Shopping Center</td>
</tr>
<tr>
<td>Area: 400,000 sq. ft.</td>
</tr>
<tr>
<td>Average Rent: $2.65/sq.ft./year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Base @ $16/ sq.ft.</th>
<th>Increase 6%</th>
<th>Increase 12%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Capital Investment—Land</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Cost per sq. ft.</td>
<td>($16.00)</td>
<td>($17.00)</td>
<td>($18.00)</td>
</tr>
<tr>
<td>2. Improvements and Buildings</td>
<td>6,400,000</td>
<td>6,800,000</td>
<td>7,200,000</td>
</tr>
<tr>
<td>3. Total Cost</td>
<td>$7,400,000</td>
<td>$7,800,000</td>
<td>$8,200,000</td>
</tr>
<tr>
<td>4. Income from Rents @ $2.65</td>
<td>$1,060,000</td>
<td>$1,060,000</td>
<td>$1,060,000</td>
</tr>
<tr>
<td>5. Less Expenses</td>
<td>260,000</td>
<td>260,000</td>
<td>260,000</td>
</tr>
<tr>
<td>6. Net Income before Depreciation</td>
<td>$800,000</td>
<td>$800,000</td>
<td>$800,000</td>
</tr>
</tbody>
</table>
7. Less Depreciation:
   \[ (2\frac{1}{2} \times \text{No. 2}) \]
   Base $160,000
   Increase 6% $170,000
   Increase 12% $180,000

8. Net Income after Depreciation
   $640,000
   $630,000
   $620,000

9. Valuation of Project:
   Capitalized @ 6%
   $10,666,660
   $10,500,000
   $10,333,333

10. Mortgage @ 66-2/3%
    7,111,111
    7,000,000
    6,888,888

11. Cash Equity Required:
    (No. 3 - No. 10)
    $288,880
    $800,000
    $1,311,112

12. Total Investment
    $7,400,000
    $7,800,000
    $8,200,000

13. Equity as per cent of Total Cost
    3.9% 10.2% 16%

14. Equity per sq. ft.
    $0.72
    $1.36
    $2.00

15. Profit Potential between Cost and Valuation:
    (No. 9 - No. 12)
    $3,266,666
    $2,983,333
    $2,700,000

16. Leverage—Profit/Capital:
    (No. 15/No. 11)
    11.3
    3.4
    1.6

The objective of the typical investor/developer is to develop property with the maximum earning power and the minimum equity investment. The equity investment capital should earn between 15 and 25 per cent before taxes in order to be competitively profitable. In addition, the capital profit in relation to the equity (Profit/Capital Ratio) becomes a key ratio in determining the quality of the investment to both the developer and any prospective buyer. Table III above indicates the very great swings in investment merit which result from relatively small percentage variations in construction cost.
Table IV indicates the earned profit before taxes expressed as a percentage of equity and calculated after allowing for the first year's interest on the mortgage.

**TABLE IV**

**COMPARISON OF INVESTMENT**

**TO ILLUSTRATE IMPACT**

**OF CONSTRUCTION COST INCREASES**

<table>
<thead>
<tr>
<th></th>
<th>Base @ $16/ sq.ft.</th>
<th>Increase 6%</th>
<th>Increase 12%</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. Net Income after Depreciation</td>
<td>$ 640,000</td>
<td>$ 630,000</td>
<td>$ 620,000</td>
</tr>
<tr>
<td>18. Interest on Mortgage @ 6%</td>
<td>$ 426,666</td>
<td>$ 420,000</td>
<td>$ 413,333</td>
</tr>
<tr>
<td>19. Net Profit</td>
<td>$ 213,333</td>
<td>$ 210,000</td>
<td>$ 206,666</td>
</tr>
<tr>
<td>20. Profit as % of Cash Equity: (No. 19/No. 11)</td>
<td>73.7%</td>
<td>26.3%</td>
<td>15.7%</td>
</tr>
</tbody>
</table>

Table IV illustrates that in order for the project to remain competitively profitable, costs must be held to an absolute maximum of $18.00 per square foot. In other words, the annual rate of return on the equity investment will decline by more than 75 percent in the event of a $2.00 per square foot increase in the capital cost.

Recently, many projects have died on the drawing board due to high interest rates. This has been especially true in highly speculative ventures.

To show how an increase in loan rates affects such a project, a capitalization and mortgage loan rate of 8% was injected into the previous example. Table V illustrates the comparison between the original (6%) and revised (8%) ventures, starting with the same Net Income after Depreciation—$640,000.
TABLE V
COMPARISON OF INVESTMENT PROFITABILITY FIGURES WITH INCREASED CAPITALIZATION-LOAN RATE

<table>
<thead>
<tr>
<th></th>
<th>Original @ 6%</th>
<th>Increased to 8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Income after Depreciation</td>
<td>$640,000</td>
<td>$640,000</td>
</tr>
<tr>
<td>Valuation of Project:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capitalization</td>
<td>$10,666,660</td>
<td>$8,000,000</td>
</tr>
<tr>
<td>Mortgage @ 66-2/3%</td>
<td>7,111,111</td>
<td>5,333,333</td>
</tr>
<tr>
<td>Cash Equity Required</td>
<td>288,880</td>
<td>2,066,666</td>
</tr>
<tr>
<td>Total Investment Required</td>
<td>7,400,000</td>
<td>7,400,000</td>
</tr>
<tr>
<td>Equity as % of Total Cost</td>
<td>3.9%</td>
<td>28.0%</td>
</tr>
<tr>
<td>Equity per Sq.Ft.</td>
<td>30.72</td>
<td>85.18</td>
</tr>
<tr>
<td>Profit Potential between Cost and Valuation</td>
<td>$3,266,666</td>
<td>$600,000</td>
</tr>
<tr>
<td>Leverage: Profit/Capital Ratio</td>
<td>11.3</td>
<td>0.288</td>
</tr>
</tbody>
</table>

Comparison of profits and return on equity is even more graphic:

<table>
<thead>
<tr>
<th></th>
<th>Original @ 6%</th>
<th>Increased to 8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Income after Depreciation</td>
<td>$640,000</td>
<td>$640,000</td>
</tr>
<tr>
<td>Interest on Mortgage</td>
<td>426,666</td>
<td>426,666</td>
</tr>
<tr>
<td>Net Profit</td>
<td>$213,333</td>
<td>$213,333</td>
</tr>
<tr>
<td>Profit as % of Equity</td>
<td>73.7%</td>
<td>9.7%</td>
</tr>
</tbody>
</table>

Thus, both the leverage and profit return on equity decreased dramatically as a result of a two per cent increase in loan and capitalization rates.

Very often costs increase beyond the established budget during the construction phase, after loan commitments have been made. Especially during "tight money" periods, the owner/developer must
CHAPTER FIVE—TOTAL SCHEDULING

meet these additional costs from his own pocket. If, for example, total project costs increase, then the equity investment may also increase to the point where expected returns may not attract—or hold—investment money.

Reviewing the total impact of the figures presented above, it is small wonder that, with increasing money costs (loan rate) and construction costs over the past several years, many speculative projects never left the drawing boards. While costs can—and should—be controlled by the architect, the loan rate increase can only be accommodated by an increase in rental rates to the consumer or extended loan tenure. The architect needs to have an appreciation and knowledge of such factors, however, to properly advise his owner/client and to bargain intelligently with leasing agents and mortgage loan companies.

Office Production

Harry Goleman, senior partner in the Houston firm of Goleman and Rolfe, stated in a recent magazine article:

Traditional management methods in the practice of architecture are no longer equal to the task of supporting comprehensive environmental design.

Today, the practice of architecture is necessarily and inextricably complicated by the business of architecture. An architect who will subject his design to merciless reappraisal may not always be willing to evaluate his organizational structure, personnel problems and budgeting functions in the same manner. Nevertheless, the architect must develop a working organization which is efficient and profitable so that he can be free to achieve excellence in design.
Accordingly, controls and procedures should be introduced into an architectural firm only to the extent that they can be expected to contribute to an atmosphere of freedom and creativity. Such an atmosphere can then be used to produce a design commodity that will result in an effective and profitable enterprise.

Many firms, large and small, have started to use different forms of computer applications. Some have utilized already existing computer programs. Following is a list of major programs available with possible office management orientation and application. Such a list is almost immediately out-dated due to new applications and programs:

1. **Accounting**—Such a computer program is most obvious for bookkeeping, payroll computations, and standard accounting procedures, but recent applications include job-cost accounting, man-hour budgeting and production comparison controls.

2. **Project scheduling and manpower control**—These programs show promise in the optimum utilization of office resources in producing work. Future applications may also include some method of problem-talent matching to actual job assignments.

3. **Cost estimating**—As in other estimating procedures, the viability of such a program depends entirely on the accuracy of the input information. Detailed cost data must be available for such a program to succeed.

4. **Specifications**—Several specification-writing programs are available to the profession on a subscription basis, and many larger firms have developed their own.

5. **Engineering**—A wide variety of mechanical, electrical, civil, and structural programs are available covering
a broad range of engineering problems.

6. **Information retrieval**—This could be an area for great time savings in most architectural offices. Several programs exist involving in-house retrieval from correspondence, job files, drawing storage and technical data resources.

7. **Project design**—Such programs can be an aid in the development of design through reference to critical parameters: cost, size, zoning and code restrictions, elevator design, program space requirements, etc.

As the scope of projects grow to include complete metropolitan areas and megacities, the use of computer aided management and design techniques will become almost a mandatory tool of practice.

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**Network Scheduling**

For the last decade, contractors have been using the computer for scheduling construction, based on various network planning techniques. Recently, several architectural offices have begun to use these same techniques to schedule office production.

Some firms, such as Goleman and Rolfe, have established network planning and analysis for office production and are now applying those same principles to overall project planning. Other firms are already offering network planning services on a consulting basis.

As an example of exactly how network scheduling can be applied to expedite design-construction coordination, the Houston Light and Power Company project serves as a case in point. Through cooperation of the architects, the engineers, and the contractors
a network schedule (CPM—critical path method) diagram was prepared that encompassed several inter-related construction phase functions. After determining the critical components of labor, material, and paper processing with all parties involved (including subcontractors and suppliers), the following time periods were established:

1. Time required for preparation of shop drawings by suppliers.
2. Time required for architects' and engineers' first markup of shop drawings.
3. Time required for suppliers' resubmittals and design approvals.
4. Time required for fabrication of materials.
5. Time of delivery to the job.

These critical times were then programmed into the contractor's computer with an actual calendar date. Later, prior to the date for a particular activity, the computer automatically typed out a letter to alert all parties concerned of their obligations.

With all the known applications of network planning in the construction industry, it would seem that the surface has scarcely been scratched. The further possibility of total project planning and coordination from inception to occupancy is one pregnant with future promise.
CHAPTER SIX
NEW CLIENT/CONTRACTOR/ARCHITECT RELATIONSHIPS

"The past is valuable as a guidepost, but dangerous if used as a hitching post."—Indiana Parent-Teacher

The demands of the construction industry on the architect are becoming more pronounced and prolific with each passing day. As a sign of the architect's changing role in response to these demands, the School of Architecture at Washington University in St. Louis is now offering two combined graduate degree programs:

1. Master of Architecture and Master of Business Administration. Studies...deal with accounting, economics, finance, marketing, production management, quantitative business analysis and management information systems.


Small wonder the serious architectural student feels confused and pulled!

MacDonald Becket, AIA, president of Welton Becket and Associates, states the problem facing the profession even more succinctly:

The larger, more complex projects being developed by today's corporate clients involve not only closer scrutiny of time schedules and budgets, but to financing, taxation, and legal aspects of the projects as well.

The projects of tomorrow for the clients of tomorrow cannot be accomplished by the architectural firms of yesterday or today. To meet the new challenges posed by these projects and these clients, an entirely new species of architectural firm will have to appear.
Trade media during the past year have abounded with articles on "The Architect as Developer", "as Contractor", "as Construction Manager", etc., etc. In fact, the proliferation of architectural job descriptions has become so all-inclusive that Peter Trench, deputy chairman of the Lowell Construction Group in England, gently chided the profession recently:

Architects now know how to build—or some of them do—and we wonder not where they are going next, but what will be left for us (contractors) to do. Some of us are thinking of going in for design.

However, during the same speech to the Royal Institute of British Architects, Trench clearly stated the questions facing the profession today:

In the concept of total design meaningful if it does not embrace the method of turning that design into reality? Indeed, is it meaningful if a knowledge (or is it a flair?) of how to assess the options open is lacking? Design certainly cannot be confined to the drawing board.

Constructors such as Trench—long accustomed to realisticaly facing the exigencies of the day, may honestly wonder whether the architect is worrying too much about his role of tomorrow and not enough about what is required today. The answer must be that unless the profession worries for themselves now, certainly no one will do it for them tomorrow. So, the question remains: What is the prospective future role of the architect in relationship to others in the construction industry?

The Architect and the Owner

The architect was once the master planner of the building arts. Today, he is usually considered to be one of many specialists involved in planning our environment. He "designs buildings" or "draws plans for buildings", when his duties are described in
cocktail conversations. Rarely is he considered a master planner or major force on the community level, however.

With population scheduled to double in the U.S. during the next 40 years, the continuing pressure of an already existing home-building construction deficit, and the demands of new construction to replace the rapid obsolescence of our central cities, more than $3 trillion dollars will be invested in building construction before the end of this century. This phenomenon can virtually be called the creation of a Second America. If present trends continue, most of this expenditure will take place without the advice and counsel of architects. Even in projects where the architect is consulted, he is usually commissioned after important decisions regarding where and how to spend money have already been made. In many cases, he deals with subordinates charged with executing corporate management's orders. In fact, the architect may never meet the real decision makers during his relationship with such a client.

Without close rapport, the architect may find it impossible to give truly comprehensive services and professional advice to his client. For instance, the architect, through basic service contractual obligations, is required to submit probable construction cost estimates at each phase of project development. Yet, in many cases, the program of the owner and the financial feasibility of the project are studied, reviewed, and documented before the architect is commissioned.

To be a viable future part of the construction process, the architect must be involved in the front-end decision making of projects he designs. To do this, he must be able to adapt to the client's need, and provide a full range of expanded architectural services.

MacDonald Becket predicts that three major types of architectural organizations will emerge during the 1970's, providing a
broad range of services to conglomerate clients with complex problems. These three will dominate the architectural scene—the package firm, the "captive" division, and the new professional architectural firm.

The package firm, sometimes called the "package builder", will include design and construction in a single operation. Because of their ability to control time and costs, these firms will figure prominently in smaller commercial and industrial work in the future. The major drawback of such a firm to date has been a far too frequent neglect of design. This weakness may be alleviated in another form of the package firm, organized by the architect who builds his own projects or even becomes the architect-builder for his clients. Such a firm would require, of course, further relaxation of existing professional ethics now prohibiting such an overt operation in private practice.

With the entry of conglomerates and systems-oriented firms into the planning-construction-financing-leasing-operating fields, the "captive" architectural firm could very well be one of the great industry forces during the last third of this century. Such total services firms will offer a construction management capability, including architectural and engineering services. Their attraction to clients will be the single source responsibility for planning, financing, construction, leasing of space, and even building operation and maintenance. Of course, the major danger in this corporate type of operation is that architecture becomes merely another service offered the client. As a result, the aesthetic and functional design oriented to the total human environment which the architect is trained to produce may be sacrificed to the expediencies of other disciplines within the conglomerate.

Becket suggests that the third type—the "new breed professional architectural firm"—must be large in order to succeed
in tomorrow's construction scene. As justification for his view, he cites the complexity and size of tomorrow's environmental planning problems. Although Becket's arguments are persuasive, there is certainly no reason why the problems of comprehensive services, geographical scope, organization, management, and design can't also be handled by smaller firms willing to use joint venture and association arrangements to enlarge their service capabilities to clients.

One of the best examples of how conglomerate client-architect relationships can be acclimated to new management techniques is the New York State University Construction Fund. This public benefit corporation has become a "$4.5 billion dollar client in its mission to accommodate a three-fold increase in full-time students on some 37 campuses of the State University of New York in the decade ending 1972." That such a public client can be compatible with private professional services has been one of the major objectives of Fund founders:

From the beginning, the Fund chose to tap the resources of professionals in private practice rather than create a huge agency with its own staff of planners and designers. It set out to implement a "government by contract" approach to design and construction whereby professional planners, architects, and consultants carry the actual responsibility for planning, design and contract supervision. To make such an approach effective, key personnel of the Fund staff were also recruited from the professional sector and charged with a primary role of expediting the complex decision-making process inherent in so massive a design/construct program.

Thus, architects are involved in both their own and client's interests for design and management. As recognition of the design/construction interface, the Fund in 1968 combined construction and
planning divisions under a single managership ("a practical reflection of the fact that the dichotomy between the two phases in conventional practice is a more or less artificial separation brought about by the historical roles of architects and general contractors").

As a client, the Fund provides several kinds of information resources. One is a series of guideline publications on Fund operations. Another is a series of research programs pertaining to specific problems of materials and costs. Still another is a series of seminars, held on an unscheduled basis, dealing with such problems as building systems, laboratory furnishings, and general planning problems. The research program itself has now been refined to provide computer-stored data on budgets, campus plan information, building site work budgets, scheduling information, and equipment lists.

The Architect and the Contractor

The New York University Construction Fund is also one of the best examples to date of innovative and creative changes in the traditional architect-contractor relationship. In fact, it presents one of the best case examples illustrating the expanded interpretation of the term "construction management".

As originally founded, construction management was a Fund staff function concerned with expediting materials and trades to a given project. After the merger of design and construction divisions in 1968, the term "construction management" was applied to an overall responsibility for the entire design/construction process. This responsibility was specifically assigned to the architects for the various projects. Where problems became too complex, such as in the development of an entire campus, involving a multiplicity of architects, buildings, communities, and contractors, a
third-party consultant (again, an architectural firm) was commissioned to handle coordination problems so that each architect would be free to handle his own design and management problems.

Construction management may be the best answer to date in solving time-cost problems in the construction industry. But it does involve a change in traditional architect-owner relationships.

In May, 1970, the Building Research Institute held its spring conference in Washington, D.C. Management of the building process was the central theme, entitled "CONSTRUCTION MANAGEMENT: Competition for Control". In a special summary report on the conference Jeanne Davern reported:

Not competition but organization for control appeared to be the real concern of all the speakers... The new "construction managers"... (seem) to be developing out of variations or expansion rather than elimination of familiar construction roles—thus corporate clients provide themselves with more sophisticated and responsible construction management staff; a kind of super-package dealer is invented by conglomerates through mergers; package dealers add new "disciplines" to the turnkey package; "entrepreneurs" eye the package deal route (without calling it that) and consider whether merger is the most effective approach to it; architects and contractors formally offer "construction management" services long considered a part of their responsibilities; and cost consultants decide to let the dog wag the tail and become "construction managers".

From Miss Davern's report, it seems apparent that some confusion still exists in defining the term—"construction management"—and that many representatives in the construction industry are vying for control, whatever it turns out to be.

Perhaps the best description of what a construction manager can do came from Anthony Manseuto of McKee-Berger-Manseuto Inc. of New York, the only bona fide construction management consultant on the program. Currently employed as project managers on the University of Massachusetts/Boston $355-million new campus,
involving seven firms in the design of six buildings and extensive site development, Mr. Mansueto described his firm's role and functions:

In the design phase, the project management design review staff is establishing criteria and procedures for design submissions; advising on the feasibility of design solutions; working with the architects and engineers prior to formal submissions in order to identify problems while there is still time to correct them; performing specialized engineering studies, as required, to solve special design-construction problems; coordinating other public agency reviews and approvals; reviewing all formal design submissions for conformance with program, satisfaction of public agency requirements, construction feasibility and a variety of other criteria. 9

During construction, "the architects and engineers will retain their traditional responsibility for design" but "the full-time, on-site management and administration of the construction process will be the project manager's responsibility."10 Other services provided by Mansueto's firm on the Boston project include construction cost management; planning, scheduling, and control; establishment of a management information system; provision of computer time and computer personnel (in-house); general construction consulting and research; administrative support; and public and community relations programs.

Peter D.J. Tirion, technical director for the Metropolitan Toronto School Board's Study of Educational Facilities, claims that "management contracting" on a project-by-project basis (combined with common use of pre-designed and pre-manufactured subsystems) reduced construction time for 11 Toronto schools in the 1969 building program "by some 60 per cent".11

Frank Whitney, engineer and president of Walter Kidde Constructors, Inc., attributes the emergence of the construction manager role to "escalating costs, increasing reluctance of the
general contractor to bid major projects, increasing complexity of building and increasingly critical time/cost relationships. 12

Among emerging techniques of construction management, one of the most exciting in terms of prospective savings in time and money is the use of "phased construction" (New York's State University Construction Fund calls it "fast-track"), achieved by overlapping design and construction phases on a project to shorten total construction time. Figure 2 illustrates a diagrammatic comparison between "standard" linear and "fast-track" scheduling. 13

![Diagram of Linear and Fast-Track Scheduling]

Figure 2: LINEAR AND FAST-TRACK SCHEDULING
Chief Structural Engineer Bertrand B. Berube of the Public Building Service, General Services Administration, claims that a recent GSA study indicates that "the time required for the customary sequential procedures of design, bid, and construction can be decreased at least one year for projects of $5 million and up with the proper use of phased construction", with resultant savings to the Government of "one year of escalation costs and rental payments."  

Architect Philip Meathe, executive vice-president of Smith, Hinchman, and Grylls of Detroit, reports even more spectacular savings from "fast-track" on a proposed project at State University of New York's Campus at Stonybrook, L.I. Projected savings include: "78% reduction in total time required to produce the completed project; $5,400,000 in construction cost escalation avoided; $3,300,000 in rent payments out of earlier than normal occupancy of the new space." Mr. Meathe sees the need for a new kind of teamwork in the construction industry, but warns that it will take "some adjustment by all members of the team (owner, architect, engineers, and manufacturers) of traditional concepts of their identity. If we don't readjust, then professional failure may be right around the corner."  

Some leaders in the industry, however, have reservations about the merits of phased construction. J. A. Rorick, director of IBM's industrial construction division, has experimented with phased construction but still prefers the "single contract". N. M. Martin, who is responsible for Sheraton Hotel's $1-billion, four-year worldwide construction program advises "aggregation" (single contract) instead of "fragmentation" (phased contracts). The arguments over contract types, awards, and methods and discussion of their various merits and demerits will continue. Though the contractual roles of parties involved in construction
may change, the consensus remains—"Architects, engineers, builders—all of us—we are in this together, and we must work together."
CHAPTER SEVEN

CONTRACT AWARDS

"He who learns and makes no use of his learning is a beast of burden with a load of books"—Saadi

At no time in the construction process are contractors more "cussed and discussed" by architects than during contract bidding and awards. Many practitioners actually become distraught at the prospects of seeing a project "lost" because of "unfavorable" bids. (The alternative prospect of redrawing to eliminate costs is an unhappy second choice.) With all the discussion and conversation in the profession, however, certain major factors involved in contract award are not widely known or understood.

Climate—Seasonality and Bidding

—For the young architect, especially, the facts of life in professional practice may first become shockingly apparent due to a little understood factor called "bidding climate". In many northern areas of the country, this factor is inextricably involved with seasonal climate, and an understanding of seasonality in construction is essential to solving some of the mysteries surrounding "bidding climate".

With today's enlightened building methods, the construction labor force could presumably expect full year-round employment in a booming—and building—economy. But, work force cuts of 20 per cent, on the average, have been the rule over the annual construction cycle. (In the early 1950's, when volume of construction work was extremely heavy, peak-to-low-month labor force shrinkages were reduced to 17 or 18 per cent. In the early 1960's, however, during a period of reduced construction activity, the low month—February—construction labor force figure was almost 30 per cent less than the peak month—August.)

1
Changes in the industry during the last 15 to 20 years have supposedly tended to reduce the seasonal pattern of construction work:

1. There has been a shift in the proportion of building construction activity in favor of the South over the past 15 years, and the seasonal pattern of Southern construction is less pronounced than in northern climates.

2. The size of the average construction project has become progressively larger, allowing greater opportunity for planning around weather problems and scheduling year-round work.

3. The proportion of total construction accounted for by on-site workers has diminished, thus reducing exposure to weather delays.

4. Builders and contractors are hiring proportionately more office staff than in the past, probably indicating a commitment to more sophisticated business management practices.

5. Technological improvements aiding cold weather construction are coming on the market with increasing regularity.

In spite of these factors, there has been no measurable trend toward reduced seasonality during the post-war period. Evidently, established patterns such as traditional periods for contract letting, calendar year bookkeeping, "moving days", and custom have been—and continue to be—important determinants in the construction industry.

More recently, contractual arrangements with labor unions have made winter work more costly, thus emphasizing the traditional pattern. Labor agreement provisions specifying that a contractor
must guarantee his employees a minimum number of hours per week make him reticent to assume such a risk in unpredictable winter months. Traditional labor union contract agreements, usually scheduled for spring negotiations, also tend to emphasize seasonality. Many contractors dismiss known troublemakers and wage-raise agitators prior to the contract negotiation period to weaken the opposition. Some may also cut back on payrolls to strengthen their own bargaining position and serve notice that their power to hire and fire is still intact.

Although not freely admitted, another reason for the failure of the construction industry to make significant progress in the area of year-round employment has been the shortage of labor. Many construction jobs require large numbers of unskilled and semi-skilled workers in fairly fixed proportion to the skilled workers. This labor pool is readily available during the summer through the use of college students, but is drastically cut back during regular school terms in colder months.

All such factors affect the bidding process, since contractors must accommodate such relatively unknown facts in their bids. Although year-round use of construction plant would be economically advantageous to the consumer/client, motivation of the contracting industry is obviously required to justify the cold weather risk. Until this is done—together with the other amplifying factors noted—seasonality will be a major factor in the bid timing process.

Other factors may be even more important in determining construction costs. Some, such as contractors' and estimators' accuracy, defy prediction. Others, however, can be analyzed. In fact, analysis of the local construction market must be made as a part of any truly comprehensive cost management program. This summary of local market conditions affecting construction is often called "bidding—or construction—climate".
Although such analyses do not have a standard format (due to varying local conditions and project requirements), certain general areas of coverage should be included:

1. Local geographical, sociological, and economic factors.
2. Contractors' interest in and capabilities for the job.
3. Labor availability and cost.
4. Availability of materials.
5. Owner and designer factors.

**Local Factors**

Demographic factors can help indicate potential problems. The construction industry's capabilities in smaller towns may be strained by the requirements of a large project. Experience and size of local contracting firms, as well as available labor, are major problems affecting construction.

The character of a community can also have potential effects on costs. In some communities, the construction industry depends heavily on one owner for work; therefore, local work must be scheduled around his construction program. In other communities, organized crime or political influence often determine the number and interest of bidders.

**Contractor Interest and Capabilities**

Contractor interest and capabilities can be a major cost consideration. In 1969, a New York community college was bid at over $100 per square foot; Bradford Perkins, of McKee-Berger-Mansueto, construction consultants, reviewed the fiasco in a recent trade journal article:

In retrospect, this well-known disaster resulted, at least in part, from a shortage of contractors with both adequate bonding capacity and interest in the project. Only two firms were willing to bid on a city project that would last four years, and neither was willing to take without premiums which approached 100 per cent.
A reverse effect can also be true. In recent months, smaller projects—more sensitive to national economic slowdowns, inflation, and financing problems, have been blessed with much interest and many bidders due to the paucity of smaller projects available. As a result, some overall project costs have levelled off or declined in spite of continuing increases in labor and material prices.\footnote{6} Continuation of such a phenomenon could well be reflected in an increased number of small contractor failures.

Capability is another important contractor consideration. In some rural areas, local contractors may not be able to build a complex project. An inexperienced contractor facing a complex project may add a significant premium to his bid—or he may not submit a bid at all. Conversely, the large outside contractor can expect certain problems working in a new area with a limited supply of skilled labor—also requiring an additional bid premium. Some smaller contractors will also add premiums for handling new or unfamiliar materials. Fiberglass ductwork, for example, should be cheaper than sheet metal in most instances, but premiums added by inexperienced contractors have made it more expensive than sheet metal on some projects.\footnote{7} Other contractors, unfamiliar with architectural exposed concrete, have submitted such high premium bids on concrete designs that bid spreads on such projects have, in some cases, exceeded 25%\footnote{8}.

Perkins suggests a list of key questions that should be asked of local industry sources in determining contractor interest and capability:

- How many contractors in one area work in a given category of construction?
- How many bids does a project of a given size normally receive?
- Is there so much directly competing work in the area that there is a reduction in the number of potential bidders?
- Is the seasonal factor any more pronounced than is normal for the construction industry?
Are there ways of stimulating increased contractor interest?

What is the prevailing contractor attitude toward unusual design or site location?

Are local contractors familiar with unusual materials which might be employed on the project?

Is there likely to be any reduction in the number of bids or bid premiums resulting from minority hiring or training requirements?

Are local contractors finding construction loans (financing) unusually difficult to obtain?

Labor Availability and Cost

The local labor force, local wage rates, prevailing premiums necessary to obtain local labor (or induce migration), trade jurisdictions, and available skills are factors that must be considered in evaluating "bidding climate".

Shortages of labor can be a most important factor. For instance, a shortage of carpenters in a community should make an architect think twice before designing a poured-in-place concrete structure for that particular locale. Heavy trade demands from other construction projects in an area can also be a factor. In Ames, Iowa, the university construction program (strongly oriented toward masonry building techniques for design continuity) created such a strong market for masons that even marginal workmen found themselves being actively wooed by the contractors involved. Premium hourly rates, far beyond the union contract requirements, were offered and paid to the more skilled draftsmen. Migration of masons from outlying rural Iowa areas ensued and the resulting shortage in the mason's trade created a specific trade labor shortage crisis that lasted almost a full year. (In the meantime, construction superintendents were forced to face a "gold-bricking" type of worker who could easily find a mason's job "across the street" if his lackadaisical efforts weren't properly appreciated.)
As a result, new records for inefficiency were set—and repeatedly broken—by these marginal "workers".¹⁰

In another case, urgent demand for plumbers and steam-fitters to finish a multi-million dollar petrochemical plant on a crash schedule offering a "7/10" (seven ten-hour days of work a week!) wage attraction almost halted other construction activity in an Iowa city of 35,000 population. In fact, some journeymen came from as far as 300 miles away, attracted by the fantastic weekly wages.¹¹

Local work practices are also important. Installation of prefabricated components may be prohibited under local union work rules. Some locals belligerently prevent use of any new labor-saving materials or techniques.

Minority employment and training requirements can mean additional cost premiums. Not only do unions resist such hiring requirements, but contractors regard such programs as an additional risk and unknown cost factor. As a result, some contractors avoid such projects, thus eliminating desirable competition. Others, despite denials to the contrary, add as much as 20 per cent premium to their bids to cover large minority hiring and training programs.¹²

Strikes are a similar risk—another unknown cost for the contractor to estimate. Therefore, it is important to check on the expiration date of existing contracts and size of wage increases likely to be negotiated in the next contract. One Iowa contractor, who neglected these preliminary queries and local amenities, serves as a definitive example. After being awarded a $2-million dollar construction contract in a labor jurisdictional area foreign to his normal operations, he discovered that his project was the only one under construction in the area on other than a negotiated cost basis. Local contractors, more familiar with the local labor scene, had correctly predicted substantial pay raise pressures in the
construction trades and had avoided long-term bid contracts where assimilation of higher wage rates would be impossible. When new labor agreements were "negotiated" six months later, inflated wage rates were readily granted by the local contractors, by that time almost completely devoid of fixed contract obligations. As a result, the "foreigner"—unable to negotiate for his own obvious interests—was forced to pay the increased wage rates for the remainder of his project, a fact that nearly forced him into bankruptcy.13

Information about labor-related cost factors and conditions can be supplied by local contractors, construction trade associations, and other industry sources. Bradford Perkins suggests that the following questions be asked in gathering such information:

- Are the jurisdictions of unusual size?
- Are there any jurisdictional disputes which might affect the project?
- Are there significant variations in the labor supply due to seasonal factors?
- Are there extreme shortages in any trade, and if so, will they cause premiums and/or delays in construction schedules?
- What inducements are required to encourage migration to the area?
- What is the impact of training programs; and what is the availability of minority workers?
- What are the basic and fringe rates for each trade?
- When do local contracts expire, what increases are scheduled in existing contracts, and what percentages are predicted for the next contract?
- Is local labor cooperative or belligerent, and what is its level of interest in the project?14

Availability of Materials

Materials supply is usually more predictable and controllable than labor. It is surprising, however, how often materials are specified that are either unavailable locally or unfamiliar to local contractors. Specially designed items often cause costly
delays. Large or specially fabricated structural members can cause shipping, fabrication, and erection delays that may be prohibitive in costs.

Specification of local materials may be extremely beneficial in cost savings, especially such high freight items as stone, brick, etc. One Houston architect saved $50,000 on a $500,000 granite subcontract by specifying Texas stone in lieu of one from South Dakota of a slightly different color.15

Owner and Designer Factors

Most owner-architect cost factors are inflationary. Recently, New York's subcontractor association told the city that "its members have added up to 20 per cent to their bids on city projects to account for slow payments."16

Some architects cause bid premiums too. Consistently incomplete contract documents, unnecessarily complex designs, and highly arbitrary and punitive attitudes toward contractors during the construction phase all tend to raise bid quotations.

The time spent in identifying serious problems regarding bid climate can reap great benefits in cost savings:

If the market study reveals serious problems....it is possible to save more money concentrating on overcoming adverse market conditions than by refining costly segments of the design. The difference between an efficient and inefficient design is often less than 15 per cent, while market conditions can add up to 100 per cent.17

The AIA Handbook of Architectural Practice underlines the problems involved in evaluating "bidding climate". Citing the frequent large difference in bids between high and low bidders on a project, the A.I.A. goes on to describe "bidding climate" as one of the variables in preparing bid quotations:

The bidding climate is the bidding activity and the attitude of the prospective bidders during the last
week of bidding. If much work is under contract and if it is known that much public and private work is going to be issued for bids in the near future, then the contractors, the subcontractors and the materials suppliers may not be in a competitive frame of mind. If bidding information and news sources indicate that there is not much work "coming off the boards", and if the contractors are completing work under contract, then bidding conditions may be very competitive for the few projects on the market. These extreme conditions can cause an estimate to be high or low by 25%.

Bid-Rigging

Although bid-rigging or collusion in the construction industry is extremely difficult to document, enough evidence exists to indicate a serious problem. There had been suspicion of collusive bidding practices for years in large generator contracts, and the electrical supplier scandal several years ago confirmed those suspicions. The recurrence of extremely small bid variations on large temperature control subcontracts with low bids alternating between three major control manufacturers seems to be more than the strange accidental pattern claimed.

The British government has been conducting a three-year investigation of public and private construction contracts. Bid fixing charges have been filed involving 19 electrical subcontracts to date, with an additional 3000 under investigation including many involving heating and ventilating contractors.

The principal bid-rigging practices uncovered to date are the "cover price" and "middle price" techniques. Similar practices are also prevalent in the United States, so the definitions and discussions are extremely relevant:

The first (cover price) is used when a contractor, not interested in a particular job, wants to ensure that he is invited to bid on a future contract let by the same owner. He asks a rival bidder for a cover price he can
quote and be assured that his tender will not be accepted. Although this practice may not disclose the successful rival's price, it does give the customer (client) an inflated idea of job costs and reduces competitive bidding.

Cover pricing, carried to the ultimate, can completely obliterate competitive bidding. For instance, one general contractor in a small Iowa town was asked to submit bids on a church structure in his own community. Since the bidders' list had been selected on an invitational basis, he then contacted the other contractors on the list requesting "cover prices" from each one. In return, he pledged similar cooperation on jobs in their own communities. If any of the parties disagreed, of course, he would then bid the project competitively as originally intended. Out of five firms invited to bid on the project, two returned plans without bidding, one contractor "got his dates confused" and "forgot to submit a bid", one ("too much work but didn't want to antagonize the architect or the owner" by not submitting a bid) submitted an admitted cover price, thus giving the local bidder his project according to his plan. (The bid price, amazingly enough, was the exact dollar amount of the architect's estimate!) 21

The middle-price technique is designed to prevent competitive bidding from becoming too ruthless. Rival contractors meet to discuss their bids, and the firm closest to the middle price (the average of the bids from all competing contractors at the meeting) is designated the successful bidder. The other contractors then submit bids to the customer (client) that are higher than the middle price. Thus the contractors do not undercut each other and profit margins are not eroded. 22

The British middle price practice had an interesting historical counterpart here in the United States. In one Iowa community, the bidders would hold their own letting on the night before the
officially-scheduled bid opening. The low bidder was "awarded" the contract and instructed to add an agreed amount to his low bid, to cover bidding expenses for all parties concerned. After the essential business had been concluded, a night of beer-filled fun and revelry ensued, celebrating the award. (Presumably, these "expenses" were also included in the revised bid!) On the following day, all contractors submitted their bids, adjusted upward by the amount of the agreed bidding expenses, leaving all bidders in the same relative position. Thus, competitive aspects of bidding were maintained, bid preparation expenses for all were covered, and the Owner presumably paid for only value received—with the notable exception of party expenses.

This remarkable cooperative arrangement continued for almost ten years until the pressure of non-cooperative "foreign" bidders forced its demise. (Rumor still persists that one disgruntled contractor, after a beer-charged argument at the "award party" the evening before, dishonored his tacit agreement by readjusting his bid to low status, thus casting the pall of suspicion on any similar future arrangements, and effectively ending the informal pre-bid award sessions.)

**Types of Contracts**

The entire construction industry is continually and avidly discussing types of contracts and their effect on project costs. That there can be a positive or negative effect on total costs seems to be a foregone conclusion, but the relative merits and demerits of the different contract agreements are always being questioned by various special interest groups in the industry.

**Single vs. Multiple Contracts**

One of the most raging controversies at the present time is
the conflict between contractors' associations on single vs. multiple contracts. The basic argument of the general contractor is that he has been "managing" the total project—including the mechanical and electrical contracts—for years, and he now wants official contract recognition of the fact. With that recognition, of course, goes monetary control over major "subcontractors" (a term that rouses the ire of mechanical and electrical contractors) and reimbursement for management of construction to the general contractor. Mechanical and electrical contractors claim loss of identity in the building process, hurl charges of "bid-shopping" at the general contractors (a charge that has been leveled at mechanical and electrical firms for years—and with some justification), and warn owners that superfluous management expense will be added to project costs under the single contract system.

In attempting to avoid the emotional arguments involved, the facts would seem to be as follows:

1. With the complexity of today's projects, some level of coordinating management over and between all contracts must be provided.

2. On smaller projects especially, where continuous owner/client representation is not available, the general contractor would seem to be a logical source for such management and control. However, the alternative possibility of construction management by architecturally-oriented representatives on either a separate contract or additional fee basis would also have great merit.

3. Additional management costs (in comparison to multiple contracts) are added to the total contract, usually amounting to approximately 2-3% of the mechanical and electrical subcontracts. This same amount would offer
a substantial basis for architectural construction management fees.

4. The charge of "bid-shopping" may be allayed by the use of assigned contracts—taking separate bids on general, mechanical, and electrical work (other contracts such as vertical transportation, furnishings, etc. could be treated similarly) and assigning the low bid awards to a third party for overall management. This third party may be the general contractor who has already included an overall management fee in his bid—or it may be a construction management firm engaged especially for this purpose.

5. A single contract on a bid basis usually precludes phased construction. However, assigned contracts can also be used in this case to avoid the necessity of finally completing all project construction documents prior to bidding.

6. On larger projects, performance bonds may be a problem under the single contract system. This can be solved by a series of sub-bonds from sub-contractors covering their own contract amounts.

The controversy on single vs. multiple contracts will undoubtedly continue. However, the arguments are usually taken out of the context of a specific situation. Size of project, competitive interest, political implications, alternative management possibilities, and owner preference all have great effect on the ultimate choice—far more than the emotional arguments projected to date by the contractors' organizations.25

Negotiated Contracts

Contracts let on a negotiated basis have several inherent
advantages in spite of the poor traditional image of "cost-plus" contracts. And, of course, the greatest general advantage is mutual confidence among the parties involved. This one factor can allow many variations:

1. Negotiated contracts provide extremely favorable vehicles for phased construction, allowing early construction starts prior to completion of construction documents.

2. If preliminary design development drawings are complete prior to contractor selection, they can be used as a control basis for costs, adding the contractor's knowledge and expertise to the material selection and detailing process.

3. Cost control can be incorporated into the negotiated contract by specifying a "guaranteed maximum" or "upset price". Such a figure must be based on comprehensive design development documents as well as a clear contractual understanding regarding design changes, unforeseen circumstances (ground conditions, strikes, wage increases, etc.) and deleted work. If the contractor has been hired with true confidence, there is no reason why all parties involved can't cooperate with a mutual and realistic regard for project costs.

4. Workmen do tend to work less efficiently on cost-plus contract projects, especially in periods of slack construction volume. Some cost control consultants acknowledge this fact by automatically adding 2 to the budgeted construction cost for negotiated contract projects.26

No negotiated contract will work satisfactorily unless there is mutual respect and confidence between the owner, architect,
and contractor. If this atmosphere is present, and the parties are competent and diligent in their efforts, this type of contract is the most versatile and effective basis available.

Staged Contracts

As mentioned previously, the most talked-about item in the construction industry today seems to be phased construction—"fast-track" scheduling—or staged contracts. No matter what terminology is used, the desired end result is the condensation of plan/construct time and resultant reduction of project costs. Those in favor of phased construction are very vocal in their praise. Large architectural firms—"bell cows" of the industry—have inundated the trade journals with documented case histories extolling the virtues of "fast-track" scheduling. Eye-catching illustrations of condensed time schedule charts greet the reader in each article. From the mounting voices of praise, it would seem that a true construction cost-saving panacea has been discovered. But some major questions—and reservations—remain.

"Fast-track" Description

Caudill, Rowlett, and Scott, a well-known Houston architectural firm, has been one of the leading proponents of fast-track scheduling. They describe it as "a management technique for reducing the total project delivery time. The fast-track project delivery system allows for the concurrent scheduling of time-consuming activities and the early start of the construction process." The CRS report goes on to state that "reducing time" will "reduce total costs". (See Figure 2, p. 60 for diagrammatic illustration of fast-track).

Under fast-track scheduling, according to CRS, construction documents are produced in several bid packages:
CHAPTER SEVEN—CONTRACT AWARDS

1. Rough site work and foundations
2. Building shell (including structure, exterior skin, elevators, and major mechanical subsystems)
3. Interior systems (including ceilings, lighting, partitions, floors, fixed equipment, and the secondary air distribution subsystems)
4. Finished site work and landscaping

Bidding

One of the biggest problems in phased construction is the coordination of construction contracts. Several bidding alternatives are possible to ensure contractual continuity and coordination:

1. **Phased Bid**—Prime contractors submit bids on sitework and foundations package with the understanding that the successful bidder will have an opportunity to bid on subsequent packages. If he is not low bidder on the later contracts, he will then manage the low bid subcontractors.

2. **Basic Bid + Unit Cost Bid**—Prime contractors bid on first construction package with unit cost bids on building systems to be used in second and third construction packages. Bidding under this system is competitive for the first package contract, but might require negotiated changes to the contract for later packages.

3. **Negotiated Contract**—A selected prime contractor works under a cost-plus agreement for construction management services, and submits quotations for various portions of the project on a negotiated cost basis. The owner may reserve the right to call for competitive bids for certain subcontract work or materials.
4. Construction Management Bid—This method of bidding involves a separation between construction management and building construction. The prime contractors bid competitively for construction management control on a fixed fee or percentage of construction cost basis with the additional agreement that all building construction will be done by subcontractors bidding competitively.29

"Fast-track" Advantages and Disadvantages

CRS is certainly not alone in their extolling the virtues of fast-track scheduling. The Ballinger Company, Smith Hinchman and Grylls, and other large architectural firms have used the technique on various projects. Most reported successes to date have involved private projects and negotiated contracts. The real controversy and problems seem to occur in the public sector.

Advantages of phased scheduling are fairly obvious. By employing a condensed time schedule, the owner avoids escalating costs, higher construction loan interest rates, and gains faster occupancy, thus gaining rental revenue. The contractor is able to cut his interim financing costs, equipment rentals, and general overhead expenses. The architect also shares benefits in overhead savings and earlier receipt of fees. On a negotiated privately-financed project, where time is of the essence, and occupancy deadlines are imperative, phased construction seems to offer very definitive advantages. However, fast-track applications are now being made to the public sector of construction. It is here that disadvantages begin to mount.

CRS and the New York University Construction Fund have been the chief proponents of publicly-financed phased construction projects to date. Construction packages are bid competitively, assigning subsequent contract packages to the first successful bidder or
CHAPTER SEVEN—CONTRACT AWARDS

...to a third-party construction management firm. The problems occur in the later phases:

1. Late phase bidders are sometimes reticent to accept work done by previous contractors.
2. Begin/end conflicts are difficult coordination items, especially in regard to specific trade jurisdictions.
3. Design tends to become fairly stereotyped since the compatibility of each package is absolutely essential. This tends to emphasize the use of modular pre-assembly and building subsystems, a fact readily acknowledged by CRS and now adopted as an integral part of their fast-track package.
4. Control cost management is essential. Few problems ensue if all package bids are within budget estimates. However, if any early phase draws high bids, the same kind of delays are incurred as in the total project package bidding process. Even worse is the high bid on a later package. When this occurs, the owner is already committed to the project, having awarded early phase contracts with construction usually well under way. To emphasize the problem potential even more, the later packages involve a greater proportion of the total building costs as well as many more cost variables.

**Conclusion**

Although phased construction may not provide all the answers to today's unique construction problems, it certainly does present intriguing possibilities for time-cost savings. In the public sector, however, the problems inherent in the fast-track technique must be honestly faced in respect to relatively fixed budgets, reduced contractor interest, and a definite tendency toward design...
sterility. The entire fast-track process relies heavily on construction management techniques that are unavailable on most projects at the present time. To ensure future fast-track success, such management techniques must be provided at a high level of competence.
CHAPTER EIGHT
OTHER TIME–COST FACTORS

"Surely, inflation must be the world's most successful thief"—Carl E. Person

Governmental Factors

MacDonald Becket, in describing "The Architect of the Future", gives due emphasis to government's role:

Politically, governmental bodies are playing a larger part (than ever before) in the construction picture as they enter the housing market, tighten building codes and take greater steps into environmental control—planning to pollution.

The actual scope of Federal involvement in the construction industry is absolutely staggering, especially when viewed as a conglomerate whole. As projected for 1971 expenditure, following is a capsule description of some of the Federal agency building and approval programs:

Public Buildings Service: The volume of its own design/construction activities approaches $200 million annually. PBS does an additional $100 million for other Federal agencies.

Facilities Engineering and Construction Agency of HEW:
This agency operates 26 construction programs under 12 separate laws, providing Federal assistance approaching 25% of in-place cost. This amounts to about $1 billion on 581 projects for this fiscal year. HEW presently supports with Federal funds over 50% of all national health facility construction and 30% of all national educational health facility construction.
Housing and Urban Development: HUD's chief effort is to stimulate construction of 26 million dwelling units during the 70's. This agency was given $45 million for the coming fiscal year to finance Research and Development, including Operation Breakthrough—not to mention other programs involving college housing, educational facility grants, and housing for the elderly.

Federal Aviation Administration: New legislation projects a 10-year commitment of $14 billion in Federal funds to expand the nation's aviation system under FAA jurisdiction. Next year's budget provides $280 million for airport expansion and improvement.

Post Office: The Post Office Construction Engineering Facilities Department is planning to spend $700 million annually for the next four or five years for new construction alone.²

When added to state and local governmental building outlays, it is obvious that these three comprise the largest construction "client" type in the United States. As such, the effect of government building volume and construction policy on the building industry is considerable. Inefficiencies in approvals procedures, design programming, or construction management are inordinately magnified in effect because of the size and scope involved. And inefficiencies have traditionally been an integral part of the governmental scene. As an example, the Post Office Department commented recently that its building projects are now "planned and implemented to turn the traditional seven to 10 year planning and construction period into three years or less."³

Many architectural and contracting firms avoid governmental contracts entirely due to the "red tape" involved in approvals,
form submittals, special inspections, and delayed disbursement of funds. The original HUD housing for the elderly program, for instance, involving a guaranteed loan backing with direct 98% construction funding from the agency, was absolutely farcical in administrative approval delays. At one point on one early project, the contractor had actually completed over half of the construction involved prior to allocated funds finally being released by the area branch of the agency. And this magnanimous act was accomplished only through the combined efforts of a U.S. Senator, two U.S. Representatives, and a syndicated newspaper article describing the fiasco. For several years thereafter, local area contractors were reticent to bid on such projects, fearing history might repeat itself. When bids were received on similar projects, they were usually inflated to provide for possible unforeseen interim financing costs.

Although Federal government red-tape may be annoying and time-consuming, state and local agency approvals can be even more unpredictable—and costly. Small-minded building department officials seem to take great pleasure in pointing out minute provisions of the code after buildings are constructed and occupied. State approval agencies, given authority by obscure Federal law, can become terrifying opponents on questions of esthetic design. In one instance, a well-intentioned but misguided state librarian single-handedly delayed construction of a civic library involving her approval for release of matching Federal funds because she didn't believe concrete to be an "acceptable" exterior material—that libraries should be "brick" and "preferably Georgian". After a six-month delay, she finally acquiesced, but only after direct order from the Governor. Her approval delay cost the Owner approximately 7% additionally in project costs due to extra expenses and escalated construction costs.
Government-enforced wage rates provide further inflationary time-cost pressures. Recently, President Nixon suspended application of the Davis-Bacon prevailing wage law. (Even more recently, the law was reinstated, together with a system of wage negotiation review boards for each construction trade aimed at reducing the inflationary wage spiral in the industry.) Under this law, contractors working on Federal and various Federally-assisted construction projects costing $2000 or more must pay their workers not less than the prevailing wage for similar work in the project area. (The law had been on the books since 1931, when it was passed as a Depression measure to prevent erosion of local wage standards by the importation of cheap outside labor.) Prior to Mr. Nixon's suspension action, the Labor Department, which administered the law, had been accused of "setting union wages as prevailing and of extending high metropolitan wage rates to lower wage areas." An incident involving a small Iowa college community of 5,000 population located exactly equi-distant from two "metropolitan" cities of 100,000 and 35,000 population will illustrate the point. When prevailing wage rates were to be set for a HUD-funded college library facility in the smaller community, the Labor Department in Washington sent inquiries to "area" contractors, requesting prevailing wage rate information. Most of the contractors on record in Washington, of course, were located in the larger cities. Therefore the union wage rates prevailing in those cities suddenly became the "law of the land" in the smaller community. Within a month after the job was awarded, most construction trades in the community were enjoying a 25% raise in pay based on the "new prevailing wage rates" being paid on the library project.

Labor Unions and Productivity

As one article headlined recently—"Unions hit the jackpot in wage settlements." Truer words were never written! Under new labor contracts, lathers in Cleveland "will earn $10.71 an hour by
early 1972, cement masons $10.41 and marble masons $10.16. Demands have gone as high as $25,560 per year. Settlements have averaged 20% a year, the Associated General Contractors (AGC) says.8

The figures also show that construction unions have won recent wage settlements far beyond that of their factory-employed brethren. A Houston Post article dated January 30, 1971 reported that "Construction workers... won pay raises more than twice as large as those for factory workers in 1970."9 That this article was an understatement is apparent when compared with the actual figures. The construction industry median hourly wage increase hit a record high of 90.5 cents while the all-industry median wage increase was only 27.7 cents—more than three times greater. Since 1966, the annual hourly wage raise for construction workers has increased from 19.8 cents per hour to the present level of 90.5 cents per hour. Until 1966, median wage increases in construction had closely paralleled those in other industry.10

While wage rates have shown dramatic increases, construction labor productivity has actually decreased.

Peter J. Cassimatis, in his study of Economics in the Construction Industry, calculates that "construction labor productivity increased over the last two decades (1947-1967), though less than in manufacturing, agriculture or the total private economy."11 According to Cassimatis' figures, the annual labor productivity improvement has been at a 2.9% average rate over the 1947-1967 twenty-year period. Since the dramatic construction wage increases starting in 1967, however, the rate of productivity in construction trades has decreased. The Chicago area serves as a graphic example. In that particular metropolitan area, "Labor costs soared over 13% per year, compounded, in the five years ending 1969 because wage rates jumped 50% while average productivity sagged 20% (according to the Builders Association of Chicago)."12
So far the construction unions can afford to be arrogant, for they represent a scarce product in extremely high demand. And the fact that they control admissions to most manpower training programs in the construction industry only heightens the problem. Engineering News Record, in a recent article on labor shortages, says:

The key problem... is that the industry is not training enough new men to meet its growing demand for labor. The principle reasons for this... are the difficulties in recruiting, inadequate apprenticeship programs, and union restrictions on the size of their memberships.\[1^3\]

The report goes on to state:

A number of contractors are also concerned about the inadequacy of training and the attitudes of their workers. "Our work demands more capable help than we can get" and "the shortages are not as serious as the poor productivity of the men we get," they say.\[1^4\]

With the present trend to more paid holidays for union workers, four-day work weeks, built-in escalation wage clauses, and a financial ability to pay for extended leisure time activities—the problem may get much worse before it gets better. Whether answers are found in a new birth of open-shop contracting firms, the use of industrialized systems, or through increased labor union recruitment and training programs, the fact remains that today's highly-paid construction worker with a recent record of decreasing productivity is a major time/cost factor.

**Depreciation During Construction**

While other time/cost factors may be more dramatic and commonly reported, one seems to have escaped the spotlight. Although owners acknowledge depreciation as a major item in building management cost accounting, very little attention has been paid to the effects of depreciation during construction as a measurable time/cost factor.
As buildings become more complex, projects larger in scope, and time intervals extended between start of construction and occupancy, the problem of depreciation costs becomes more acute. As an example, construction on One Shell Plaza, a 50-story reinforced concrete office structure in Houston was begun in 1966. The building was first occupied by the major tenant in April of 1970. Just after this date, a noticeable rise in sub-foundation water table was noticed. Upon further investigation, it was discovered that the 30-odd sand-point well heads in the dewatering system required complete replacement, having been completely eroded since their installation some three years previously. As a result of normal equipment use and wear, the owner was faced with a major replacement cost even prior to project completion. Such wear and tear on building equipment is certainly not uncommon on extended projects, since power, heat, and air conditioning are often used during the construction period. And it is highly doubtful that replacement costs for relatively short-lived equipment are included in either the contractor's or owner's estimates of costs or expenses.

Thus, the problem of funding depreciation—a common bookkeeping item during the useful life of a building—can also be a problem during the construction period. This is especially true when applied to today's structures filled with sophisticated and complicated equipment and controls, the majority of which has a relatively short average useful life. While 50-75 year "life expectancies" for buildings are generally accepted, the life expectancy of equipment within those same buildings is an entirely different matter. Table VI is a listing of common items of building equipment with an average useful life of 15 years or less:
TABLE VI
BUILDING EQUIPMENT
WITH AVERAGE USEFUL LIFE OF
FIFTEEN (15) YEARS OR LESS

<table>
<thead>
<tr>
<th>Description of Equipment</th>
<th>Average Useful Life (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air conditioning system, medium</td>
<td>15</td>
</tr>
<tr>
<td>Air conditioning system, small</td>
<td>10</td>
</tr>
<tr>
<td>Dehumidifier</td>
<td>10</td>
</tr>
<tr>
<td>Fans</td>
<td>15</td>
</tr>
<tr>
<td>Gauges</td>
<td>15</td>
</tr>
<tr>
<td>Regulators, suction or static pressure</td>
<td>5</td>
</tr>
<tr>
<td>Valves, automatic expansion and by-pass</td>
<td>5</td>
</tr>
<tr>
<td>Valves, solenoid</td>
<td>15</td>
</tr>
<tr>
<td>Clocks</td>
<td>15</td>
</tr>
<tr>
<td>Heaters, electric</td>
<td>10</td>
</tr>
<tr>
<td>Heaters, gas</td>
<td>15</td>
</tr>
<tr>
<td>Burner equipment, oil</td>
<td>10</td>
</tr>
<tr>
<td>Awnings</td>
<td>5</td>
</tr>
<tr>
<td>Incinerators</td>
<td>14</td>
</tr>
<tr>
<td>Pumps, suction: pressure and sump</td>
<td>13</td>
</tr>
<tr>
<td>Screens, window</td>
<td>10</td>
</tr>
<tr>
<td>Shades</td>
<td>5</td>
</tr>
<tr>
<td>Venetian blinds</td>
<td>8</td>
</tr>
<tr>
<td>Roofs, asphalt and tar (prepared)</td>
<td>15</td>
</tr>
<tr>
<td>Roofs, tarred felt</td>
<td>10</td>
</tr>
<tr>
<td>Galvanized iron, light or cold dipped</td>
<td>15</td>
</tr>
</tbody>
</table>

The problem of depreciation has usually been anticipated for such finish items with short life durations as awnings, shades, and venetian blinds where the owner receives full depreciated
value during their useful life. However, other building equipment such as air conditioning, fans, gauges, heaters, oil burners, valves, pumps, regulators, and roofs that are installed early in the construction process will have "lived" a great share of their expected useful lives by the time the building is completed. Using a building with a two-year construction period as an example, some of the items listed will have "aged" between 7-20% of their expected life by the time the building is occupied.

Such depreciation in value during the construction period is an expense that must be acknowledged by the contractor, the owner, or both. Since it is an expense of construction, it should be properly accounted for. And since it is contingent and proportional to time expended during the construction period, every effort should be made to expedite completion and owner occupancy in the shortest possible period of time.
"Statistics are no substitute for judgment"—Henry Clay

In previous chapters, management time/cost factors, phase scheduling to reduce construction time, and the effects of increased construction costs on investment returns were discussed. The salutary effect of condensed construction time on investment return will be illustrated in this chapter. Again, emphasis is given to the broader aspects of total project investment, a broad scope view usually missing in today's practice of architecture.

To promote their construction management services, the Turner Construction Company recently ran an advertisement which was headlined "...every month of construction is a month's rent lost." Although the loss of operating rents is a major item for investment consideration, the shortening of the construction time period may have far more impact than gaining earlier rental occupancy.

As Paul Farrell says in his article on "The High Cost of Construction Delays":

The length of time required for construction of an office or other speculative building often has a substantial effect on the amount of necessary equity money; a lengthy construction period will reduce the return on equity investment and may even force the investors out of the project.

Conversely, a marginal investment can become highly attractive due to greater returns ensuing from a shortened construction period.

To illustrate this fact, a speculative office building project will be used as an example. Table VII lists basic facts on the hypothetical project:
TABLE VII
OFFICE BUILDING FINANCING

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Area</td>
<td>1,600,000 sq.ft.</td>
</tr>
<tr>
<td>Net Rentable Area</td>
<td>1,300,000 sq.ft.</td>
</tr>
<tr>
<td>Base Construction Period</td>
<td>48 months</td>
</tr>
<tr>
<td>Average Annual Rental Rate</td>
<td>$6.00/sq.ft. (Net Rentable Area)</td>
</tr>
<tr>
<td>Annual Operating Expenses</td>
<td>$2.00/sq.ft. (Gross Area)</td>
</tr>
<tr>
<td>Loan Rate</td>
<td>8.5%</td>
</tr>
<tr>
<td>Loan Period</td>
<td>25 years</td>
</tr>
</tbody>
</table>

**Project Costs:**

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structures + Site Improvements</td>
<td>$32,000,000</td>
</tr>
<tr>
<td>Land</td>
<td>3,000,000</td>
</tr>
<tr>
<td>Fees, Insurance, and Taxes</td>
<td>3,000,000</td>
</tr>
<tr>
<td><strong>TOTAL INVESTMENT</strong></td>
<td><strong>$38,000,000</strong></td>
</tr>
</tbody>
</table>

**Interim Financing:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortgage Banker</td>
<td>$500,000</td>
</tr>
<tr>
<td>Loan Discount</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Construction Interest</td>
<td>5,500,000</td>
</tr>
<tr>
<td><strong>TOTAL FINANCING</strong></td>
<td><strong>$7,000,000</strong></td>
</tr>
</tbody>
</table>

**TOTAL INVESTMENT**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan Receipts</td>
<td>$33,750,000</td>
</tr>
<tr>
<td>Lease Deposits</td>
<td>650,000</td>
</tr>
<tr>
<td>Equity</td>
<td>10,600,000</td>
</tr>
<tr>
<td><strong>TOTAL FINANCING</strong></td>
<td><strong>$45,000,000</strong></td>
</tr>
</tbody>
</table>
As shown in Table VIII, the total project cost is $45,000,000 of which $38,000,000 will be invested in structure, site improvements, land, professional fees, taxes, insurance, and other costs. (Tenant improvements, equipment, and furnishings are not included in the accounting.) As indicated, there are also various interim financing costs: the mortgage banker will receive a "finder's fee" in the amount of $500,000 and a $1,000,000 loan discount is assumed, deducted in advance of payment.

Construction loan interest is estimated at $5,000,000 based on an 8.5% rate and adjusted for the periodic payments to contractors over the four-year building period. This interest-only financing charge will occur at an annual rate of approximately $2,840,000 at the end of the construction period. Financing costs will increase to approximately $3,270,000 annually under the permanent loan agreement including amortization of principal payment in addition to interest.

Gross annual rents of approximately $7,800,000 will be available to the owner starting 48 months after construction begins. With annual expenses of $3,200,000 the net income will be $4,600,000 per year, beginning after the fourth year of construction. Figure 3 illustrates these income and expense figures.

Figure: OFFICE BUILDING INCOME AND EXPENSES
Figure 4 shows a composite picture of the relationships between financing costs, income and expenses, and time:

![Composite Picture](image)

The project will require $45,000,000 in funds during the first four years before the permanent financing will become effective. The mortgage loan will provide $33,750,000 of that amount. (See Table VIII) Lease deposits made by new tenants will produce an estimated $650,000 (one month's rent plus interest on contractor retentions and deposits during construction) in cash which will be available prior to construction completion. Therefore, another $10,600,000 is needed to make the project "fly". One source of these funds is the pockets of equity investors in the project; another is from the net income on the completed project:

a. If the project can be partially occupied on lower floors during the last year of the construction period, approximately $2,300,000 ($\frac{1}{2} \times 1,300,000 \text{ sq.ft} \times 6.00/\text{sq.ft} \times \frac{1}{2} \times 1,600,000 \text{ sq.ft} \times 2.00/\text{sq.ft.}) of additional income would be generated. Therefore,
equity owners would be able to reduce their investments from $10,600,000 to $8,300,000. (See Figure 5)

Figure 5: OFFICE BUILDING FINANCING WITH PARTIAL OCCUPANCY DURING LAST 12 MONTHS OF CONSTRUCTION

b. If total construction could be completed and occupied in 36 months rather than the original 48 month construction period originally assumed, the financial benefits to equity investors are even more graphic. Since additional net income in the amount of $4,600,000 would be generated, equity investment could be reduced by that amount to $6,000,000. (See Figure 6)
The conclusions seem to be fairly obvious. The sooner the project starts to produce revenue, the sooner equity investors can stop using their own capital to cover financing costs. In other words, the money required from equity investors can be reduced by almost 20% ($10,600,000 to $8,300,000) if partial occupancy during the last 12 months of the construction can be achieved. If construction time can be condensed to 36 months, equity investment can be reduced almost 40% ($10,600,000 to $6,000,000), roughly $400,000 per month savings to the investors.

After the building is occupied, this project will produce an annual cash flow of approximately $1,330,000. ($7,800,000 rents less $3,200,000 expenses and $3,270,000 permanent financing costs) This cash flow will occur annually regardless of the amount of equity invested in the project. Obviously the owners would prefer to realize this amount of cash flow on a $6,000,000 investment (22% rate) than on $10,600,000 (12.6% rate).
Therefore, if the owner's financial interests are to be truly and professionally acknowledged and accommodated, all members of the construction team must exert every effort to shorten the construction period, thereby effecting earlier project occupancy. 2
SUMMARY

"Progress is always the product of fresh thinking, and much of it thinking which to practical men bears the semblance of dreaming"—Robert Gordon Sproul

Construction cost controls have been an historic problem in the construction industry. However, we are now at a point in time when the problem is even more critical. Projects are larger, more complex, and require more sophisticated management techniques.

Although architects may never again completely regain their past image as the Master Builder, they must recognize a new and broader scope of practice or lose their viability in the construction market place. The "new" architectural firm may be a corporate giant composed of many specialists or it may be a small office of generalists with a ready source of consultants available for specialized reference. But, whatever form the future firm takes, the architect must begin to see in broader views or lose his ability to be seen as a potential leader on the construction team.

By taking a new and broader view of project scope, the architect will begin to see the total meaning of creative cost control management. He will begin to appreciate the total financial support required for project completion, rather than emphasize a relatively meaningless preoccupation with per square foot costs of construction. With that total picture, he can then respond creatively and definitively—using his newly-found knowledge as a key to project control.

In an attempt to define and analyse the total project cost problem, with special emphasis on architectural practice implications, the following items have been discussed in this thesis:
SUMMARY

1. The trend in construction costs and the need for management control.

2. A description of architectural services and types of architectural firms in existence today.

3. A survey of innovative architectural office practice management techniques as they affect fees and total costs, and a discussion of total personnel involvement in future creative management practice.

4. The implications of total scheduling, including a case example showing the effect of increased costs on investment quality.

5. Investigation of new client/contractor/owner relationships in total project planning and management.

6. Investigation of contract bidding and award factors with time-cost implications, including bidding climate, seasonality, bid-rigging, and phased scheduling.

7. A survey of other major time-cost factors over which the architect has little or no control.

8. A case study of the effects of time condensation on total project financing.

In this thesis, it has also been shown that non-design factors may have far greater influence on total project costs than materials and methods selections. These same factors have been shown to have an amplified impact on a project’s investment quality. All the factors discussed, however, have time-cost implications. Whether it is in the architect’s office, the realtor’s suite, the banker’s conference room, or the contractor’s job shack, the implications of time-cost permeate the total project.

As soon as the architectural profession recognizes—and
responds—to the real cost-time problems in total project scope, then—and only then—can architects hope to assume a true leadership role on tomorrow's construction team.
INTRODUCTION


CHAPTER ONE—ELEMENTS OF CONSTRUCTION COST CONTROL


3. Ibid. p. 79.


CHAPTER TWO—THE IMPORTANCE OF MANAGEMENT


CHAPTER THREE—ARCHITECTURAL PRACTICE TODAY


CHAPTER FOUR—INNOVATIONS IN OFFICE PRACTICE


4 Ibid. p. 9.

5 Ibid. p. 11.

6 Ibid. p. 13.

7 Ibid. p. 14.

8 Ibid. p. 15.


Footnotes cont.


14 The method of time budget estimating illustrated was developed by the author over a period of years based on several seminars, discussions, and trial and error in actual office practice. The latter process is still in current use, and refinement hopefully continues.

CHAPTER FIVE—TOTAL SCHEDULING


3 Ibid. p. 94.


7 "Computer Programs to Share," AIA Journal, April, 1968, p. 94.

CHAPTER SIX—NEW CLIENT/CONTRACTOR/ARCHITECT RELATIONSHIPS


4 Ibid.


6 Ibid.

7 Ibid.


9 Ibid. p. 2.

10 Ibid. p. 3.

11 Ibid. p. 4.

12 Ibid. p. 4.


14 MRI Report, op. cit., p. 4

15 Ibid. pp. 4-5.

16 Ibid. p. 5.

17 Ibid. p. 17.
CHAPTER SEVEN—CONTRACT AWARDS


2 Ibid.

3 Ibid.


5 Ibid. p. 61.

6 Ibid. p. 61.

7 Ibid. p. 61.

8 The bid spread occurred on a city library project in Spencer, Iowa—Maiwurm/Wiegman, Architects in Spring, 1970.

9 Perkins, op. cit., p. 61.

10 Interview with John H. Evans, general contractor, 1968.

11 Petro-chemical plant, Fort Dodge, Iowa, 1968: Interview with Deon Gadbury, mechanical contractor.

12 Perkins, op. cit., p. 61.


14 Perkins, op cit., p. 61.


16 Perkins, op. cit., p. 61.

17 Perkins, op. cit., p. 61.

Footnotes cont.

19 Interview with Deon Gadbury, mechanical contractor, 1968.


22 "Bid-rigging," op. cit., p. 159.

23 Interview with E. J. Grosz, city building inspector, Fort Dodge, Iowa, circa 1960.

24 Ibid.

25 Master Builders of Iowa vs. other contracting associations: Discussions and pamphlets, circa 1965.


28 Ibid., p. 34.

29 Ibid., pp. 35-36.

CHAPTER EIGHT—OTHER TIME-COST FACTORS


3 Ibid., p. 58.

4 Rotary Ann Home for the Elderly, Eagle Grove, Iowa—Maiwurm/Wiegman, Architects, 1967. (Senator B. B. Hickenlooper and Reps. Neal Smith and R. Gross were the congressmen involved.)

CHAPTER NINE—TIME AND COSTS


2 Ibid., pp. 116-117 and interview with Georgia H. Thompson, real estate agent, Houston, Texas. Figures used approximate One Shell Plaza, Houston.
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