Construction management: an evaluation of the role and practice

Arthur Franklin Anderson
The University of Montana

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CONSTRUCTION MANAGEMENT:
AN EVALUATION OF THE ROLE AND PRACTICE

by

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Bachelor of Architectural Engineering
University of Michigan, 1949

Presented in partial fulfillment of the requirements
for the degree of
Master of Business Administration
UNIVERSITY OF MONTANA
1976

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[Signatures]
Chairman, Board of Examiners
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Date
Sept. 9, 1976

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ACKNOWLEDGMENT

This paper is an attempt to keep faith with University of Montana School of Business Administration Professor Thomas J. Johnson (Ph.D., University of Chicago), who recently passed from among us.

Tom Johnson insisted on good thought. He had a knack for shaking up the carefully constructed "best" effort of his students--and then helping them reshape that effort into a form far better than they had dreamed possible.

It was a privilege to have had him as a tutor, counselor and friend. This completes that agenda we began--when it seemed there would be time...

Arthur F. Anderson
August, 1976
TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>LIST OF TABLES</th>
<th>iv</th>
</tr>
</thead>
</table>

Chapter

<table>
<thead>
<tr>
<th>I. INTRODUCTION</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>II. HISTORICAL PERSPECTIVE</td>
<td>6</td>
</tr>
<tr>
<td>III. STATISTICAL PERSPECTIVE</td>
<td>22</td>
</tr>
<tr>
<td>IV. CONSTRUCTION MANAGEMENT PRACTICE</td>
<td>27</td>
</tr>
<tr>
<td>V. PROFESSIONAL PERSPECTIVE</td>
<td>32</td>
</tr>
<tr>
<td>VI. RECOMMENDATIONS</td>
<td>44</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APPENDIXES</th>
<th>50</th>
</tr>
</thead>
</table>

| SELECTED BIBLIOGRAPHY | 62 |

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## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Indicative Size of Selected Contractor and Design Firms,</td>
<td>25</td>
</tr>
<tr>
<td>Ranked by Value of Construction Work Undertaken in 1974;</td>
<td></td>
</tr>
<tr>
<td>and Selected Industrial Firms, Ranked by 1974 Sales.</td>
<td></td>
</tr>
<tr>
<td>2. Management Areas in the Traditional Construction Process</td>
<td>38</td>
</tr>
</tbody>
</table>
Chapter I

INTRODUCTION

During the past decade, roles of those involved in construction industry operations have been undergoing reevaluation. Construction projects are becoming increasingly complex as are the materials and methods used on them. Environmental and social issues are affecting location and other aspects of construction work. Adverse impacts of inflation are being felt as projects are delayed to work out complex interrelationships of the work and to resolve external conflicts. The reevaluation of construction project roles is aimed at dealing with those disturbing influences and at reducing time delays that have been built into traditional processes.

The reevaluation has resulted in the introduction of a new coordinative process or system called Construction Management. The purpose of this paper is to (1) explain the origin of Construction Management, (2) outline current Construction Management practice, (3) discuss Construction Management in terms of professional management principles and (4) recommend ways to improve Construction Management practice.

As Construction Management practice evolves, it seems important that rather comprehensive summarizations and assessments of its development be provided from time to time. Many individuals and firms whose traditional roles in construction projects may be affected by Construction Management are likely to be relatively uninformed about it. This
is because much of the information currently available is found in journals, periodicals and special publications in the fields of architecture, engineering and general contracting (for construction work). Information from those sources gets to readers on a piecemeal basis for the most part. In addition, it is more often given as news than as a comprehensive review and evaluation such as this paper is intended to provide.

This paper is also intended to be of value to those involved in training and educational aspects of the construction industry. There is a consensus among those who have written articles and guidelines on Construction Management that its practice should be professional in nature. This implies a need for formalizing the objectives and content of appropriate courses and curricula. The construction industry should call on people trained in the fields of education and professional management for assistance on educational programs for Construction Managers. Those called on would benefit from studying, as an introduction to their tasks, material such as provided through this paper.

The intent of this paper, then, is to inform as well as provide evaluation. Historical background is sketched to show some past cultural and economic influences on coordinative roles in construction work. The recent growing awareness of a need for better methods to plan and deliver construction projects is indicated through reference to various articles written in the past decade. To assure common understanding of the subject matter, a definition of the construction industry is provided along with related statistical data. Currently accepted Construction Management practice is outlined as found in publications of
contractor, design and construction industry client groups involved in planning and implementing construction projects. Training and education needs are discussed, based on an industry directory and supplemental articles. Various writings and texts are used to demonstrate that a professional management viewpoint is helpful in defining problems and opportunities involved in the practice of Construction Management.

The construction process addressed in this paper is typically initiated by the customer for whom the work is done. Production is undertaken at a time and place and under conditions largely within the customer's control. The product may take any of a variety of forms, such as dwelling units, manufacturing plants, highways, bridges and others—characteristically large, immobile and custom-built. A unique ad hoc organization is brought together, on a generally sequential basis, to design and produce the one-of-a-kind item demanded by the customer together with appropriate designers and workers skilled in handling the materials involved in the project. Coordination may be provided by the customer, the designer, or the workers, depending on arrangements made by the customer. Currently, the practice of Construction Management is intended to overarch all other coordination—reaching all those involved in the project and extending from concept through final delivery of the completed project for the customer to occupy and use.

As already indicated, much of the information about Construction Management is found in certain articles and special publications of design, contractor and client groups involved in construction projects.

1See Appendix A for a more expansive definition of construction and the range of products and services included.
The only widely known book dealing with the subject is William B. Foxhall's *Professional Construction Management and Project Administration*, published originally in 1971 and revised for a second edition published in 1976.¹

There are three basic entities involved in construction projects as dealt with in this paper: owners, designers and contractors. These three elements are designated as traditional and each is dealt with as though singular in number. The owner is the client, customer, or constituency for whom the project is built. The designer includes all those involved in feasibility studies, technical requirements and drawings and specifications detailing quantity and quality of the work to be done. The contractor includes those who provide labor, materials and equipment to prepare the site and do all other physical work needed to complete and deliver the final product.

Owner-designer relationships are typically client-to-professional in nature. The designer is understood to be a learned professional "... operating essentially under his own direction... for the benefit of others."² He has satisfied certain education and experience criteria and generally has passed written and oral examination by his peers. The designer is authorized by the owner to do particular acts and to act on particular occasions. Within authority delegated by the owner, the designer's acts bind the owner and those who transact


business with the owner on terms set by the designer.

The contractor normally operates in the capacity of an independent contractor. He is left to his own devices and methods so long as these are directed toward the owner's objectives. Education and experience requirements for contractors are not rigorously prescribed. Written and oral examination by peers is not required in most cases. In general, all that is required is some showing of financial responsibility--assets, bondsmen--and payment of a license fee, to put a contractor in business, legally, in most states. In certain cases a progression through a series of experience and examination steps is required to obtain a contractor's license in a special field such as electrical or mechanical (plumbing, heating, ventilating and air-conditioning) work.

Construction Management and Construction Manager are both symbolized by CM in the material that follows except where clarity requires a full spelling. Relationships between this new entity and the three traditional elements of construction projects are still evolving. Mainly to follow the evolution of those relationships, a roughly chronological arrangement of material has been followed in this paper.
Chapter II

HISTORICAL PERSPECTIVE

This chapter depicts some of the primary influences on construction practices. Social and cultural influences dominated early projects such as the pyramids of Egypt, the aqueducts of Rome and the great cathedrals of Europe. In more recent times the ever-increasing number of construction specialists has led to coordination problems. Now, economic considerations are finally forcing the industry to examine the teamwork aspects of its performance.

Early Construction Practices

The earliest directors of construction work were no doubt tribal leaders with the vision to see that group efforts could do what individuals alone could not. Roles of tribal leaders evolved into roles of rulers and priests who controlled wealth and slave labor. These leaders planned and directed construction, producing thereby a historical legacy of palaces, temples, roads, waterways, monuments and other public works.

The principles that guided construction for centuries were discovered and validated largely through trial and error. Failures taught lessons. In the time of Hammurabi (around 1,900 B.C.) such lessons could be very costly to the builder. The law was simple and direct:

If a contractor builds a house for a man, this man shall give the contractor two shekels of silver per ser (a unit of weight) as recompense.
If a contractor builds a house for a man and does not build it strong enough, and the house which he builds collapses and causes the death of the house owner, then the contractor shall be put to death.

If it causes the death of the son of the owner, then the son of the contractor shall be put to death.

If it causes the death of a slave of the owner, then he (the contractor) shall give the owner a slave of equal value.

If it destroys property, he (the contractor) shall replace what has been destroyed, and because he did not build the house strong enough and it collapsed, he shall rebuild the house at his own expense.

If a contractor builds a house for a man and does not build it so that it stands ordinary wear and a wall collapses, then he shall reinforce the wall at his own expense.1

For nearly 3,500 years after Hammurabi, most major construction was done at the bidding of religious, political or military leaders. Their knowledge of construction principles was limited. Those who worked for the leaders relied on "secrets" or general principles handed down from age to age. A serious search for rational explanations and proofs of the structural properties of construction materials was not undertaken until the time of the Renaissance. Most of the studies and applications were, at first, only academic. Calculus and Cartesian coordinate geometry were necessary mathematical precursors for theories of statics and strength of materials. No construction designers or builders participated in the studies that led to scientific breakthroughs for the construction industry. Most of those involved were, in fact, "physicists, mathematicians, geometricians—many of whom were drawn into the natural sciences through their study of medicine. They were professors at universities or else found a living as 'court mathematicians.'"2 It took nearly 500

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years of mental effort during and after the Renaissance to produce the
formulae that today are almost taken for granted by professional engi-
neers and architects in construction design.

By the late 1700's French bridge builders were finally putting
construction theory into practice. The Industrial Revolution encouraged
further innovation. Steel became available. Construction technology
matured rapidly as theoretical possibilities and limitations were tested
in actual projects.

In the 19th century, as was the case in many industries, con-
struction was led by a relative handful of imaginative entrepreneurs.
They saw the need for canals, railways, tunnels, buildings of all types,
and other construction works. They knew what was theoretically possible.
They arranged with others, often corporations and governmental bodies,
to finance the work. Successes led to more work in more locations for
more clients on more grandiose scales.

Early in the 20th century the inventiveness that stimulated
growth in the construction industry seemed to be leading the industry
into problems. Newly developed materials and techniques evoked increas-
ingly complex structures. For example, buildings had to be adapted to
permit incorporating central heating, air handling, people moving, plum-
ing, electrical power and communication systems. Each new system
required some special updating of the knowledge of all those involved
in construction processes.

Specialists developed. Designers became involved in determining
ways to incorporate new technology into a variety of projects. They
began to leave actual work processes to others. Responsibility for much
project work was "delegated to a new specialist, the general contractor, who subsequently parceled much of his work out to specialty contractors."^1

Thus the specialists began to sort themselves into two major groups—designers and contractors—and the owner was often hard pressed to determine accountability for results on his project.

**Modern Procedures**

Larsen’s *Guide to Business History*, published in 1948, seems to reflect fragmentation and general lack of leadership and continuity in the construction industry:

There are no general comprehensive works dealing with the history and development of the construction industries in the United States. The absence is probably largely owing to the fact that so much of the industry is made up of small and local petty capitalist units; and a much smaller proportion of industrial capitalists are of regional importance, at the most. Only a small number have attained national operation and importance . . .

... The business side of construction, the individuals and companies engaging in construction, and the general organization of the construction industries have received little attention from historians.

One must perforce, in so far as printed materials are concerned, rely largely on fragmentary books and articles published from time to time and on serial publications.^2

Nearly 20 years later the situation had changed but little. However, some construction industry publications began carrying articles indicating that changes were at least being discussed. The June, 1967, issue of a periodical carried a special report asking "Who is leading the design and construction team?" The report began with the following

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Certainly there is a feeling of unrest that has stimulated serious reevaluation of traditional roles among the design and construction group. In the end, it will be the public in general and the client in particular who will decide whether or not changes are in order. Some experiments are already attaining status as acceptable methods of procedure in some quarters.¹

The remainder of the report and six other articles in the periodical dealt with items such as "package builders," "owner-controlled design/construction group," "consultant-contractor," "contractor controlled design/construct team," and "expanded services from engineers and architects." The main theme appeared to be basically that the designer and contractor might have to become more closely aligned in order to deliver products fitting the owner's needs.

A dilemma for the designer was sketched in a later issue of the same periodical. Influences on one hand were shown as tending to draw the designer into the actual construction operations. On the other hand were shown the risks of legal entanglements from on-site conditions over which the designer might lack control. New construction contract documents discussed in the report appeared to have caused some owners and contractors apprehension that designers were trying to abjure their share of responsibility for construction work.²

Another construction industry periodical in April, 1968, described an intermediary appearing in the construction picture and operating between the designer and the owner. Names mentioned for the intermediary


were "construction management," "construction consulting," "construction project management," and "project management." The intermediary was to have responsibility for four objectives of the owner:

1. Simplified project management
2. Rigid control of time
3. Tight budget controls
4. Adequate quality control.

In addition to those goals, the intermediary was to have a "strong orientation toward business management." Success would rest on "ability to satisfy client demand by applying modern management techniques to the building process, from start to finish."

In 1970 the Associated General Contractors (AGC), the most prestigious organization of contractors in the United States, if not the world, held a conference on Construction Management. The conference directed attention to "unification of estimating, scheduling and buying with building planning, specifying and even programming." Again, the theme was get the contractor and designer closer together for the owner's best interests.

At the same time that a new current seemed to have started toward closer designer and contractor collaboration, counter currents, already strongly in motion, were advocating cleaner segregation of the designer's role from that of the contractor. Discussing legal implications of the word "supervision," a 1970 report on several legal cases concluded with

a warning that designers should not take on "supervisory" roles even on projects they designed.¹

The Crisis in Construction by M. R. Lefkoe, published in 1970, suggests several reasons for what he calls a "construction crisis." One is that the definition of construction activity fails to include off-site functions as well as on-site functions. Among off-site functions that should be fused with on-site work, Lefkoe includes design, research and development, and financing.² Lefkoe's concept of an answer to construction industry problems embraces the idea of a closer relationship between designer and contractor for the owner's benefit.

The October, 1970, issue of the monthly AGC news magazine discussed traditional and "new" designer/contractor relationships.³ The traditional system was described as almost forcing the designer and contractor into adversary roles: the designer is placed by the owner in a position of authority but without having his own money "on the line;" and the contractor is given primary responsibility and considerable latitude to control the schedule, cost and quality of the work plus having his own money "on the line." The article admitted the contractor's control is often weakened through a "brokerage" method of hiring, scheduling and overseeing of the work of specialists needed for various facets of the project. However, no matter what weaknesses of the traditional system needed correction, any intermediary introduced, such as a

¹"Law," ibid., p. 31.


"construction manager," would have to be capable of dealing with the full range of tasks the owner expects either the designer or the contractor to do for him.

In 1971, the American Institute of Architects and the Producers Council cosponsored a first National Conference for the Building Team. The Commissioner of the Public Buildings Service of the General Services Administration (GSA) of the Federal government told participants on-site labor costs of construction would be reduced "... as giant corporations with design, manufacturing and construction capabilities replace traditional building firms." "Phased construction" was hailed as a proven means of holding down costs but requiring a "strong building team of owner, architect, construction expert, and, to some extent, manufacturers." The construction expert, among other tasks, "... advises the architect on which drawings must be completed for construction to continue smoothly." A contractor pointed out that "You can do without (a designer), too, if the subs are smart enough."\(^1\) (Subs are specialty subcontractors, contractors in their own right.)

Later in 1971, GSA made construction history by awarding a CM contract to schedule, direct and control the design and construction of a multi-million dollar building project.\(^2\)

The Associated General Contractors discussed CM at a midyear directors' meeting in 1971. The chairman of the building division reported, "We've had 18 meetings on this issue and we haven't gotten anywhere ... " Concerns were expressed about political awards,


ill-equipped competitors (taking CM jobs from "qualified" contractors,) reduction (of contractors) to the role of subcontractors, and the absence of financial responsibility (on the part of CMs who were not also contractors). ¹

An English contractor touring the United States to study the American approach to coordination of designer and contractor revealed how the situation was seen in England: "Our experience to date suggests that the problem really is not a management problem, but stems basically from a design dilemma. The designers can't completely resolve a design problem without rigidly specifying the method of construction." He illustrated the problem from an actual experience. The owner had in mind a building for a rapidly changing technology, meaning that even after construction was underway he would require some changes just to keep up with his, the owner's, technology. The contractor was hired, while the designer was still developing construction documents to depict the owner's needs. The contractor's role was to assist the designer by suggesting economical materials and expeditious methods of assembling the completed project. The designer was delayed in completing the drawings so the contractor requested a corresponding extension of time for completing the project. He was told that since he took part in the design, an extension could hardly be justified by the owner. The Englishman concluded, "That argument just goes on and on, and the whole thing gets into a mess."²


A 1971 contractors' round table discussion centered around implications of the CM contract that GSA had awarded. One contractor remarked, "I would have to assume what many others have already assumed: that GSA is trying to get someone else to take on that phase of organizing and constructing that their construction division normally does.

The Government Accounting Office (GAO) has raised hell with government agencies lately and I think GSA wants to avoid some of this criticism by hiring a construction manager and transferring the responsibility to him." Another contractor felt, "They could give authority to their man in charge of the project and accomplish just as much as they will by hiring a construction manager." Also noted was that a contractor might be in a position of having to go to the CM, for example, to assure himself that the painter did not delay painting and thereby permit undue damage to occur to work installed by the contractor's work force whereas, in the traditional construction process, the contractor could control that sort of work sequencing directly.¹

The GSA Commissioner responded to the contractors' round table. The intent of the CM system, he said, was "... to bring the elements of the building team together instead of having them all separate." He pointed out that delays caused by exceeding money budgeted by Congress in one year could be eliminated because "We're going to know how much we need way ahead of time ... Right now our estimating is quite unsophisticated, to put it mildly." Financial responsibility and subcontractor coordination, as handled by contractors in the traditional process, the Commissioner claimed, often has been a matter of the contractor "cutting

¹"Construction Management and GSA," ibid, pp. 28-33.
all the corners and whipsawing the subcontractors." He went on to say that the CM "... doesn't have this problem. He can be selective about who he brings in, and he can go out and get competitive bids from subcontractors having the freedom to do the job well." (Strangely enough, the Commissioner thereby defined, exactly, a method very commonly used by constructors to get subcontractors to work with them on projects not controlled by a CM.) Dramatizing his own conviction that CM was the way of the future, the Commissioner warned, "The contractors that don't see the handwriting are going to go from the big time to the small time. They'll be the old-fashioned type of contractor."¹

Looking at and beyond CM, the vice-president of a firm having both design and contracting capabilities ventured an opinion, early in 1972, that CM was only an interim phase on the way to a complete design-construct process. By 1985, he predicted, designers "... will have two major roles: they will either work for an owner, or they will work for a design-construct firm." Designers would thereby become important members of the staffs of owner's firms in that they could interact for the owner with the design/construct team.²

The Associated General Contractors (AGC) turned again to a discussion of CM in their 1972 convention. The contractors in attendance adopted guidelines outlining purposes, functions and responsibilities of CMs. This was conceded to be mainly an effort to give contractors an edge over designers in getting CM jobs. The guidelines clearly stated


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that the AGC:

Does not endorse the CM approach as a substitute for any other successful contracting method.
Still maintains its subscription to competitive bidding and the single contract system.
Does not encourage the CM approach on public works.¹

Following a six page "state-of-the-art" report on CM, Engineering News-Record editorialized, "... the current quibbling over who outranks whom and who's best qualified to be CM is not only self-defeating, but is also nonsense ... that professional can be anyone from inside or outside the industry who can efficiently provide the array of quality services the owner needs and demands. The fact that so much of CM's genesis lies in the past omissions of (contractors and designers) is enough to defeat any philosophical claim of royal prerogative. Once the members of the industry concede this, then the real task can begin ... guiding the evolution of CM toward the perfection of a highly efficient, cost-controlled, economically viable, and legally sound delivery system.²

Responding to questions about liability for construction work under the CM approach, a bonding company indicated it was not familiar with the concept. However, the response noted that if the designer undertook to build the project, the designer should carry professional liability insurance, "... to protect himself from claims of malpractice, etc.," and should be required to post "a performance bond


guaranteeing performance of the contract.\textsuperscript{1}

Commentary by a practicing CM in 1973 indicated that CM was still in "evolution and ferment." The CM admitted to overlapping the designer in areas such as estimates of probable construction cost and "certain aspects of contract administration." Some tasks shifted from designer to CM, without CM concurrence, included document checking and coordination, preliminary processing of shop drawings,\textsuperscript{2} preparation of bid packages and bid documentation, on-site communication and analysis of proposed changes in the work. Still, the CM claimed, there should be no overlap in the designer's liability in most cases. The CM quoted no proof of this, such as reduced premiums for designer's liability insurance while operating with a CM. Of the future, the CM noted that the rapid rise in the use of CM was due to owners' needs for "more effective means of delivery of large, complex projects than had been available through public bidding of single contracts for each product." CM was only one part of the response to the owners' needs; still evolving was the concept "... of total project management--... a single, unified project venture... working toward a common set of objectives."\textsuperscript{3}

The 1974 convention of the Associated General Contractors passed over CM for more pressing matters. Others kept the CM issue alive,

\textsuperscript{1}See Appendix B.

\textsuperscript{2}Shop drawings are documents from construction material suppliers showing intricate and critical details of prebuilt products to be incorporated into the work; details must be reviewed and approved by the designer before the constructor gives the supplier a final order to deliver the material.

\textsuperscript{3}"A/E-CM Relations: Approaching a Modus Vivendi?" \textit{Architectural Record} (October, 1973), pp. 67-68.
however. One contractor-oriented CM felt CMs should be hired on day one of the owner's negotiation to obtain designer services and that CMs should be allowed to use their own employees to do some of what would normally be the contractor's work. The latter practice, if allowed, would put the CM's objectivity in a cloud, an owner responded.\(^1\) A construction marketing conference hailed CM as an inflation-fighting tool.\(^2\) Michigan was reported to be ready to apply its laws for contractors to CMs,\(^3\) but not without CM resistance.\(^4\) A report on CM in a multi-story building project opened with the statement, "Construction management in all its forms is a highly rational response to viable needs—needs which exist primarily for owners. And by fulfilling owner-needs, construction management techniques also deliver by-product benefits for the design professional, the contractor and the material suppliers as well." Other points made included "... the facts of economic life for the owner require that there be new disciplines available on his facility delivery team. These disciplines should provide the means for dealing effectively with budget, material availability, compatibility among families of materials, schedule, cash flow and, ultimately, owning, operating and maintenance costs. There is a mandate to deal electively with these factors during the planning and design phases of an emerging project


which is of tremendous importance to the ultimate success of every project."¹

Another CM reported that CM was

. . . practiced in so many different ways that no two definitions are likely to sound related. Today, three groups with wide procedural variations call themselves construction managers. The first group is general contractors; the second, architects or engineers; and the third, consultants with specialized backgrounds . . . If it's done right, here's what it does:

1. Better pre-construction planning to eliminate errors and change orders.
2. Clear lines of authority and responsibility, improved communications, and no conflicts of interests.
3. Greater flexibility in adding or eliminating features.
4. Opportunity to start the job sooner by fast tracking.
5. Owner's needs are clearly and constantly interpreted yet he has more time to run his business, keeping profits up when he needs them most.
6. Owner has the benefit of consultants with business administration and managerial capabilities, construction industry experience, and a modern, pragmatic approach to problems that beset the construction industry."²

Designers still claim to be interested in facilitating change to meet the demand for an improved delivery process, although not necessarily through a CM approach. The 1976 president of the American Institute of Architects (AIA) feels that designers should either get what it takes to manage construction in their own organization or get a contractor on the owner's team and get on with the building job. If the owner demands single responsibility, the designer can become a subcontractor for the contractor, but that removes the designer from a direct relationship with the owner.³

²"Is There a Construction Manager in Your Future?" Buildings (July, 1975), pp. 52-55.
During the past 10 years, then, some major objections have been voiced by construction industry representatives and clients to the traditional "bucket brigade" system for handling construction projects. The system creates adversaries—not teammates. The designer cannot, or will not, take control of on-site work. The contractor is not legally qualified to make technical decisions about uses of materials. This non-assumption of roles appears to leave responsibility voids. Owners propose to span the voids with a "business-oriented" entity called a Construction Manager that will assist the Owner in:

1. Developing money and time budgets and staying within them.
2. Assuring material availability and compatibility.
3. Obtaining material deliveries as expeditiously as possible (for example, without waiting for all construction documents to be completed).
4. Dealing with project problems as they arise in both conceptual and construction stages.
5. Anticipating ultimate costs and problems in owning, operating and maintaining the completed project.

Some of those speaking or writing about problems with the traditional system have claimed to see dire results ahead for those in the industry who failed to grow or change to meet "new" needs. Others expressed the idea that CM is only one step on the way up—or is it back?—to unification of project design, construction and management. Neither designers nor contractors seem to wholeheartedly endorse the CM idea.

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Chapter III

STATISTICAL PERSPECTIVE

Too often in technical discussions, background information is wrongly assumed to be common knowledge. For that reason, a brief review of the sources of data used to depict the construction industry and its operations is appropriate. What is the nature of this industry that seems now to need help in managing its affairs?

Two leading sources of construction industry statistics are the U.S. Department of Labor (using Bureau of the Census data) and the McGraw-Hill Information Systems Company. Their definitions differ (refer to Appendix A and letters, Appendix B). However, both sources indicate clearly the industry's complexity.

The Department of Labor (and Bureau of the Census) see construction as follows:

The 1972 Census of Construction Industries covers all establishments primarily engaged in contract construction (general contractors or special trade contractors) or in construction for sale on their own account (operative builders) or in subdividing real property into lots (subdividers and developers, except cemeteries) as defined in the 1972 edition of the Standard Industrial Classification (SIC) Manual. This is the system of industrial classification developed over a period of years by experts on classification in government and private industry under the guidance of the Office of Management and Budget. This system of classification is in general use among government agencies and also outside the government.¹


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lists 390 subcategories of industries within the main categories, groups and major groups of construction industries.\(^1\) (A summary of the SIC listing of construction industries is given in Appendix C.) The growing complexity is indicated by the fact that the 1967 SIC Manual listed 305 subcategories of construction industries—85, or 28 percent, have been added in 5 years.

The Bureau of Census' Construction Industries data covers only construction work done by firms in SIC construction industry categories. The Bureau's Series C30 provides data on all new construction put in place, whether by SIC construction industry firms or by others. With this data the only missing pieces of a complete report on construction work would appear to be maintenance and repair work done by establishments outside the SIC classification.

The Department of Labor and Bureau of the Census do not recognize design as part of the construction business except in the case of certain buildings where the contractor has included design as part of his own work effort (i.e., done by his own forces or by a designer the contractor employs). The Commissioner of Labor Statistics, in 1970, made some proposals about new statistics for construction, but none dealt with rounding out data on maintenance and repair work or the design of construction projects.

The McGraw-Hill people "... think of the construction industry as all encompassing. It includes design, engineering, the exercise of governmental authorities and related permit and other expenses, land

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preparation, the cost of financing, etc. It never includes the cost of land.\footnote{This is the definition assumed for purposes of this paper, even though statistical summaries are not complete for construction activity defined in such broad terms.} Labor Department statistics indicate that construction expenditures account for around 10 percent of the gross national product (GNP) of the United States and that the industry employs around 5 percent of the labor force other than agricultural workers. For 1967, design expenditures, if added to construction, would bring expenditures up to around 10.5 percent of the GNP; design employment, if added, would bring labor force up to around 5.3 percent.\footnote{Engineering News-Record (ENR) annually publishes the McGraw-Hill ranking of contractor and design firms in terms of the value of construction work undertaken. Fortune magazine annually publishes a ranking of other industrial firms in terms of sales. Although the value of construction work cannot fairly be equated with industrial sales, Table 1 presents data on selected firms from the ENR and Fortune surveys mainly to indicate that business handled by construction industry firms is not insignificant in comparison with other industries. The top five contractors and designers would all place among the top 100 industrial firms if}
TABLE 1

INDICATIVE SIZE OF SELECTED CONTRACTOR AND DESIGN FIRMS, RANKED BY VALUE OF CONSTRUCTION WORK UNDERTAKEN IN 1974, AND SELECTED INDUSTRIAL FIRMS, RANKED BY 1974 SALES

<table>
<thead>
<tr>
<th>Rank of Firm</th>
<th>Contractor Firm ($ million)</th>
<th>Design Firm ($ million)</th>
<th>Industrial Firm ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6,247.5</td>
<td>6,197.5</td>
<td>42,061.3</td>
</tr>
<tr>
<td>2</td>
<td>4,870.3</td>
<td>3,780.7</td>
<td>31,549.5</td>
</tr>
<tr>
<td>3</td>
<td>3,618.2</td>
<td>3,397.0</td>
<td>23,620.6</td>
</tr>
<tr>
<td>4</td>
<td>3,539.0</td>
<td>2,728.4</td>
<td>23,255.5</td>
</tr>
<tr>
<td>5</td>
<td>2,931.2</td>
<td>2,310.0</td>
<td>18,929.0</td>
</tr>
<tr>
<td>10</td>
<td>1,476.7</td>
<td>1,599.0</td>
<td>16,458.0</td>
</tr>
<tr>
<td>25</td>
<td>594.3</td>
<td>405.5</td>
<td>4,980.7</td>
</tr>
<tr>
<td>50</td>
<td>218.6</td>
<td>65.1</td>
<td>3,215.7</td>
</tr>
<tr>
<td>100</td>
<td>105.0</td>
<td>15-19.9</td>
<td>1,928.9</td>
</tr>
<tr>
<td>200</td>
<td>52.1</td>
<td>5-7.49</td>
<td>1,009.8</td>
</tr>
<tr>
<td>300</td>
<td>36.7</td>
<td>2.5-4.9</td>
<td>1,009.8</td>
</tr>
<tr>
<td>400</td>
<td>25.8</td>
<td>1.8-2.49</td>
<td>411.0</td>
</tr>
</tbody>
</table>

Sources:
included in Fortune's survey on the basis of construction work undertaken. Many of the top 50 contractors would make the "Fortune 500." The McGraw-Hill reports indicate that both contractors and design firms are doing CM work, but it is only a minor part of all work reported.

A 1974 survey of the buildings part of the construction industry\(^1\) shows several interesting details. First, contractors earn more than designers by nearly $10,000 per year per firm. Designers are more likely to have graduated from college than contractors. Contractors are likely to have been in their profession longer than designers. More than 50 percent of both designers and contractors are in the 40-59 age bracket, the survey shows.

A 1972 survey of architectural firms shows about 25 percent involved in complete design and construct operations.\(^2\)

Statistically, the construction industry is large enough to be conspicuous and diverse enough to be responsive to a variety of customer needs at many scales. It is anchored to many traditional roles and categories of work but shows activity in many new ones, including CM. The full scope of construction activity, by both the SIC "classified" construction industry and by firms outside the SIC categories and doing construction work, has yet to be assessed in the all encompassing terms of the McGraw-Hill definition.


Chapter IV

CONSTRUCTION MANAGEMENT PRACTICE

Introduction of CM to the traditional construction process has been instigated by owners. It appears to be an attempt to recall the situation when construction genius and intuition could be counted on to get all the work done and done right. Unfortunately, the work is now far too diverse in most cases for even a genius to handle all of the necessary, coordinative details. This does not mean that genius and intuition are no longer applicable in construction processes. Rather, there are better ways to deal with situations where complex technologies must interface on projects than to rely on intuition to direct the action.

The real problem now appears to be how to reduce to tolerable limits uncertainties about project costs, time for completion, and quality. Related to that is the problem of how to operate in areas where certainty can be established while continuing to unravel the remaining uncertainties.

In the traditional construction process the designer reduces uncertainty by continually evaluating alternatives while preparing the construction documents. Where there are several "right" ways to proceed, one course is chosen and further details are then geared to that course. Through this procedure points of decision are anticipated and work is visualized as flowing from start to finish along preset courses. One disadvantage of this procedure is that no work can start and no materials...
can be ordered until the entire course is plotted. Another disadvantage is that the contractor is tied to the course, as plotted, regardless of whether or not he may be able to work effectively under the preset routine and regardless of efficiencies possible through adoption of other "right" ways to do the work.

The contractor reduces uncertainty by stating the time needed and the amount it will cost to complete the project according to the construction documents. Where there are uncertainties, the contractor resolves them by making interpretations from the construction documents. Those interpretations may not be in concert with the intent of the designer or the owner. Gaps or miscues in the construction documents are a frequent cause for disputes. Any dispute has the potential for increasing costs and causing delays.

Designers and contractors offer special skills in their own areas. Most of them are not inclined to get into each other's realms, no matter what the owner expects of them individually and collectively. There are legal precedents that make it risky for designers or contractors to operate outside their traditional 20th century domains.

Since neither designer nor contractor appears willing to take on added coordinative roles in the construction process, a new element, the CM, has been added to the construction process. The new element is currently operating on somewhat of a trial basis. The scope of activity and responsibility is still being defined.

Early in 1972, three publications dealing with CM became available. Two were developed by groups representing designers of construction projects, and one by contractors. One designers' publication opens with
the following statements:

Two words—professional and management—sound the keynote of response needed in today's near-crisis in building design and construction. Professionalism is the saving quality that preserves the fundamental and essential relationships between the client and those who design and deliver his building. Construction management is the operating instrument of professionalism in the whole process and, therefore, must itself be applied with professional integrity. It is the near-crisis, brought about by the accumulated, unresolved complexities and constraints of our time, that has called for this amplified role of management . . .

The second design group expresses deep concerns about the failure of the traditional methods to meet owner's objectives. Their report, prepared by a specially appointed committee, concludes:

1. Project and construction management services are increasingly being used in the implementation of significant construction projects.
2. While confusion over definitions persists, three functional roles, Project Manager, Design Manager, and Construction Manager, seem to be emerging.

   The Project Manager directs the efforts of the Design Manager and Construction Manager, and supervises additional areas of concern such as feasibility, site selection, real estate, financing, accounting, tenant and leasing activity.

   The Design Manager supervises conventional basic design services.

   The Construction Manager supervises activities related to scheduling, cost control, value analysis, contract interfacing, quality control, and similar construction related matters. He provides construction related input to the design process, as well as general direction of contractors during the construction activity.

   These are professional services which are not in the construction contract tier. Construction, materials and equipment contracts are between the Owner and the contractors.

The contractors' publication, on the other hand, asserts that CM is not an innovation because "those principles" have been used for many years.

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years. The publication includes the following definition:

The Construction Manager is the qualified general contracting organization which performs the Construction Management under a professional services contract with the Owner. The Construction Manager, as the construction professional on the Construction Team, will work with the Owner and the Architect-Engineer from the beginning of design through construction completion. The Construction Manager will provide leadership to the Construction Team on all matters relating to construction. He will provide the Construction Team with information and recommendations on construction technology and construction economics. He will propose construction alternatives on the project cost and schedule. Once the project budget and schedule have been established, he will monitor the subsequent development of the project to ensure that those targets are not exceeded without the knowledge and concurrence of the Owner. He will manage the procurement effort, coordinate the work of all trade contractors, assure conformance to design requirements, provide current cost and progress information as the work proceeds, and perform other construction-related services as required by the Owner.1

Owners have also published CM guidelines. Their guidelines express the notion that cooperation, teamwork and acceptance of leadership in respective "Spheres of operations" among the owner, designer and contractor will result from owners' employment of a CM for construction projects. The General Services Administration (GSA) handbook claims

The NEW TEAM approach creates a different working relationship between Owner, Architect-engineer, and Contractor, which now makes possible the early formulation of critical project decisions on a more coordinated and objective basis while drawing on the uninhibited experience and knowledge of the Architect-Engineer and the Construction Manager, both of whom are pledged to the Owner's best interests. The old antagonisms are laid to rest and a new cooperative spirit emerges.

The GSA CM approach includes

. . . overlapping of design and construction activities in a carefully planned, executed, and controlled order to permit the simultaneous construction of early-delivery elements are still under design . . . Interferences between work-in-place and subsequent design requirements are possible, but GSA believes the risks are acceptable and warranted. In fact, they provide a real-life

technical challenge to the design-construct team to anticipate, minimize, and accommodate.¹

Both GSA and the Department of Health, Education and Welfare (HEW) guidelines express their intent to create a team without a prime participant, one whose members work side by side.

Adding Construction Management talents to the design team enhances the (designer's) capabilities by providing knowledgeable consultation in the areas of construction costs, materials and methods of construction, manpower utilization, and scheduling of the work. It relieves the Owner of many of the anxieties that usually beset him, particularly those concerned with forecasting costs and completion date. Finally, the Construction Manager can provide a vital connecting link between the designer and those who will be bidding the work. This could eliminate many of the conflicts and resulting expensive change orders which are prevalent in the traditional method.²

It appears that owners intend the CM to operate as an independent contractor. Yet the notion of special agency is strongly implied, also. Perhaps a CM can have both relationships with his client at once. The courts will deal with that problem, if, indeed, there is one, as disputes arise over performance and non-performance of CMs.

It also appears that owners intend, with designers' support and contractors' acquiescence, that the CM will operate as a professional. That implies CM practice will be under the individual's own direction and done in an ethical manner for the benefit of both client and the public. It further implies that CMs will act on the basis of a special body of learning that is structured to the roles CMs are expected to assume.


Chapter V.

PROFESSIONAL PERSPECTIVE

Construction workers were slaves for many centuries in early history. Only recently have those in the design field achieved professional status. The CM issue is now forcing the construction industry to consider: Should contractors' work, or at least managerial elements of it, be raised to a professional level? Educational programs are available to enhance management skills of those who work on construction projects but an output of managers from those programs is hardly visible as yet. The touch that is missing may be that of professional management.

Construction Education

In Montana, during the period from around 1935-1955, several contractors capable of handling multi-million dollar projects started firms and prospered. A handful of the firms' owners had sons. It is interesting to note that the fathers, mostly not college educated, felt college education would help equip their sons to take over the business dad had built up by hard work (and the favorable climate for many public works projects). In most cases sons were sent to schools of architecture where there was a second son, number two son was usually sent to a business administration school.¹ Those already successful in construction, even in comparatively rural Montana, apparently felt the

¹Writer's note—based on personal acquaintance with the situation.
Burgeoning complexities of their business made it necessary, for continuing success, that contractors increase their knowledge in the fields of design and management through formal education.

Others, elsewhere than in Montana, addressed the need for formalized and professional education for contractors. In 1967, King Boyer, a professional engineer and University of Florida professor in the Building Construction Department noted that construction education was new at that time, and also expressed an opinion that aims of construction educators and contractors were not then the same. Educators, he felt, were mainly interested in enhancing construction quality while contractors were mainly interested in obtaining better estimators and superintendents who knew how to run a project at a reasonable profit.¹

In 1971, Ben Gerwick, a 1940 Phi Beta Kappa graduate in engineering who had become vice-president of a construction firm, resigned that position to become an educator. He was concerned that engineers were losing control of construction for lack of managerial ability and that engineering was becoming separated from construction in practice as well as in education—a separation that he viewed as artificial. As he prepared to strengthen and broaden programs in construction within the civil engineering department at the University of California, he placed a high priority on including business courses in the curriculum.²

Arthur Sampson, the man who brought CM to the Public Building


Service (PBS) of the General Services Administration (GSA) of the federal government is a graduate in business administration. His career includes industry and political jobs in finance, purchasing, personnel administration, systems analysis and budget preparation. His managerial philosophy is "to get people swinging together." Sampson was careful to assure both designers and contractors they would all be given fair consideration for CM contracts, provided they had the capabilities "to oversee and coordinate projects from design to completion."^1

A designer who is also a part-time college instructor recently expressed dismay that design professionals and educators still cling to traditional ideas of their practices. He asserts that design-educated people should break out of the old mold of designing monuments and symbols for clients' (and their own) egos and "infuse their abilities into other professions."^2

Until recently, contractors had no structured education to prepare them for their role in the construction process. By tradition, they were expected to get their training on-the-job. However, owners have often pressured contractors to perform as part-time lawyers, accountants, personnel managers and even designers on their projects. Thus, though unable to identify with any professional group, contractors are being constrained to find some formalized training that will enable them to respond to owners' needs and expectations on a fairly high level. The


complexities of construction project organization and operation are such that on-the-job training is no longer adequate.

At the present time designers receive little, in their formalized education, that prepares them to take on the overarching managerial roles owners assume will be handled by their traditional project team of designer and contractor. There is a recent trend, however, for design schools to include courses that have more practical on-the-job and management content.

A Construction Education Directory has been published by the Associated General Contractors of America (AGC). Collaboration between contractors and designers is obvious in the listing of schools offering courses in construction education. The directory includes 43 engineering and architectural schools offering construction options in their degree programs. While 83 schools offer CM curricula, only three are schools of business administration. However, many of the CM programs appear to include courses in economics, management, organization, personnel and labor relations, statistics and accounting.

The Directory outlines in some detail the AGC Education Committee's requirements for project-related positions of varying degrees of responsibility. It also outlines a 4- or 5-year course in CM. The curriculum content includes basic science (math, physics, chemistry, geology, etc.), basic and applied engineering, construction (contracts, bidding, operation, schedules, cost control, systems, etc.), management (economics, accounting, finance, personnel, business law, real estate, 

organization, etc.) and socio-humanistic studies (composition, literature, speech, political science, social science, psychology, ethics, etc.).

The opportunity for contractors to obtain college-level education has been established with existing colleges of design (architecture and engineering) and business (management). The curriculum is new and in a formative status. Graduates should be capable of handling a wide range of roles in the construction industry including design, construction, and CM. In addition, graduates should be capable of assuming roles in other industrial and professional areas that will improve the planning and execution of construction projects for the benefit of owners.

**Professional Management Perspective**

Peter Drucker points out the discipline of managing is "of the post-Cartesian world-view." That gives management a time relationship with modern scientific construction technology (p. 7, 8). Drucker goes further: "... two kinds of employed professional—the professional specialist and the professional manager—are mutually dependent on one another. They must exist and work together to be effective at all." In explanation, Drucker writes,

The specialist works in a field of knowledge and accomplishment that... sets its goal in its own terms: engineering or biological knowledge, sales or functional buildings. It is the job of the manager to bring all of these together, to make them effective and weld them into one performance. His professional knowledge is the capacity to organize. He is certainly dependent on the specialist. But the specialist is equally dependent on him.

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1 Ibid., pp. 8-11.


3 Ibid., p. 75.

4 Ibid., p. 76.
Ernest Dale shows there is wide agreement in professional management circles that, in addition to the capacity to organize, managers need ability in at least the following areas as well: planning, staffing, directing and controlling. To round out those five areas of skill, Dale adds innovation and representation. The manager operates in those seven areas in getting things done. He gets things done by making decisions. That involves knowing "... what results should be achieved, what each person and group should contribute to the common effort, and how the results can best be achieved without duplication of work or lost motion."^1

In the traditional 20th century construction process, professional management functions fall among the owner, designer and contractor roughly as depicted in Table 2. An almost endless variety and number of organizational patterns applicable to construction processes are possible.

A good idea of the problems and complexities of the traditional 20th century construction process can be gained by likening a construction project to a natural disaster. James D. Thompson deals with this concept in some detail showing how human and nonhuman resources designed for other purposes begin to accumulate to take care of disaster recovery activities. Thompson calls the organization involved in the recovery activities a synthetic organization. It forms in an ad hoc fashion and

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^2Ibid., p. 5.


<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
<th>By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Determine short- and long-run objectives that may include the project, economic, social and political environment, make market and financial analyses, survey sites, study feasible alternatives, develop preliminary schemes, select a solution and refine details, prepare construction documents, establish budgets of money and time.</td>
<td>Owner</td>
</tr>
<tr>
<td>Organizing</td>
<td>Determine construction technologies and skills needed for the project, decide duties and work responsibilities, provide coordinative lines of authority and other inter-relationships.</td>
<td>Owner</td>
</tr>
<tr>
<td>Staffing</td>
<td>Locate skilled people to undertake the work, arrange for interfacing of work segments done by various skills on a continuing basis through the life of the project.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Direction</td>
<td>Meet and dispose of day-to-day problems, check work performance and provide assistance, administer reward/punishment incentives.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Control</td>
<td>Plot sequential operations in advance of needs, adjust timing of operations, evaluate quality and quantity of work done to assure progress toward goals, make necessary reports including consideration of budgets.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Innovation</td>
<td>Combine old and new techniques to meet changing conditions as the project develops and progresses, improve conditions, explore possibilities relating to owning, operating and maintaining the complete project.</td>
<td>Designer</td>
</tr>
<tr>
<td>Representation</td>
<td>Notify users and others of the reasons for the project, explain new technologies, deal with unions and public groups who may have a stake in the project.</td>
<td>Owner</td>
</tr>
</tbody>
</table>
dissolves rapidly when the need that required it has been met.

Thompson points out that while the synthetic organization may be "instrumentally rational," it is not efficient. This is because it "must simultaneously establish its structure and carry on operations ... (and also) ... order the actions of its components in a situation of interdependence and in the face of uncertainty as to where and how that interdependency exists."\(^1\)

Most organizations doing construction work complete only a portion of the project. Thompson's synthetic organization appears appropriate for the traditional sequenced construction process because many elements of the total organization are apt to be unknown when the project starts. In fact, until the designer first begins, there is no organization for that particular project—no people are arrayed together just to carry out the specific objectives embodied in that one-of-a-kind project. Given that situation the professional manager could predict the work would be done inefficiently.

The synthetic organization could increase its efficiency, Thompson claims, if it could learn in advance the full extent of the problem and the full array of resources that would be available to help solve the problem. In this context it can be seen that the CM should aim to disclose fairly early in the construction process the full extent of the project, including areas where resolution of specific details is uncertain. The CM should also, in advance of actual needs, determine the resources that will be needed and arrange for their timely availability as the project requires them. By doing these things the CM

\(^1\)Ibid., p. 53.
should increase the efficiency of the group of individuals and firms that somehow is eventually organized to carry on the construction work involved in the project.

William G. Scott sees organization "as a mechanism having the ultimate purpose of offsetting those forces which undermine human collaboration . . . organization tends to minimize conflict, and to lessen the significance of individual behavior which deviates from values that the organization has established as worthwhile."\(^1\) The notion of minimizing conflict is certainly present in the many concepts of CM. However, those concepts seem to place their hope for minimizing conflict in an individual rather than in an organization. Little, if any, attention is focused on how the project organization will be formed other than that the CM is to somehow dominate the project and, at the same time, sublimate the organization so that it operates with minimal conflict. The idea that organizational structure can operate as a behavioral control is not new to professional managers, but it does not appear to be given recognition in CM concepts.

In some of the concepts of CM there appears to be a willingness to accept some lessening of quality as a reasonable price for expediting project delivery. The professional manager views all resources, human and nonhuman, as having values related to scarcity. It is not enough, then, to simply get the job done. The resources needed must be obtained and used effectively and efficiently. To do this, control must be established to protect or enhance intrinsic values of the resources.

and work, to avoid installing work badly and to avoid wasting resources.

Controls, Anthony shows, start with top management of the owner, the organization needing the project. It is through "strategic planning" that top management decides whether to undertake the project. That decision affects the character and direction of the organization. The objectives to be achieved through use of the finished project have a bearing on how the project will be handled from its conception through completion of construction, ready to use.

Within the framework established by strategic planning, the next level, middle management, carries on management control. This process "... is intended to make possible the achievement of planned objectives as effectively and efficiently as possible ..." The owner's management control process must be extended to the construction project. This can be done through the construction documents to some extent. However, as Anthony points out, "It needs to be a total system ..." Thus, either the CM must become familiar with the owner's management control system and implement it or he must establish a control system that is responsive to the owner's.

Going below top management, the CM should assure that specific tasks are carried out effectively and efficiently. That is, the CM should be able to demonstrate to top management that each element doing some portion of the construction project is doing it to quality standards commensurate with the best industry practice for the money spent.


2Ibid., p. 2.  
3Ibid., p. 3.
This, Anthony calls "operational control." He includes concepts of scheduling—relating outputs of one element of the construction organization to inputs of another, for example. Most operational action is taken in response to logical rules.

Robert L. Katz has expressed the notion that each of three recognizable managerial levels should have certain skills in differing degrees. The supervisory level is depicted as needing almost no conceptual skills, a much larger degree of human skills and great technical skills. The middle management level is depicted as needing about equal amounts of conceptual, human and technical skills. Top management is shown as needing more conceptual skills than any other level, needing human skills similar to the other two levels, but needing much less, if any, technical skill. Those relationships should have a bearing on the way the CM relates to representatives of the organizations involved in the project.

Another useful notion posed by Thompson is that rational organizations "seek to seal off their core technologies from environmental influences." By way of illustration, designers insist on being given a free hand in developing technical details of a construction project and, in general, seem more interested in protecting the integrity of their design role than in taking on any expanded role. Contractors, on the other hand, seem more open to suggestions that they take on expanded roles (but find themselves bounded off from the other domains by legal

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1Ibid., p. 7.


and professional fences). Thompson explains contractors' behavior in this way: "The organization facing many constraints and unable to achieve power in other sectors of its task environment will seek to enlarge the task environment."¹

There is no question that professional management can handle the coordinative role designed for CM. However, it does not follow that those who perform as CMs in name are therefore professional or professional managers or even managers. In most cases contractors who have become CMs have apparently acted very much like contractors—that is, serving as brokers for technologies, now including design technologies. Designers who have become CMs have acted very much like agents of the owner. Those who would be called professional managers should be found doing professional management activities. Furthermore, they should be totally conscious that what they are doing is, indeed, professional management. There is no conclusive proof that CMs are either doing or are aware of how to do a professional management job. The similarities are likely coincidental.

¹Ibid., p. 37.
Chapter VI

RECOMMENDATIONS

The stir of the past 10 years in the construction industry signals growing concern over methods by which products of the construction industry are delivered. Designers and contractors face a clientele of owners who are growing more insistent on a one-stop source for their construction projects. This is not to say the condition is universal. Such concerns would be most notable where owners want speeded-up construction for economic reasons, such as with industrial plants and office buildings where time saved on construction means earlier returns on money spent for those improvements. A gap has been growing between traditional type designers and contractors; this gap is believed by owners to be a major barrier to speeding up delivery and reducing costs of finished projects. To span the gap, owners have implemented CM. Under a CM designer and contractor work together from the beginning of the project instead of, as in traditional methods, doing their work in sequence.

Where implemented, owners have required the CM to be knowledgeable in both designer and contractor areas. CM contracts are quite specific about functions the CM is to undertake as overseer of preparation of construction documents and procurer of construction specialists. Acceptable results have been reported.
Four major recommendations follow:

1. Owners needing speeded up construction project action and faced with traditional designer-contractor-owner delivery modes should consider the option of starting the project under a CM using guidelines developed and used by other owners with acceptable results.

2. Designers facing a clientele of owners requiring CM services should enlarge their capabilities to perform the required tasks for such owners.

3. Contractors facing a clientele of owners requiring CM services should enlarge their capabilities to perform the required tasks for such owners.

4. Schools of architecture, engineering and business administration should, in collaboration with contractor organizations and skilled educators, develop a program and action plan for achieving professional status for CMs.

In some cases the owner may be able to take on the CM role for his project; there is no real reason to give it away when, for example, someone well qualified to be CM is already on the owner's staff. In other instances, the proper training may qualify one of the owner's people to be CM. In most cases, however, owners will have to hire CMs as the need arises.

At the present time there is little for an owner to use as a basis for determining the qualifications of firms that might undertake the CM role. The best source is the ranks of designers or contractors. Designers are generally professionals who are constrained by their ethical codes from taking their fee as a designer plus a share of the profit.
that would accrue to a contractor. Thus, their experience in the contractor area is based mainly on observation. They are not likely to be adept at detailed cost estimating, organizational development, negotiations with technicians, directing day-to-day work, controlling progress and correcting deviations from scheduled time or costs of specialized portions of the work.

Some designers may be fully qualified to act as CM on certain projects. Designers might consider collaborating with or employing a reliable contractor to supplement their own CM skills. If unable or unwilling to employ a contractor, the designer may have to find the training courses needed and become properly skilled to perform CM roles as demanded by owners.

Contractors who might accept CM roles are generally not professionals. With few exceptions, they pass no examination (other than showing financial integrity and generalized experience) and they are legally prohibited from making judgments in areas that require the recognized skill of professional designers licensed under state laws. They are generally not knowledgeable about organization theory, about relating space to human and other needs or about dealing with technical and code authorities. They are not qualified to prepare or alter construction documents prepared by designers. They are generally not adept at determining whether specialists or subcontractors can perform well and have, in fact, lived up to construction requirements as developed by designers.

Contractors not skilled as CMs face options similar to designers: collaborate with or employ a designer or find the necessary training courses and become skilled as a CM. Every state has at least one
university, college or technical school that offers construction education courses. The designer or contractor should be willing to invest some time gaining CM skills if that is what owners are demanding.

Carrying out the fourth recommendation would mean taking a big step toward the goal of professionalism for contractors. Curricula developed in the AGC Construction Education Directory\(^1\) appear to be a start in this direction. It will take considerable time and effort, however, to develop licensing requirements to serve and be accepted by the public and the construction industry. It will be even more difficult to break the traditional designer and contractor molds and bring in a professional contractor, duly educated and licensed to design as well as build construction projects.

Over the long-term, the current designer/contractor schism would be ended as Recommendation 4 was fully developed and implemented. Those who now think in terms of a conceptual phase, feasibility phase, planning phase, design phase, construction phase, and post-construction or operating and maintaining phase would relate all of those phases to a holistic idea of construction.

In the near-term, Business Administration schools might be considering ways to assist construction industry educators in developing construction managers who may claim to be professional managers with some legitimacy. That is, CM courses should teach management theory, management history, management control systems, organization theory, financial management, construction business law, personnel management,

etc., from a professional management viewpoint.

An old Roman, Petronius Arbiter, once said:

We trained hard, but it seemed that every time we were beginning to form up into teams, we would be reorganized. I was to learn later in life we tend to meet any new situation by reorganizing, and a wonderful method it can be for creating the illusion of progress while confusion, inefficiency and demoralization reign!^1

There is a warning there about reorganizing too often. Another warning comes from management consultant Stewart Thompson (not to be confused with James D. Thompson of Organizations in Action fame). Stewart T. feels the age of the manager is over; managers are now incapable of leading anything or anybody anywhere. He proposes bypassing management for a "corporate strategy." That, he explains, involves developing "new perceptions of the messages our environments are sending us, messages which do not register on surveys of 'motivation' or of 'management effectiveness.' We have to notice, and what we have to notice has to register as experience that is richer than our private and temporary fascination and goals."^2 Charles Tavel predicts the age of the entrepreneur, which, he says was followed by the age of the manager, will now be followed by the age of the "strategist"—supporting Stewart Thompson. The strategist will see the "whole picture" and adopt tactics accordingly to achieve his, or his firms, objectives.^^3

The manner in which CM has been introduced and is being developed suggests it is not simply a reorganization. It is a reuniting of


designers and contractors; they all once were content to be called builders. Further, CM will have no trouble fitting the mold of those who may choose to call themselves "strategists"; it is designed to experience the whole picture of the construction industry and to make appropriate adjustments as needs arise.
APPENDIX A

A DEFINITION OF CONSTRUCTION

Construction—Construction covers the erection, maintenance, and repair of immobile structures (together with service facilities which become integral parts of structures and are essential to their use); the physical development of land for purposes other than agriculture; and the demolition of existing structures.

"Structures" are defined broadly to include—in addition to buildings—such works as highways and streets; dams; silos and water towers; electric light and power transmission and distribution lines; petroleum and gas pipelines and distribution lines; radio, television, and radar towers; water supply lines and sewers; and all similar work which is built into or affixed to the land.

Construction also covers those types of service facilities which, when installed, become an integral part of the structure and are necessary to the use of the structure. These include such components as plumbing, heating and ventilation, central air conditioning, electrical facilities, and elevators and escalators.

Changes to structures involving exterior or interior walls, such as the erection of partitions in a loft building to convert it to offices or the remodeling of a store front, are considered construction.

The erection of scaffolding and/or forms for concrete work is considered construction.

Clearing and developing of the site is a part of construction.

In general, construction does not include the furnishings and equipment designed to prepare the structure for a specific use. Examples of such equipment are steam tables in restaurants, pews in churches, lockers in school buildings, printing presses or stamping machines in industrial buildings, and refrigerators in homes. The installation of such furnishings and equipment is, however, included in construction when performed by construction contractors. However, the erection of "processing equipment" in certain industries, where such equipment is largely fabricated on the site, is defined as construction. (For example, the towers, vats, and related piping at chemical plants and petroleum refineries, or the blast furnace complex at steel plants.)

Construction does not include mobile structures; such as,
trailers, mobile homes, floating drydocks, and ships. Also excluded from construction are those operations associated with extraction of minerals (drilling oil and gas wells, sinking mine shafts, stripping overburden, tunneling and shoring mines, open-pit mining, and activity primarily devoted to the production of sand, gravel, and other minerals by dredging) and closely related support activities on mineral properties (erecting, repairing, and dismantling of drilling rigs; building of well foundations; excavating slush pits; and cementing wells). Work which is an integral part of farming operation (such as, plowing, terracing, and the digging of drainage ditches) is also excluded from construction.

**Distinction Between New Construction and Maintenance and Repairs**—
Construction is composed of two broad categories of activities: (1) New construction and (2) maintenance and repairs. "New construction" is defined to include the complete, original erection of structures and essential service facilities, as well as additions and alterations. Additions and alterations include such construction as the addition of a wing, a story or stories, conversion of space to other uses where structural changes are involved, or the initial installation of integral building services equipment in existing structures (e.g., elevators, escalators, or central air-conditioning systems). "Maintenance and repairs" relates to the restoration of existing buildings or other structures or their related service facilities, including replacement of integral parts. Repainting, repapering, reroofing, redredging, railroad maintenance-of-way, and street and highway patching and minor resurfacing are included.

APPENDIX B

Appendix B consists of letters written to seek clarification of the definition of the construction industry and responses to those inquiries.
United Pacific Insurance Company
Fidelity and Surety Department
Tacoma, Washington

March 26, 1972

Gentlemen:

I am currently working on a professional paper dealing with the construction industry. This is in pursuit of a master's degree in Business Administration (MBA). I find that the construction industry is not clearly defined although much statistical information and data are available about its activities. Since I am a graduate architectural engineer and a licensed architect, you can understand this finding has caused my curiosity.

My purpose in writing to you is to ask what activities of the construction industry you currently include under your construction bond coverages. More specifically, do you try to separate design (architectural and engineering) work from construction work where both are involved in a single project? How do you stand on construction management activities? I refer here to construction management contracts such as recently awarded by General Services Administration of the Federal Government and not to construction management in general. Do you know what sort of bonding or liability insurance arrangements are being required?

I will appreciate any information you can furnish me on bonding in the construction industry. What is your strategy for future bonding requirements as the industry changes and more design and construction collaboration takes place? Is there a substantial difference in costs of bonding construction contractors and costs of professional liability insurance? Could you possibly go either, or even both ways, in guaranteeing performance on certain projects? What sort of problems do you anticipate will arise from enforcement of new Occupational Health and Safety Act regulations on construction projects?

I will appreciate any help you can furnish me on your involvement with the construction industry and hope for an early reply as I would like to complete a rough draft of my paper in April of this year.

Yours truly,

Arthur F. Anderson
April 7, 1972

Mr. Arthur F. Anderson
429 Livingston Avenue
Missoula, Montana 59801

Dear Mr. Anderson:

This is in reply to your letter of March 26, 1972. We are very happy to provide answers to the questions you have raised, and I will follow the format of re-stating your questions and then following with answers which we understand to be general underwriting practices of the surety industry.

1. DO YOU SEPARATE DESIGN FROM CONSTRUCTION WORK WHERE BOTH ARE INVOLVED IN A SINGLE PROJECT?

A surety underwriter would prefer that the construction contract be limited to construction of the improvement according to plans and specifications prepared by an independent architect. The practice of including design in construction contracts appears to be growing, however, and the surety, in guaranteeing performance of the contract, would also be assuming the risk of architectural and engineering performance. In some cases the surety underwriter might feel such design and engineering risks were too great for the contractor to undertake and would, therefore, decline to issue the bond. In other cases, because of the substantial financial condition of the contractor, the bond would be approved, nevertheless.

2. HOW DO YOU STAND ON CONSTRUCTION MANAGEMENT CONTRACTS SUCH AS RECENTLY AWARDED BY GENERAL SERVICES ADMINISTRATION? DO YOU KNOW WHAT SORT OF BONDING OR LIABILITY INSURANCE ARRANGEMENTS ARE BEING REQUIRED?

Sorry, but we are not acquainted with this program, but because you raised the question we will make inquiry.

3. WHAT IS YOUR STRATEGY FOR FUTURE BONDING REQUIREMENTS AS THE INDUSTRY CHANGES AND MORE DESIGN AND CONSTRUCTION COLLABORATION TAKES PLACE?

The only strategy a surety underwriter can employ is to ascertain the facts regarding the qualifications of his contractor-applicant, and upon learning the contract terms of the contract under consideration, make a judgment and approve or decline. Certainly the surety underwriter must inform himself of new developments in the
nature of construction contracts, but always the underwriter comes down to the point of individual judgment regarding the specific contractor's qualifications to undertake a specific contract.

4. IS THERE A SUBSTANTIAL DIFFERENCE IN COSTS OF BONDING CONSTRUCTION CONTRACTORS AND COSTS OF PROFESSIONAL LIABILITY INSURANCE?

Premium rates for these two entirely different risks are incapable of comparison because contract bond rates are the same for every contractor regardless of his qualifications. This is so because surety rates are more similar to bank interest rates. Surety rates are not based on loss experience but, like bank interest rates, are based on costs of performing a service.

5. COULD YOU POSSIBLY GO EITHER OR EVEN BOTH WAYS IN GUARANTEEING PERFORMANCE ON CERTAIN PROJECTS?

If we understand this question we would say that if an architect undertook to build the project he had designed, then the architect should carry professional liability insurance to protect himself from claims of malpractice, etc., and the owner should require the architect-contractor to post a performance bond guaranteeing performance of the contract.

6. WHAT SORT OF PROBLEMS DO YOU ANTICIPATE WILL ARISE FROM ENFORCEMENT OF NEW OCCUPATIONAL HEALTH AND SAFETY ACT REGULATIONS ON CONSTRUCTION PROJECTS?

Every new risk thrust upon a contractor increases his obligations, and whenever enforcement of regulations involves increased costs to the contractor he will suffer financially unless such costs are foreseen and can be passed on to the consumer.

We hope the foregoing will be helpful to you in the preparation of your paper.

Sincerely yours,

UNITED PACIFIC INSURANCE COMPANY

Morris E. Brown
Executive Vice President

MEB:br
Dear Sir:

I am currently working on a professional paper dealing with the construction industry. This is in pursuit of a Master's degree in Business Administration (MBA). I find that the construction industry is not clearly defined although much statistical information and data are available about its activities. Since I am a graduate architectural engineer and a licensed architect, you can understand this finding has aroused my curiosity.

My purpose in writing to you is to ask if you are currently considering any changes in your data base for construction industry statistics. Examples that occur to me that may be causing problems include firms that provide design (architect and engineering) services with construction, "turnkey" enterprises, construction management firms and combinations of real estate planning and building plan service with construction activities. Can you separate the service producers from the goods producers in these operations? Is any thought being given to combining design of construction projects with actual construction to round out the picture of the construction industry?

I will appreciate any help you can furnish me on this definition problem. More specifically, would you please send me a copy of your address "Construction, new statistics for an old industry." This was presented at the second annual Collective Bargaining Forum in New York on May 19, 1970. It is listed as government publication 11546-L2, 26:176 and is not available in the local university library. Incidentally, this library has a good source of available Federal Government publications including the 1967 Census of Construction Industry, Monthly Labor Review, Standard Industrial Classification and that sort of material.

I will appreciate your consideration and hope for an early reply as I would like to complete a rough draft of my paper in April of this year.

Yours truly,

Arthur F. Anderson
April 10, 1972

Mr. Arthur F. Anderson
429 Livingston Avenue
Missoula, Montana 59801

Dear Mr. Anderson:

As requested in your letter of March 26, I am sending you my paper, "Construction: New Statistics for an Old Industry," and a copy of the construction report prepared by the Subcommittee on Construction Statistics. Recommendations have been made to improve the existing statistical information on the construction industry. This report may answer your question on the separation of service producers from the goods producers in these operations.

The definitions for the components making up the construction industry used by the Bureau of Labor Statistics are those provided in the SIC manual.

The 1967 Census of Construction report shows class of firms and number of establishments which represent the construction industry. There were approximately 794,038 establishments in the U.S. in 1967 operating primarily as general contractors, special trade contractors, operative builders or subdividers, or developers.

I am also enclosing some reprints which may be of interest.

Good luck on your paper!

Sincerely yours,

GEOFFREY H. MOORE
Commissioner

Enclosures
George Christie, Chief Economist, FW Dodge Services
Engineering News-Record, McGraw Hill Building
330 West 42nd Street
New York, New York 10036

March 26, 1972

Dear Sir:

I am currently working on a professional paper dealing with the construction industry. This is in pursuit of a master's degree in Business Administration (MBA). I find that the construction industry is not clearly defined although much statistical information and data are available about its activities. Since I am a graduate architectural engineer and a licensed architect, you can understand this finding has roused my curiosity.

My purpose in writing to you is to ask what your present definition of the construction industry includes. Related questions are: Do you separate value of design from value of construction in firms that do both? Where do you feel "turnkey" and construction management activities fall, statistically, in design or construction? (I refer here to the recent GSA type construction management contracts, not to construction management in general.) And, looking ahead, what changes in statistical bases for construction industry statistics do you expect to make in coming years?

I will appreciate any help you can furnish me on this definition problem and hope for an early reply as I would like to complete a rough draft of my paper in April of this year.

Yours truly,

Arthur F. Anderson
March 29, 1972

Mr. Arthur F. Anderson
429 Livingston Avenue
Missoula, Montana 59801

Dear Mr. Anderson:

This is in response to your letter, dated March 26, addressed to Mr. George Christie. We are cognizant of the problem you define in your letter. We, too, are not satisfied with the definitions that we apply to construction. At the same time, we recognize that there is no one simple, workable definition that would hold over time. At the same time, because of the length of time that we have worked with one set of definitions, we would be reluctant to make any changes now.

In any event, we think of the construction industry as being all encompassing. It includes design, engineering, the exercise of governmental authorities and related permit and other expenses, land preparation, the cost of financing, etc. It never includes the cost of land.

At this point in time, we find the above definition particularly useful because of the changes in the functions and relationships of all the major parties bringing construction about (i.e. owner, architect, contractor, lending institution, etc.). No matter how these functions are combined, there is no possibility of leaving out any one or more. It is for this reason that we are happy to include them all in the cost of construction.

Should you or any one wish to exclude a particular function from construction expenditures as a whole, you could do this from government and other statistics measuring the incomes of these functions, e.g. architects, consulting engineers, etc.

We hope that this will help you in the preparation of your paper.

Sincerely yours,

JHM:nba

John H. Morawetz
Product Planning Manager
Statistical Services

CC: Mr. George A. Christie

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APPENDIX C

THE STANDARD INDUSTRIAL CLASSIFICATION OF THE CONSTRUCTION INDUSTRY, 1972

Sub- Division C. Construction

categories Major Group 15—Building Construction—General Contractors and Operative Builders

Group 152 General Building Contractors—Residential Buildings

15 Industry 1521 General Contractors—Single Family Houses
15 Industry 1522 General Contractors—Residential Buildings
Other than Single-Family

Group 153 Operative Builders

4 Industry 1531 Operative Builders

Group 154 General Building Contractors—Nonresidential Buildings

23* Industry 1541 General Contractors—Industrial Buildings and Warehouses
30* Industry 1542 General Contractors—Nonresidential Buildings
Other than Industrial Buildings and Warehouses

Major Group 16—Construction Other than Building Construction—General Contractors

Group 161 Highway and Street Construction, Except Elevated Highways

23 Industry 1611 Highway and Street Construction, Except Elevated Highways

Group 162 Heavy Construction, Except Highway and Street Construction

9 Industry 1622 Bridge, Tunnel, and Elevated Highway Construction

21 Industry 1623 Water, Sewer, Pipe Line, Communication and Power Line Construction

69 Industry 1629 Heavy Construction, Not Elsewhere Classified

Major Group 17—Construction—Special Trade Contractors

Group 171 Plumbing, Heating (Except Electric), and Air Conditioning

20 Industry 1711 Plumbing, Heating (Except Electric) and Air Conditioning

Group 172 Painting, Paper Hanging, and Decorating

8 Industry 1721 Painting, Paper Hanging, and Decorating

Group 173 Electrical Work

9 Industry 1731 Electrical Work

Group 174 Masonry, Stonework, Tile Setting, and Plastering

9 Industry 1741 Masonry, Stonework, Tile Setting, and Plastering

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Industry 1742 Plastering, Drywall, Acoustical and Insulation Work
Industry 1743 Terrazzo, Tile, Marble and Mosaic Work
Group 175 Carpentering and Flooring
    Industry 1751 Carpentering
    Industry 1752 Floor Laying and Other Floor Work, Not Elsewhere Classified
Group 176 Roofing and Sheet Metal Work
    Industry 1761 Roofing and Sheet Metal Work
Group 177 Carpentering and Flooring
    Industry 1771 Concrete Work
Group 178 Water Well Drilling
    Industry 1781 Water Well Drilling
Group 179 Miscellaneous Special Trade Contractor
    Industry 1791 Structural Steel Erection
    Industry 1793 Glass and Glazing Work
    Industry 1794 Excavating and Foundation Work
    Industry 1795 Wrecking and Demolition Work
    Industry 1796 Installation or Erection of Building Equipment, Not Elsewhere Classified
    Industry 1799 Special Trade Contractors, Not Elsewhere Classified

*includes design when it is made part of the contractor's work

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