

EDUCATING CONSTRUCTION MANAGERS

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ABSTRACT: The speed with which the Construction Management (CM) system has entered the daily practices of the construction industry has caught educators in a lag. The management of construction and construction management were considered synonymous until construction management became a formal contracting system. Educators designed construction education programs around the needs of the general contractor and the requirements of the general contracting system. As CM became popular, educators began teaching the CM process but have not yet totally modified instructional programs to accommodate the unique requirements of construction managers. This paper establishes the differences between the educational requirements of a contracting-oriented program and a construction management-oriented program with respect to the management tools and the philosophy of those using the tools.

INTRODUCTION

Construction management is an innovative approach to project delivery in the construction industry. At one end of the scale, construction management is clearly distinguishable from the traditional method of general contracting. At the other end of the scale, some forms of construction management closely resemble general contracting. The central theme of this paper is that no matter what form of construction management is used, it is sufficiently different from general contracting to merit a somewhat different philosophy with regard to the education of its practitioners.

The construction management approach has been employed since the 1950s, and it is assumed readers are familiar with its concepts so that further discussion is not necessary. For readers who wish to explore the various issues in construction management, however, several texts (Barrie and Paulson 1984; Kavanaugh 1978) and several journal articles (Tatum 1983; Haltenhoff 1986) offer excellent treatment of the topic.

USE OF CONSTRUCTION MANAGEMENT

The degree to which construction management is currently used is indicated in Table 1. Column one is broken out with forty contractors in each group. Group one represents the Engineering News Record top forty contractors, group two the next forty and so on. The amount of total contracts is listed in column two, and column three is the portion of column two which is the amount of the total comprising construction management contracts. This amount includes those contracts where the

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TABLE 1. Construction Management Contracts^a

Group (1)	Total contracts (2)	Construction management contracts (3)	Percent CM (4)	Fee only (5)	Percent fee only (6)
1	76,019	27,740	36.5	5,691	20.5
2	15,087	3,803	25.2	1,356	35.7
3	8,411	2,277	27.1	602	26.4
4	6,310	1,241	19.7	63	5.1
5	4,916	407	8.3	.4	0.1
6	4,086	1,570	38.4	844	53.8
7	3,338	376	11.3	18	4.8
8	2,841	509	17.9	228	44.8
9	2,406	385	16.0	129	33.5
10	1,995	168	8.4	4	2.4
Totals	125,407	38,472	30.7	8,933	23.2

^aSource: Adapted from Engineering News Record, April 16, 1987.

Note: Figures in millions of dollars.

construction manager assumes some degree of risk. Column five lists those contracts where the construction manager assumes no risk.

Table 1 demonstrates that construction management contracts make up an important portion (\$38.5 billion) of the total construction contracts let in the United States. These are contracts where the construction manager is directly responsible for a portion of the work and has at least \$500,000 at risk (ENR 1987). Even when "fee only" contracts are considered, \$8.9 billion would seem to be a significant enough amount to justify some degree of attention by educators in presenting the principles and philosophy of construction management.

TASKS OF CONSTRUCTION MANAGEMENT

It may now be useful to examine differences in terms of tasks of the construction manager and general contractor. Table 2 on the following page highlights some of the tasks of the construction manager and the general contractor. This list is not intended to be complete or inclusive; rather, it is intended to illustrate the relative timing of the involvement of the construction manager and the contractor during various phases of construction.

Table 2 is also meant to serve as a reference for discussion of the allegiance of the two entities. The construction manager is obviously oriented toward the client, and just as obviously, the general contractor is oriented toward protecting his profit. Nothing sinister is implied in this orientation of the general contractor, nor is there an implication that the client's interests are not foremost in the general contractor's priorities. In the private sector, from the standpoint of future business, it would be imprudent for the general contractor to act otherwise. Nevertheless, because the general contractor assumes the financial risk for the completion of the project, it is reasonable to expect his motivation to be different from the construction manager.

As expected, the construction manager is heavily involved during the predesign and design phase of a construction project. It is this early

TABLE 2. Comparison of Tasks

	Construction manager (1)	General contractor (2)
Predesign phase		
Assist in developing funding	x	
Conduct feasibility studies	x	
Prepare preliminary budget	x	
Environmental impact studies	x	
Site selection studies	x	
Prepare zoning requests	x	
Advise on design team selection	x	
Design Phase		
Advise on scope definition	x	
Begin value engineering	x	
Prepare milestone schedule	x	
Propose alternate methodologies	x	
Identify long lead materials	x	
Devise multi-contract strategy	x	
Prepare bid packages	x	
Manage technical consultants	x	
Review specification criteria	x	
Prepare general conditions	x	
Prepare supplementary conditions	x	
Identify design interferences	x	
Bid phase		
Prequalification of bidders	x	
Cash flow projections	x	x
Survey labor market	x	x
Propose value engineering options	x	x
Analyze bids	x	x (subs only)
Recommend contract awards	x	
Construction phase		
Conduct preconstruction meetings	x	x
Obtain permits	x	
Administer contracts	x	x (subs only)
Control cost and schedule	x	x
Manage owner-furnished items	x	
Administer submittals	x	x
Negotiate change orders	x	x
Coordinate and inspect work	x	x (subs only)
Arrange for inspections and testing	x	
Construction with own forces		x
Closeout contracts	x	x

^aSources: Compiled from (Haltenhoff 1986a), (Kavanaugh 1978), (Barrie and Paulson 1984), and (Stukhart 1986).

involvement that most notably differentiates the tasks of the construction manager from the general contractor. Admittedly, there are general contractors who are involved in early stages of a project, but they are usually operating under some form of negotiated contract. As such, they

would be considered outside the scope of basic general contracting as defined in this paper.

The predesign phase places heavy demands on the construction manager. In this phase, his versatility or lack of it makes a significant impact. Construction managers frequently become involved in the larger role of project management. Those construction managers with special skills have been asked to help clients negotiate the labyrinths of financial institutions.

Environmental impact studies also require special skills, as do site selection and zoning. Even if the construction manager is not expert in all these areas, he coordinates the experts (consultants) and provides leadership and direction on behalf of the client. Thus, the construction manager must at least be knowledgeable in the areas just mentioned.

The design phase is another phase where the tasks of construction managers are different from those of general contractors. As Table 2 suggests, this is a phase where the construction manager makes important contributions. Value-engineering studies and alternate construction methodology proposals have a far-reaching impact on the final cost of the project. Preparation of contract documents and advising on specification criteria is another opportunity for the construction manager to make a difference in the project.

Few general contractors would admit to an inability to perform in the above areas, and it is not the intent of this paper to suggest otherwise. Because the general contractor is not usually involved in the project at this point, however, he has not polished the skills needed to do the tasks in the design phase. Also, there is undoubtedly some form of natural selection at work in the marketplace. Those general contractors who have survived have usually not done so on the strengths needed in the predesign and design phases of a project. Rather, they have accumulated their expertise in the construction phase.

In the bid phase, the tasks of construction manager and general contractor begin to overlap, although for reasons noted earlier, they undertake these tasks from a different viewpoint. For example, the general contractor might propose new and untried methods or materials in his bid as alternates. On the other hand, since most clients do not want their facility to be a test-bed for experiments, the construction manager will take a more conservative approach to the suggestion of alternates.

In the construction phase, the tasks of construction manager and general contractor are also similar. Both administer contracts, control cost and schedule, manage submittals, negotiate change orders, and coordinate and inspect work. The most notable difference is that the basic construction manager does not do work with his own forces. In those tasks where overlap exists, again the viewpoint is different—the construction manager attending to the owner's interest and the general contractor naturally attending to his own interests.

Finally, as Adrian (1981) notes, the construction manager acting in the expanded role of project management could become involved with marketing and property management of the completed facility. This would be another instance of looking to the construction manager for skills not usually found in the general contractor's organization.

In the past few years there has been an active, well-meaning, and reasoned debate as to what constitutes the best preparation for a career in the construction industry. Positions in this debate range from those advocating technology-based curricula to those advocating engineering-based curricula. Positions are also taken concerning the length of time needed to properly educate or train people.

Recognizing the need for experience, Warszawski (1984) poses a question as to whether any formal education can provide the skills needed in the management of construction. Others discuss the desirability of five-year or graduate programs (Haltenhoff 1986; Oglesby 1982). These authors as well as the Business Roundtable ("Management education and academic relations" 1982) and Jordan (1986) analyze the curriculum content of construction education programs.

It would seem clear, given the additional tasks the construction manager is expected to perform, that he needs skills beyond those needed by the general contractor. It would also seem clear that the pressures of accreditation boards and curriculum committees leave little room in a four-year program for adding the additional courses needed to prepare a person for a role in a construction management firm. One is quickly led to the conclusion that if a program is to offer additional, in-depth course work, it would be best done over a five-year course, in the context of either an extensive bachelor's degree program or a program which would award a master's degree upon the successful completion of the fifth year.

In those institutions where five-year programs are available, Table 3 is suggested as a list of courses specifically designed for students wishing to prepare for positions with a construction management firm. Most of the courses could be given in a graduate civil engineering curriculum, while others might necessarily be offered in architecture or management departments.

The writer recently took a survey of the major institutions offering graduate degree programs in construction engineering and management. The survey indicates that many of the topics listed in Table 3 are offered in construction-related curricula. In some cases, however, several of the topics are grouped into one course. While this may be preferred to not offering the course at all, it is felt the topics listed merit separate and in-depth coverage.

In addition to offering the courses listed in Table 3, the approach to teaching the courses is also relevant. Warszawski (1984) argues for a comprehensive approach. That is, treating the project as a whole and examining how all the elements fit together from design through construction. In the education of the construction manager, this is especially important, since he is involved at the earliest stages of the project. Equally important is the viewpoint from which the courses are offered. The owner's perspective should be balanced with that of the contractor.

Case studies and seminars are also useful in the education of the construction manager. Case studies provide an opportunity for students to appreciate the problems of all parties to the construction process. Seminars provide a forum whereby practitioners from industry can share their experiences with students.

TABLE 3. Construction Management Courses

Engineering Courses (1)	Management Courses (2)
Alternative Construction Methodologies	Finance and Accounting
Building Systems	Human Relations
Cost Engineering	Insurance and Bonding
Computer Applications Including CAD	Labor Relations and Economics
Concrete and Steel Construction	Land Use Planning
Construction Equipment Management	Negotiation/Conflict Resolution
Construction Management Information Systems	Real Estate Development
Construction Safety	
Contract Administration	
Contract and Labor Law	
Environmental Planning	
Life Cycle Costing	
Mechanical & Electrical Systems	
Operations Research Methods	
Professional Construction Management	
Risk Management	
Scheduling	
Statistical Analysis	
Soil Engineering	
Value Engineering	

Naturally, providing the formal courses in the proper framework is not a panacea for the construction industry. Most firms generally give additional training to new personnel, and it is acknowledged that extensive experience is required before one assumes a senior role in a construction management company. Formal education, however, will continue to play an important role in the initial preparation of construction managers.

SUMMARY AND CONCLUSIONS

Construction management is now well established as an alternative to general contracting and design build. Although construction management may not be the best form of delivery for all projects, its popularity can reasonably be expected to grow as appropriate clients become more comfortable with its unique advantages.

This paper has endeavored to show that the practice of construction management is different from the practice of general contracting. These differences are primarily reflected in the early involvement of the construction manager in the design phase. The other notable difference is in the client orientation of the construction manager.

Many of the skills of the construction manager and the general contractor are interchangeable, but the additional demands on the construction manager warrant a somewhat different educational consideration. Further, it is recognized that schools should not devote all their attention to teaching construction management. It is also recognized that although not all graduates will find their way to construction management firms, all should benefit from an understanding of the characteristics of the construction management delivery method.

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