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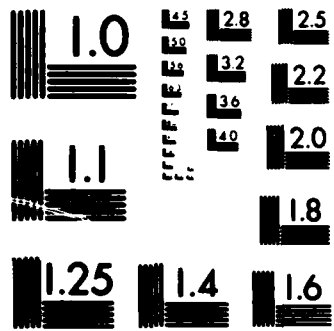
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THE POLICY AND REGULATORY RESPONSIBILITIES  
OF CONSTRUCTION MANAGEMENT

by

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of the non-thesis requirement for the degree of

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## INTRODUCTION

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A definition of construction management may be paraphrased as a process of integrating planning, design, and construction to accomplish the basic requirements of an owner, (10). Due to the magnitude, duration, and number of interacting organizations that can be involved in the construction process, an effective form of project control must exist if the construction of the facility is to be on schedule, within budget, and in accordance with the established specifications.

The ability of the construction manager to carry out these duties requires much more than just good engineering. Construction management requires many of the same managerial skills and organization needed to run a large manufacturing company. A good staff of individuals specializing in many different areas as well as sound management is essential.

This paper is intended to examine some of the management requirements of construction supervision. Much of the data will be extracted from the construction of nuclear power plants. However, the material is applicable to all types of construction. The more complex and sizable the project, the more important good construction management becomes.  
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## THE BENEFITS OF CONSTRUCTION MANAGEMENT

The rate of cost escalation in the construction industry has been growing disproportionately as compared to the rest of the economy, as well as compared to other economically advanced countries. The engineering and construction industry has placed a great deal of the blame on external regulation, labor unions, consumer activists, and lawyers. Sure, these areas have had an impact on construction, but the construction industry itself has not kept pace. In many cases its technology is frozen in the early to mid 20th century. New materials and advanced equipment have been brought to the job sites, but the means of running the projects has not shown the same level of improvement.

Research conducted by Fondahl, Paulson, and Parker (8) identified the following areas which demonstrate the greatest potential payoff in improvement of construction practice within the present state-of-the-art:

- (1) Timeliness of decisions
- (2) Preconstruction preparations
- (3) Environmental and other regulatory considerations
- (4) Organizational structure
- (5) Design effectiveness

None of these areas pertain to materials or equipment. They all relate to the improvement of effective management. Here is where construction management has the greatest potential for making a truly valuable contribution to the construction process.

Much of what affects the cost of construction, the general economy, environmental regulations, cost of labor, etc., may be beyond the control of the construction organization, but it is submitted that there remains a great potential for improvement from within. No one has more at stake than the construction industry itself, which includes engineers, architects and contractors, in seeing major improvements in the way construction is carried out.

The escalation in cost of nuclear power plant construction from \$240/KWE for plants commissioned in 1969 to \$750 to \$800/KWE in 1975 (5), if allowed to continue may price a much needed facility out of business. The increase in the length of time required for completion also compounds the likelihood that fewer plants will be constructed. Construction management techniques also heads Budwani's list of factors effecting the man-hour requirements of nuclear power plant construction (5).

The improvement of management does not require the invention of new technology, only the effective utilization of what is in existence. This fact may have something to do with the limited research in construction management, but no area has greater potential for improving the outcome of construction than good management. The larger and more complex the construction project, the greater the potential benefits from providing effective construction management. Good construction management can also serve as the communications network for a construction project. Communications is no less important in construction than in any large organization.



## ORGANIZATION OF THE CONSTRUCTION MANAGEMENT TEAM

For most projects the construction manager should not be thought of as an individual. The term can refer to a team or an organization that supplies construction management as a service. A group of people must be assembled and tailored to the specific needs of the job at hand. The following is a list of some of the skills that may be required to provide effective management:

- 1) Engineering
- 2) Labor Relations
- 3) Economic Evaluation
- 4) Legal Advice
- 5) Environmental Management
- 6) Materials Procurement and Control
- 7) Quality Control
- 8) Communications and Data Processing
- 9) Job Safety

Since no one person is capable of providing all these services, a team of specialists is required. These people may be necessary on a full time basis or only for consultation. No one organizational plan is applicable to all construction operations. However, all the above listed areas of concern must be examined in formulating an effective construction management organization.

The research by Fondahl, Paulson, and Parker (8) "in comparing good contracts with marginal contracts, and in comparing more productive managers with those who are ordinary, one does not find differ-

ences that could be classified as breakthroughs in either ideas or concepts. Rather one finds that productive managers generally have been able to develop a team of people who care about and work hard on the problem and have put into consistent use many of the good management techniques available to everyone."

The construction management team must be able to deal with many different individuals and firms. These include the owner, planner, designer, user, contractor, major consultants, and third parties such as environmental groups and regulatory agencies. The team will be required to communicate at the level of each of these groups. Engineers too often communicate well with others in their field, but fall short when it comes to being effective outside their limited sphere of knowledge. In construction management, the project engineer's technical ability is often second in importance to that of management and good communication skills. Good lateral communications must be established and maintained. Good communications equipment can be extremely important in this respect.

The establishment of a good team is important in construction management, but it should not be overlooked that a strong leader is essential. The overall responsibility for the effective execution of the project cannot be allowed to pass from one group to the next without accountability or soon little is being accomplished. Reportability for results is a necessary management criterion. The effectiveness of each individual must be gauged against established goals and objectives. It appears that large projects invite an overall job atmosphere where

no one is responsible for the completion and control of the task at hand, and therefore productivity may be adversely affected.

The many meetings that are an inevitable part of any construction operation must not be allowed to become involved in some trivial or tangential point not involving the majority of the members. "Even with good lateral communications, all of the respective progress meetings need to be chaired with a firm hand and defined agenda. If a focused effort is not made to monitor and control the organization, a project can find itself burdened with such a large volume of paperwork and meetings that little effective decision making and implementation is taking place." (6)

## TIMING OF INVOLVEMENT

On many construction projects "the die has already been largely cast by the time construction begins. Much of the problems impacting construction costs and schedules have their roots in the overall organizational framework." (8) As shown by Maevis (11), the construction manager was brought aboard after the project was under construction when it became evident that there was insufficient staff to handle a project. The survey by Tatum (16) in many areas indicated that preconstruction planning can greatly improve construction performance.

For the construction management operation to truly be effective in providing a project on time and within budget, it must be involved from the very beginning of project development. Tatum (16) outlines examples of currently deficient areas from his survey; including: organizational planning, administrative services planning, construction facilities and methods planning, and planning for implementation of quality control programs. The expansion in planning scope can result in improved performance of the essential construction administration and support tasks.

Planning should involve experienced personnel who will hold responsible positions during the actual construction period. Preconstruction planning should be initiated soon after the start of conceptual engineering. The preconstruction efforts should include personnel experienced in actual construction. It is too often the case that the planners and designers have little or no construction

experience or expertise. Only minor changes in a project design can have a sizable impact on the constructability of a project.

With projects such as nuclear power plant construction having delay costs in the realm of \$500,000 per day and construction durations of over 10 years, it is easy to see how early CM involvement can provide high rates of return. The Washington Public Power Supply System (WPPSS) is a vivid example of need for early involvement of an experienced construction management team. The WPPSS directors conceded that they came ill-equipped to the complex job of supervising and building nuclear projects. This has had the devastating effect of over four-fold increases in costs and years in delays. Not all of the problems may have been solved by early planning and involvement of experienced personnel, but a much better picture of what was involved would have been presented.

Particularly in government projects where the initial planning stage may cover many years, it is difficult to bring construction management in as part of the initial concept stage. However, even without this early involvement the construction manager (either as a retained consultant or as an in-house staff), may provide a benefit from involvement in the early design stages. The overall broad scope of itemizing major problems and following up on them is too often overlooked by the A/E in worrying about the details of the project. In many cases, due to a change of personnel during the project, the final individual responsible as construction manager has never completely reviewed the plans or received a full briefing from his predecessors. The consequence is that very little continuity is available for the

demanding job of managing the actual construction. A system of control must be established early on in the project and carried through to the completion of the construction.

A project should have a budget; its designs should be on paper, it should have a schedule which in turn forecasts the requirements for resources of labor, equipment, and materials; and needs a dynamic and responsive feed-back-control system to cope with the operations once under way. All these areas can be beneficially served by a good construction management organization.

## POLICY DEVELOPMENT

Policy development is defined as the process of conducting studies and analysis that provide the basis for decisions on the use of resources (2). As far as construction management is concerned, the most useful is operating policy, the selected course of action over a relatively short time period. The necessity for the engineer to demonstrate some preciseness in his actions and the uncertainties of the future, make long-term policy statements even less helpful. "Two major questions must be answered in the policy development process: (1) Should expenditure of resources be increased (or decreased), and (2) how should the program objectives be specified?" (1) Policy development is not management, nor planning, nor design. It is a different process; one that is geared to the needs for a policy decision and not to the implementation of policy.

Much too often the construction manager gets too involved in the day to day operations of the construction project. Thereby losing sight of one of their prime objectives, to insure the owner receives the facility that will satisfy his needs. Somewhere in the construction management organization, and likely near the top, a wider view of the project must be taken. Policy must be formulated in advance of the construction process, not only in reaction to problems that develop.

Means must be developed for evaluating the impact that policy, contractual, and technical decision making in the planning and design stages has on capital costs in the construction phase. The construc-

tion manager can furnish this needed insight that would enable more rational decision making to take place and avoid the blind disregard for the final outcome during the initial planning stages. To enable the construction manager to provide start to finish continuity of a project he must be given authority and the full support by the owner. The owner must have the basic knowledge to be able to support the construction management and must do so.

The construction manager must be given authority commensurate with his responsibility. If the CM is furnished by an inhouse force little additional coordination should be required. However, if the service is rendered by a consultant, the specific details of project control must be specified in the contract between the owner and construction management firm. This relationship should place the construction manager in more than just an advisory role. The CM should be held responsible for the outcome of the project and possess the necessary authority to carry out his management function. This authority should not be taken lightly. The construction manager must not forget the prime objective of furnishing the complex project that meets the requirements of the owner for the lowest cost and on schedule.



## DECISION MAKING

In the survey by Fondahl, Paulson and Parker (8), timeliness of decisions was ranked highest among controllable internal factors with respect to potential for improvement within the existing framework of project techniques. But to be capable of making timely decisions, with a degree of confidence as to their validity, a good organization with defined goals must be established.

As projects become larger and larger, decision making begins to reflect bureaucracies and decisions are no longer made at the lowest possible level. All decisions are passed up the hierarchy until they reach the project manager who is extremely overworked and no longer can furnish the overall coordination necessary.

The relationship with the owner is no less important in decision making than in policy development. The construction manager must be given the support of the owner to allow for prompt decision making on the job site. The policy development becomes an important first step in this relationship. The owner and the construction manager must sit down very early in the planning process and prioritize the considerations of the project. If both parties are well aware of the desires and limitations that the owner may face, it improves the construction manager's ability in providing the correct direction to the contractor. If a mutual trust and understanding can be developed between the owner and the CM, the need for constant decisions by the owner can be minimized. If the CM is truly doing his job, there should be little need for the owner to involve himself in the day-to-day decision making

process. The CM is responsible for progress briefings but should not require routine matters to be decided by the owner. If good policy guidelines are established early in the relationship, minimal owner involvement should be required. This requires a much more active role on the part of the CM. He cannot be passive in his outlook towards the operations involved.

Peter Drucker in his book, *Management: Tasks, Responsibilities and Practices* (7), states that a manager carries out five basic operations:

- (1) Sets objectives and goals
- (2) Organizes
- (3) Communicates
- (4) Establishes yardsticks for performance
- (5) Trains and develops people, including himself or herself.

Of these five areas, only measurement of performance is greatly affected by technology. Most engineers being technically trained and experienced find it difficult to deal with the other areas of responsibility. The engineer must possess and make good use of the major management skills.

The job of the construction manager is, in the most part, a people-oriented problem. The ability to coordinate the many parties involved is a major undertaking. Each group, owner, designer, contractor and regulatory agency speaks a different language. The CM must be able to assimilate all this information and provide a common denominator in dealing with problems. Experienced personnel are extremely important in this regard. The management team leaders must possess a diversified

background which includes strong leadership and management training.

One of the prime causes of delay during construction is the time required for engineering information and decisions on changes to be furnished to the contractor (16). The construction manager must establish a formal procedure to insure the information is provided in a timely fashion, but should not be so hasty as to fail to evaluate the consequences of the directions. The CM must always evaluate the situation from the viewpoint of what is in the best interest of the owner.

To enable the upper levels of the construction management team to make the important decisions, much of the day-to-day operations must be taken care of at the lowest possible field level. Borcharding (4) makes a good case for the use of participative decision making. Participative decision making is the process of involving the individuals responsible for carrying out the activity in formulating the means of accomplishment. This does not infer that the workers run the organization. Goals are established by management, and the workers assist in developing the procedures for implementation. Once this participative decision making no longer takes place on a job, supervisors, and especially workmen, lose their enthusiasm and frequently productivity is reduced. This relates both to the construction management organization as well as the actual construction forces. Management and field supervisors must develop policy together rather than relying on strict orders passed from upper management through the hierarchy to the field. The management organization can derive much benefit from the views and understanding of the field personnel. If good quality personnel are in

the field, every effort should be made to make maximum use of their talents. If management doesn't utilize these abilities, they run the risk of losing contact with the job as well as wasting valuable human resources.

The larger the construction operation, the more important participative decision making becomes. Area supervisors and on-site inspectors must accept area responsibility, be held accountable for their decisions, and develop confidence in making stand-by decisions without renegeing to top management. Likewise, upper level management must be willing to delegate decision-making authority so that everything isn't bottled up in their office.

## COPING WITH THIRD PARTIES

Another important operation in the process of completing a construction project is dealing with the public. Especially important on Public Works projects are the inquiries that may come from the news media, legislators, and special interest groups such as environmentalists. It is extremely important in managing a construction project to keep "a good press" (13). The construction management team must be structured to recognize the influence of the people outside the fence. Decisions and Policy must include considerations for the effect they may have on the general public. Recent experience has shown how costly delays caused by involvement in some type of public litigation can be to a construction project. Not all of the incidents can be avoided, but good advance planning, which includes considerations for the public, can minimize these delays.

For large and/or highly controversial projects, a public relations specialist should be included in either the CM or owner's organization. Policy should be established during the planning stages as to how inquiries will be handled. There is nothing worse than to have conflicting information coming from different parties in the organization. Good lines of communications must be established and maintained between the owner and the CM in dealing with matters involving public relations. Forewarning of potential problems can minimize their impact on the job progress.

## REGULATORY CONSIDERATIONS

In both surveys by Tatum (16) and Fondahl, Paulson and Parker (8), the leading external factor effecting the construction operation was regulatory requirements. Since there is little that can be done, as far as the construction manager is concerned, to change the regulations, the best protection is to have an organization that can understand the process and quickly respond.

Much of the adverse effects of regulations can be minimized by good preconstruction review and planning. The CM team must include those who are intricately familiar with the laws and regulations and able to keep abreast of the changes. In nuclear power plant construction, more than any other, the effects of regulation is felt. In the survey by Tatum (16), 42% of the delays were caused by changes imposed by modifications in licensing and regulatory requirements. With the huge cost involved, it is easy to see where effective management of these modifications is extremely important and has the potential for enormous savings. The CM must be able to determine the effect of the changes and formalize the procedures necessary to minimize their impact on the construction schedule. Once the redesign is formulated, it must be effectively communicated to the contractor and the necessary changes efficiently processed.

The regulations affecting all construction, primarily environmental and OSHA, must be effectively administered. With environmental, the most important considerations must be undertaken in the planning stage of the project. All facets of the environmental impact must be con-

sidered. Here again it is imperative that a knowledgeable individual be included in the CM team. Once construction starts, even after a well thought out plan is prepared, the environmental management must continue. Henningson (9), in his paper on environmental management during construction, outlines the use of specialized environmental inspectors. The Environmental Inspector (EI) should establish an effective liaison with the staff of Federal, State, or local regulatory agencies. He could also assist in the design phase and improve communications between design and construction administration groups on environmental matters. The EI services may be part of the CM team or included as a special consultant.

During construction the EI activities may be subdivided into three phases:

- (1) Site preparation
- (2) Excavation
- (3) Restoration

Throughout the project the EI must maintain a daily log of all site visits and his log should be supplemented by a photographic record of construction efforts (9). A well planned and executed environmental program can insure all regulations are met and help avoid unnecessary delays due to environmental problems.

On the job safety must also be included as an important part of the project organization. Construction safety is the responsibility of everyone involved, designer, contractor, CM and owner. Again the use of an experienced individual in construction safety is necessary.

As with environmental concerns, the safety considerations must be incorporated in the design and a well-managed program followed throughout the construction operation.



## SUMMARY

The present trends in construction, including increasing costs, decline in productivity and longer construction periods, heighten the potential benefits from effective construction management. Surveys of varying types of construction show many similarities in the problems encountered. Most of the potential for improvement lies in the improvement of the overall management of the project from conceptual planning through construction completion. Construction management can furnish this service. The CM can take on many forms, in-house forces, as part of the design contract or as an independent consultant. The means by which the service is provided is not as important as how that organization is formulated.

Construction management cannot be thought of as being furnished by one individual. Even on moderately-sized projects, the complexity and many fields of endeavor require the formation of a team. The team must possess specialists in engineering, labor relations, law, economics, environment, procurement, quality control, communications, data processing, and safety. These services may be required on a full-time basis or only as an intermittent consultant. However, there must be a management core that is involved from the planning through construction phases. Much of what is established in the conceptual planning stages casts the die for the construction operation.

The construction manager and his staff must be a knowledgeable, hard working, dedicated group who have an overriding interest in com-

pleting the project within the framework set by the owner. In conjunction with the responsible actions of the construction manager, he must be given the authority and full support of the owner.

The decision making and policy development associated with the construction operations can be greatly improved by the use of available management techniques. Too often the management process is technology oriented and not enough attention is paid to the important people aspects of the organization. Good lateral communications, delegation of authority, participative decision making, strong leadership and a well organized monitoring and feedback system are a few of the areas of importance.

A program designed to insure compliance with, monitoring of, changes in, and dealing with the changes in regulatory requirements must be established. The cost of regulatory involvement in changes and delays in a construction project can be substantial. It is the job of the construction manager to minimize their adverse impacts on completion of the project for the owner.

Fondahl, Paulson and Parker (8) recommended that a program be established to determine just what type of documentation - clear, concise, factual, transferrable, and useable documentation - would be of value for recording, preserving, and transferring the important lessons being learned on today's construction projects. Also, the preparation of case studies on important features, events, decisions, methods, or other worthwhile factors on the project should be fostered.

"Major construction projects present a rich area for both research and suggestion of improvements based on the principles of organizational behavior. This research could yield benefits in project cost as well as schedule performance" (16).

With projects of ever-increasing size and complexity, the construction manager will become an even more important factor in the successful execution of major projects.

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