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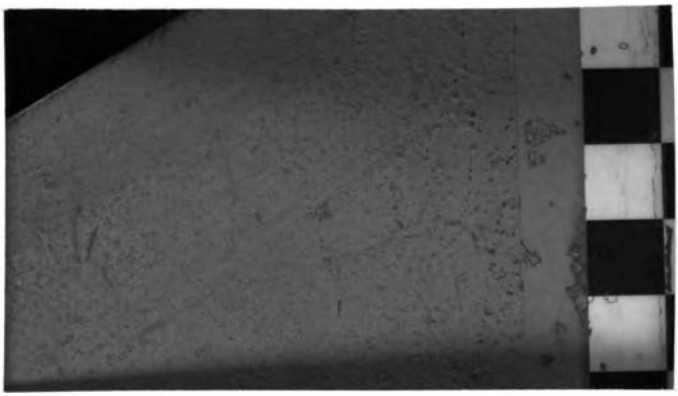

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No. 81

Reaction of Federal Agencies to the Business Roundtable's Recommendations on Modern Management Systems

Federal Construction Council
Consulting Committee on Modern Management Techniques

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BACKGROUND

In the late 1970s the Business Roundtable* undertook a far-reaching study of the construction industry from the perspective of the industry's consumers--particularly its large corporate consumers. That study, the Construction Industry Cost-Effectiveness (CICE) Project, was carried out over a 4-year period by 23 study teams composed of more than 250 construction specialists from some 125 different organizations (private companies, universities, trade associations, and government agencies). The results of the project were presented in the following 25 reports:

- Reports on Project Management (Study Area A)--A1 Measuring Productivity in Construction (September 1982), A2 Construction Labor Motivation (August 1982), A3 Improving Construction Safety Performance (January 1982), A4 First and Second Level Supervisory Training (May 1982), A5 Management Education and Academic Relations (June 1982), A6 Modern Management Systems (November 1982), A7 Contractual Arrangements (October 1982).

- Reports on Construction Technology (Study Area B)--B1 Integrating Construction Resources and Technology into Engineering (August 1982), B2

*The Business Roundtable is a New York City based association in which the chief executive officers of some 200 major corporations meet to address a wide variety of public issues. It began in 1969 as The Construction Users Anti-Inflation Roundtable.

Technological Progress in the Construction Industry (July 1982), B3 Construction Technology Needs and Priorities (August 1982).

- Reports on Labor Effectiveness (Study Area C)--C1 Exclusive Jurisdiction in Construction (July 1982), C2 Scheduled Overtime Effect on Construction Projects (November 1980), C3 Contractor Supervision in Unionized Construction (February 1982), C4 Constraints Imposed by Collective Bargaining Agreements (September 1982), C5 Local Labor Practices (April 1982), C6 Absenteeism and Turnover (June 1982), C7 Impact of Local Union Politics (June 1982).

- Reports on Labor Supply and Training (Study Area D)--D1 Subjourneymen in Union Construction (February 1982), D2 Government Limitations on Training Innovations (March 1982), D3 Construction Training Through Vocational Education (August 1982), D4 Training Problems in Open Shop Construction (September 1982), D5 Labor Supply Information (April 1982).

- Reports on Regulations and Codes (Study Area E)--E1 Administration and Enforcement of Building Codes and Regulations (October 1982).

- Summary Reports--More Construction for the Money (January 1983), A Message to Owners Who Pay for Major Construction (February 1983).

These reports were distributed widely by the Business Roundtable. They were discussed at length by federal agency personnel (e.g., see the Society of American Military Engineers, 1984, and Engineering News Record, 1984) as well as by construction professionals employed by private owners, contractors, and design firms (e.g., see Associated General Contractors, c. 1983). One report in particular, Modern Management Systems (Business Roundtable, 1982), caught the attention of federal agency managers. This report attracted special attention both because it addressed a subject (management of construction) that has long been of concern to federal agencies and because it dealt directly with the problem identified by the Business Roundtable itself as being of overriding importance: "[The fact that] more than half the time wasted during construction is attributable to poor management

practices" (Business Roundtable, 1983a). The Business Roundtable's concern about management is demonstrated by the fact that most of the recommendations of its study teams involved better ways of managing construction projects (Business Roundtable, 1983a).*

Recognizing the interest of federal agencies in the subject, the Program Committee of the Federal Construction Council (FCC) included a study of modern management techniques in the FCC technical program for 1984. The FCC Consulting Committee on Modern Management Techniques was formed to carry out the project. The committee was directed to identify steps that federal agencies are taking or could take as owners to encourage construction contractors to increase the rate of their acceptance and use of the modern management techniques proposed by the Business Roundtable.

In carrying out its assignment, the committee assembled information on the practices and views of various federal agencies, met with Dennis Bradshaw of the staff of the Associated General Contractors to learn of the reaction of construction contractors to the findings and recommendations of the Business Roundtable, met with three representatives of the Business Roundtable (Hugh Beaton** of the DuPont Corporation and John Rasmussen and William Sim of the Potomac Electric Power Company) to obtain information on the assumptions and conclusions on which the Business Roundtable recommendations were based, and reviewed several relevant publications.

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*The Business Roundtable did not define the term "modern management systems." It can be assumed, however, that the term refers to the whole spectrum of sophisticated techniques and concepts that have been developed during the past 50 years to facilitate the management of large, complex organizations and activities. Most modern management systems employ computers and/or probability theory.

**Mr. Beaton served on the study team that prepared the Business Roundtable report on modern management systems.

2
OVERVIEW OF BUSINESS ROUNDTABLE RECOMMENDATIONS

The Business Roundtable report on modern management systems proposes, in essence, that owners (construction consumers) take the lead in promoting the use of modern management systems in construction (Business Roundtable, 1982). Chapter 1 of the report justifies this proposal as follows:

> The construction industry has been criticized, to a large extent justifiably, for its slow acceptance and use of modern management methods to plan and execute projects. Many people, both inside and outside the industry, view this as a primary cause of serious delays in schedules and large cost overruns that have plagued the industry in recent years. Yet there is no lack of modern, cost-effective management systems that provide project managers with all the controls they need.
>
> Owners are the ultimate beneficiaries of improvements in the cost, schedule, and quality of their construction projects. But many owners do not seem to be aware of the economic payoff from the appropriate use of modern management systems, and therefore are unwilling to incur the costs of operating the systems.

Subsequent chapters of the Business Roundtable report (1982) discuss specific steps owners can take to effect improvements in planning and scheduling; cost estimating, budgeting, and control accounting; quality assurance; materials management; and meshing or linking different management systems. The final chapter of the report sums up the situation as follows:

> Many owners and contractors have not yet recognized the major role that modern management systems can play in the achievement of cost-effective projects. Today's projects are becoming more complex in nature, often because of external influences beyond the control of the owner or contractor. Most of the old tried and tested systems of yesteryear can no longer handle the complexity and volume of data confronting today's project and construction managers. Action is needed to put in place modern management systems which will provide effective project controls. . . .
>
> Owners should consider:
>
> - The need for modern, cost-effective, management systems to plan, execute, and control their projects.
>
> - Their responsibilities and prerogatives as related to the use of management systems. In this regard, they should formally establish their specific scheduling, cost control, quality assurance, and materials management objectives prior to requesting bids for a construction project.
>
> - The selection of design-construct and construction contractors who can demonstrate that their procedures, systems, and personnel capabilities meet prescribed standards for control of schedule, cost, quality assurance, and materials management.
>
> - The possible use of incentives to contractors to achieve project objectives, whether they be schedule, cost, or quality assurance.

As will be discussed in subsequent chapters of this report, many federal agencies have already implemented, or have started to implement, a number of the recommendations of the Business Roundtable regarding specific aspects of construction management, and by so doing, they have, in effect, endorsed the Business Roundtable's general thesis that owners ought to play an active role in the construction process. Indeed, this has been the view of most agencies for many years. As will also be noted, however, federal agencies have not taken any action on many other Business Roundtable recommendations regarding the management of construction, and it appears

that most of the agencies will have limited opportunity to do so in the future.

The recommendations that federal agencies generally have found difficult to implement are those that urge owners to take certain steps to force contractors to adopt various specific modern management techniques. The general view of most agencies is that such steps are appropriate when an owner assumes all or most of the financial risks associated with a construction project (e.g., by acting as the general contractor himself, either alone or with the help of a construction manager, or by hiring a construction firm under a cost reimbursement arrangement), which is common practice among the owners that participated in the Business Roundtable study. However, most agencies believe that such steps are neither necessary nor appropriate when a construction firm is selected through competitive bidding and operates under a fixed-price contract, the approach federal agencies generally are required to use. In fact, of the agencies represented on the committee, only the military agencies and the Department of Energy have let any cost-reimbursement contract in recent years, and even in those agencies such contracts are very rare--probably representing less than 3 percent of all construction contracts let.

The cost-reimbursement approach has been used primarily for very large, complex industrial and utility projects that take several years to construct and for "fast-track" projects in which construction is started before all design work is completed. Projects of these types involve many unknowns, and most construction firms either would be unwilling to assume the financial risks associated with undertaking them on a fixed-price basis, or would charge an exorbitant amount to do so.* Use of

*A project can be carried out on a "fast track" schedule (i.e., the project schedule can be telescoped) without necessitating the use of a cost-reimbursement contract if it is broken into well defined segments or phases, with complete plans and specifications prepared for each phase. With this arrangement, a project can be carried out through a series of separate, competitively-bid, fixed-price contracts. Most agencies use this approach whenever possible when they need to accelerate a construction schedule.

the cost-reimbursement approach eliminates such concerns by having the owner assume most of the financial risks.

For a variety of political and practical reasons, federal agencies try to minimize uncertainty about the ultimate cost of construction projects. Consequently, whenever possible they avoid proceeding with a construction project when the number of unresolved issues is so great that the cost-reimbursement approach would be required. Private owners do not function under similar constraints, and they frequently do use the cost-reimbursement approach.

For many years owners using the cost-reimbursement approach voiced few complaints about the results achieved with the approach or about the performance of the construction industry; however, a few years ago a number of owners experienced huge overruns on large projects. The committee believes that this situation prompted the Business Roundtable to initiate the CICE project. This being the case, it is understandable that the Roundtable study concentrated on the concerns of the large owners using cost-reimbursement contracts and that many of the resulting recommendations concerning the use of modern management techniques are aimed primarily at dealing with the major shortcoming of the cost-reimbursement approach: the fact that it provides little incentive for contractors to seek more efficient methods of operation. The competitively-bid fixed-price contracts ordinarily used by federal agencies do not have this shortcoming and, therefore, most agencies feel that many of the recommendations of the Business Roundtable are not applicable to them.

Most agencies believe that competitively-bid fixed-price contracts provide powerful motivation for contractors to seek ways of improving the efficiency of their operations. With such contracts, every dollar saved is an extra dollar of profit, and every dollar wasted is a dollar of profit lost. In fact, contractors involved in competitive bidding risk being forced out of business if they do not operate efficiently. Competition is keen in that segment of the construction industry that is involved in competitive bidding, and firms that fail to adopt cost-saving techniques usually find it difficult to win contracts or to make a profit on any contracts they are awarded. Consequently, most contractors

involved in competitive bidding are constantly on the alert for opportunities to save money. If the management techniques recommended by the Business Roundtable are effective, they will permit the contractors who have adopted them to submit lower bids, and they will be quickly adopted by other contractors. Most agencies believe that contractors do not need any encouragement from them to look for ways to save money. Furthermore, many government procurement officers believe it would be unwise for agencies to involve themselves unnecessarily in a contractor's business because it could provide a contractor with an excuse for demanding additional money at the end of a project on the grounds that his efficient plan of operation was harmed by an agency's meddling. For these reasons many agencies have been cautious about adopting those Business Roundtable recommendations that would cause them to become involved in a contractors day-to-day operations. Some agency officials have also observed that federal operations are less than perfect and that it would be presumptuous of the federal government to dictate management procedures to contractors.

It should be noted that not all agencies agree with this cautious approach to the adoption of Roundtables' recommendations. Some agencies believe that the shortcomings of the construction industry that have been enumerated by the Business Roundtable apply to contractors working on fixed-price contracts as well as to contractors operating under cost-reimbursement contracts and that, therefore, the Business Roundtable recommendations are just as applicable to owners (like federal agencies) that let fixed-price contracts as other owners. These agencies argue that even if a particular owner might not realize any immediate benefits from adoption of the Business Roundtable recommendations, he will benefit in the long run because of the long-term improvements that their adoption will bring to the industry as a whole. However, the majority of federal agencies feel that they need not and should not involve themselves unnecessarily in the affairs of a contractor, and this view is reflected in the discussion of specific aspects of construction management in subsequent chapters of this report. Specifically, it will be noted that most of the Business Roundtable recommendations that have been adopted by federal agencies deal not with the efficiency of a contractors operations, but rather with matters

that are of more direct concern to agencies (e.g., schedules and quality assurance).* However, it is also likely that in the future some agencies might consider adopting those Business Roundtable recommendations aimed at improving construction efficiency for those rare cases when cost-reimbursement contracts are used.

*One exception to this general policy is that agencies sometimes try to help improve the management procedures of small/disadvantaged businesses that have been awarded contracts under a set-aside program.

3
PLANNING AND SCHEDULING

The Business Roundtable report on modern management systems concludes that a 10 percent reduction in the schedule of a typical construction project is possible and that this would result in a 3 percent cost saving to the owner, primarily from an earlier return on the owner's investment (Business Roundtable, 1982). The report also concludes that the duration of projects can be shortened if:

- Schedule reduction is made a specific objective by project personnel.
- The owner provides appropriate incentives.
- All participants, including owners, adopt effective planning and scheduling techniques.
- Construction site productivity can be increased.*

In order to achieve these objectives the report recommends the development of "a model planning and schedulingsystem" based on "network theory embodied in the critical path method" and of "a model set of operating guidelines." Finally, the report recommends that owners take a number of specific actions in order "to help the industry implement better and more standardized methods of planning and scheduling." In particular, the report recommends that owners "be more

*Methods of increasing productivity are discussed in other Business Roundtable reports.

active in excercising their responsibilities and prerogatives in all aspects of scheduling."

Inasmuch as federal agencies are not profit-making organizations, they would seldom realize the 3 percent cost savings projected by the Business Roundtable to result from a 10 percent reduction in the duration of a project.* Therefore, federal agencies cannot justify routinely requiring the use of sophisticated scheduling procedures on the basis of savings due to a quicker return on investment. Nevertheless, most agencies endorse the use of such procedures--generally on the grounds that they provide a basis for establishing realistic schedules, determining the validity of requests for payments, and planning cash outlays, and because they reduce the likelihood of long delays and help to resolve disputes regarding delays. Many agencies also make the use of such procedures a contractual requirement; however, the policies of the agencies vary on this point:

- The National Aeronautics and Space Administration (NASA) requires the use of the critical path method (CPM) on most projects costing over $1 million, but NASA does not prescribe how the CPM schedule is to be developed.

- The Naval Facilities Engineering Command (NAVFAC) requires the use of CPM on all major projects; whether a project is "major" is determined on the basis of complexity, not dollar amount. NAVFAC also may require prospective contractors on such projects to demonstrate prior experience with CPM scheduling. NAVFAC reports that only a small percentage of their projects are classified as complex.

- The Corps of Engineers' (CoE) policy is for all construction projects to have a construction schedule. District and division offices determine whether a CPM schedule is needed based on the complexity of the project.

*Such savings might, however, be realized in special situations; e.g., when early completion of a building would permit an agency to vacate a high rent building.

- The Air Force requires the use of CPM on its more complex project and works closely with its construction agents (the CoE and NAVFAC) to identify the projects that are to be considered complex. Once a project has been identified as complex, thus requiring the use of CPM, the agent then assumes the responsibility of executing the project in accordance with its standard policies and regulations.

- The Architect of the Capitol (AoC) requires contractors to develop CPM schedules using whatever system they normally employ. The AoC also usually develops a CPM schedule for each project, which is used as a check on the contractor's schedule. Currently, the AoC is having a new computer program for generating CPM schedules developed by a consultant.

- The Veterans Administration (VA) requires CPM on all projects over $2 million. After the contractor's project schedule is approved, the VA does all the computer processing and report generating for monthly project updates on its own computer system. The monthly updates require the contractor to update his schedule in terms of both time and money and to make logic revisions associated with contract changes issued between updates. The VA trains all its project management staff on CPM and recently has opened this training to contractors on VA projects. The VA currently is operating a pilot program involving the location at selected project sites of computer terminals linked to the main operating system in Washington.

- The General Services Administration (GSA) formerly used the approach currently used by the VA. Now, however, it requires that contractors on projects costing $2 million or more provide CPM schedules using their own systems. The GSA also is in the process of acquiring small computers (including "lap portables") capable of supporting the field inspection personnel with CPM scheduling software; however, GSA intends to continue to require its contractors to develop and update their own schedules. The new equipment is expected to allow government field personnel to become more familiar with modern scheduling techniques, and to provide a means to cross-check contractor schedule submittals.

- The United States Postal Service (USPS) requires contractors to develop CPM schedules, but it does not dictate the form of such schedules or control their use.

- The Department of Energy requires major contractors to operate internal management control systems which meet the Department's cost and schedule control systems criteria (CSCSC) on all projects costing over $50 million. The contractor must demonstrate how his systems meet the criteria shortly after contract award. CPM is encouraged but CSCSC does not specifically require the use of CPM. The only requirement is that the scheduling system be fully integrated with the work assignment, budgeting, and cost collection systems and tie together from top to bottom.

The committee has been informed that the Business Roundtable is sponsoring the development of "a model planning and scheduling system" and "a model set of operating guidelines" in accordance with its own recommendations. The study is being conducted by the Construction Industry Institute (CII), a new construction research organization located at the University of Texas. (CII was formed under the auspices of the Business Roundtable.) Several agencies have expressed interest in this initiative by CII and a desire to review the results and recommendations that may be forthcoming to determine if they could be applied to government projects. It should also be noted, however, that some agencies have expressed concern that the standardization efforts might be premature given the dynamic state of computer technology.

4
COST ESTIMATING, BUDGETING, AND CONTROL ACCOUNTING

The Business Roundtable report on modern management systems identifies many problems with the methods used by owners and contractors to estimate and control construction costs, particularly for negotiated (cost-reimbursement) type contracts (Business Roundtable, 1982).* The report also concludes that:

> Poor scope definition, limited use of risk evaluation techniques, poor documentation of the basis for estimates, loss of control of scope during design, and lack of management involvement are problems that can be corrected if owners and contractors adopt and actively use available procedures and systems.

The report urges owners to take the following steps to improve the situation:

1. Recognize that it is extremely risky to budget projects--especially large ones--on the basis of conceptual estimates made with a low percentage of project definition and design completion.

2. Use risk-analysis techniques to evaluate undefined areas, scope growth potential, process and design status, schedules, regulation

*The Business Roundtable report (1982) does not specifically refer to cost-reimbursement contracts; however, the background report that provided the basis for the Business Roundtable's findings clearly indicated that cost-reimbursement contracts are the major concern (Business Roundtable, 1983c).

changes, procurement, productivity, start-up and management skill. Be prepared to accept contingency factors appropriate to the risk evaluation in order to get a more accurate estimate of final cost.

3. Require that escalation of costs be calculated on the basis of a realistic schedule of expenditures for labor, equipment, and materials. Escalation for materials should be by commodity classification.

4. Make sure that project managers have adequate training and experience to make estimating and cost control decisions, and are fully involved in the development of estimates and in cost control efforts.

5. Require that medium and large projects be subdivided at an early stage into smaller, more easily managed segments for estimating/budgeting, and cost control purposes.

6. Require that cost modules be tied to schedule modules to assure cost and schedule control and integration of each project segment.

7. Require that the basis for cost estimates be documented and used as a communication and control device.

8. Promote the use of computerized estimating techniques where the size of the project justifies their use.

9. Require that cost estimates be brought up-to-date at planned intervals as the design of a project proceeds. Documentation of changes at this stage is critical to project cost control efforts.

10. Plan the cost control program to provide actual cost feedback to be used for management decisions on a timely basis and to provide a historical record for future estimating.

11. Choose design-construct contractors and/or construction contractors who demonstrate that their procedures, systems and personnel capabilities meet prescribed criteria for cost estimating and control.

12. Consider contractual incentives to help assure implementation and tangible results in estimating and cost control.

13. Commit to an adequate outlay for estimating and cost control.

14. Require a post-project review of actual costs vs estimated costs to determine areas where the estimating data base should be modified.

A few of the recommendations (e.g., recommendations 10, 11, and 12) are applicable only to those federal agencies that use cost-reimbursement contracts. Although such contracts are used infrequently (and in most cases only with special approval from agency headquarters), they are nevertheless important since they are ordinarily used for complex, high-cost projects requiring special management attention in order to preclude large cost overruns. However, most agencies do not use such contracts so the recommendations in question are of no concern to them.

Most of the other recommendations, however, are as applicable to federal agencies as they are to other classes of owners. Furthermore, many of the problems relating to estimating and budgeting that the Business Roundtable recommendations are intended to cure have been of concern to federal agencies for many years, and many agencies have already taken most of the steps suggested by the Business Roundtable to improve the situation. Consequently, the committee is convinced that most agencies would enthusiastically endorse most of the Business Roundtable's recommendations in this area. Further, it believes that most agencies would strongly endorse recommendation 1 because they have found that most instances of inadequate funding are caused by budgets being prepared on the basis of incomplete designs and/or users making basic changes in projects after budgets have been approved.

Many of the steps suggested by the Business Roundtable are not one-time actions. Rather, they call for a change in thinking or the adoption of a certain attitude, and such behavior modification is difficult to institutionalize. The agencies have found that the sound principles reflected in the Business Roundtable's recommendations are easily forgotten in the hectic process associated with getting construction projects planned, designed, and built and that they need to be reiterated frequently. The Business Roundtable's report has been of value to the agencies because it has served to do just that.

The committee believes that some agencies would demur with regard to recommendation 2 of the Business Roundtable regarding the use of risk-analysis techniques. The Federal Construction Council Consulting Committee on Cost Engineering (1983) investigated the possible use of one such technique (probabilistic estimating) by federal agencies and found considerable opposition to the idea for various reasons. Recently, however, several agencies began promoting the application of risk analysis to cost-estimating on an experimental basis. The Naval Facilities Engineering Command, for example, has directed its field divisions to consider possible application of risk analysis on one or more new projects. The Air Force and the Department of Energy also are experimenting with the use of risk analysis on selected projects. In addition, the need to find better techniques for estimating construction was discussed in a report by the House Subcommittee on Military Installations and Facilities (U.S. Congress, House, 1984).

5
QUALITY ASSURANCE

The chapter on quality assurance of the Business Roundtable's 1982 report on modern management systems was based on a detailed investigation of the subject by a special study team (Business Roundtable, 1983d). As part of its investigation, the study team conducted a survey of "large owners who are members of the Business Roundtable and have large construction projects, large construction companies, and large design/construct firms." The study team also interviewed many individuals from various companies and organizations.

Based on the work of the study team, the Business Roundtable identified a number of general shortcomings relating to how quality assurance* is handled on construction projects. Among the general problems identified were the following:

- The fact that formalized quality assurance/quality control programs have really evolved rather than been planned on a sound engineering basis.

- The fact that the application and benefits of a quality assurance/quality control program are neither fully understood nor effectively utilized in the planning, design and construction phases of most projects.

*The Business Roundtable defines quality assurance as "a planned and systematic pattern of all actions necessary to provide adequate confidence that a product will conform to established requirements." It says that quality control "implements the quality plan by actions necessary for conformance to established requirements."

- The fact that only very few firms attempt to measure the cost effectiveness of their quality programs.

- The fact that confusion exists about the differences between quality assurance and quality control as well as [about the] the best organizational structure to handle these two functions.

- The lack of well defined career paths in quality assurance and quality control for all types of companies.

- The lack of information about training programs in quality assurance and quality control in construction.

- The infrequent use of statistical methods and automatic data processing (ADP) in construction quality assurance and quality control.

The Business Roundtable also suggested that owners are partly to blame because: "Of the three types of companies queried, owners exhibited the least interest in establishing formal QA/QC programs even though they stand to benefit the most because they must live with any poor quality construction that is accepted." The Business Roundtable further observed that "there is no question that increased attention to quality by owners would bring them tangible benefits--in costs, productivity, and in the use of their facilities over time."

On the basis of such findings, the Business Roundtable recommended that construction quality control in general be improved and that owners consider a number of actions including the following:

- Clearly defining the level of quality assurance required on their projects.

- Requiring designers, constructors, and vendors to have formal QA/QC programs and procedures as one prequalification for bidding or negotiating work.

- Requiring pre-job meetings to review and clarify all QA/QC requirements and define how they will be monitored.

- Having the operational executive (preferably the plant manager) become more active in the planning and execution of the QA/QC efforts.

- Establishing an autonomous quality assurance group within the company to analyze and approve programs and procedures that are submitted and to assure that the programs are in fact put to use during design and construction.

- Placing the responsibility for the control of quality directly upon the organization performing the work and under the day-to-day direction of the manager responsible for the execution of the work.

- Establishing a regular post-project quality review to assess the effectiveness of the QA/QC effort. The results of the review should be documented for use in future project planning.

- Tracking the cost of critical items over the entire life of the facility built in order to get a more precise reading on the results of the quality level achieved during design and construction.

The Business Roundtable further recommended that owners:

- Establish definitive career paths for QA/QC personnel within their organization.

- Have current, relevant QA/QC manuals and procedures.

- Use automatic data processing more extensively for statistical analysis and to create data for historic comparisons in future years.

- Fully explore the many ideas and modern methods now being proposed for improving the quality of engineered construction through motivational techniques. They include quality circles, innovative labor relations, personnel motivation, and participative decision making.

The committee's experience is that the Business Roundtable's finding about owner disinterest in quality assurance is not applicable to most federal agencies. In fact, most agencies have long taken a very keen interest in the subject, and most of the Business Roundtable's recommendations to owners were considered and, in most cases, implemented by federal agencies many years ago (e.g., see Federal Construction Council Task Group T-50, 1968). This does not mean, however, that federal construction projects are free of quality control problems. Indeed such problems have occurred often, but in almost all cases they have been caused by a shortage of trained personnel, not disinterest. Nevertheless, the Business Roundtable recommendations are helpful because they highlight the need for continuing emphasis on the subject of quality assurance.

The only Business Roundtable recommendation that some federal agencies might find difficult to implement is the one about requiring designers, contractors, and vendors to have formal QA/QC programs and procedures as one prequalification for bidding or negotiating work because, as already noted, federal agencies generally are precluded from taking any action that would restrict competition. Some agencies also might take exception to the recommendation that responsibility for the control of quality be placed directly on the organization performing the work. Among the agencies, the concept being recommended is called "contractor quality control." It has been used by military agencies for more than 15 years and some of the civilian agencies (e.g., GSA and NASA) have employed the concept from time to time. There is, however, a considerable difference of opinion between agencies about how well the concept works. Suffice it to say that some agencies prefer to rely on their own personnel for quality control or to hire an independent organization to provide inspection services.

6
MATERIALS MANAGEMENT

The Business Roundtable report on modern management systems asserts that although "many firms in the construction industry have sophisticated and computerized control systems for materials and equipment," such systems often are deficient in meeting the materials management goal and that "the construction industry lags far behind the manufacturing industry in applying the concepts of materials management" (Business Roundtable, 1982). A number of specific shortcomings of the construction industry are identified, and criteria are presented for developing effective materials management systems. Finally, the report recommends that owners consider:

- Requiring that materials management systems meeting the [suggested] criteria are used for their projects both by their own organizations and by their contractors.

- The adverse impact on cost and schedule of proposed changes to drawings and specifications and fully evaluate their effect before making changes. Incomplete drawings and specifications should not be issued for procurement unless the owner fully accepts the probable large increase in costs that will ensue in return for minor savings of time.

The report also recommends that both owners and contractors should:

- Develop standards of performance for materials management.

- Select materials management personnel carefully and provide adequate training and career progression plans. Increased attention should be given to providing training for any local-hire personnel performing materials management activities at the job site.

- Use automatic data processing more extensively for materials management, especially for large projects and for job site activities where it can be most effective at eliminating waste of time and money.

- Expedite placement of purchase orders by techniques, varied to suit the dollar amount and conditions of orders, such as a form of proposal to encourage technical uniformity in bids, price agreements, requirements orders, small dollar value orders, and petty cash fund purchases for small items.

- Improve job site inventory control by broader use of coding systems and of re-order points for commonly stocked materials. Satellite warehouses close to work areas should be established for large projects.

Federal agencies are only peripherally concerned with materials management on fixed-price contracts; consequently they have have taken no action on these recommendations. Materials management on a fixed-price contract generally is considered to be the responsibility and prerogative of the contractor except in special situations; e.g., when the government itself is furnishing some equipment to be installed by the contractor, in which case the government shares materials management responsibility with the contractors for the government-furnished equipment, or when a foreign contractor needs government assistance in locating and procuring U.S. made products to be used overseas. Some agencies (e.g., the VA) also become involved in materials management to the extent that they review CPM schedules to ensure that procurement actions for critical materials are initiated in a timely fashion.

7
LINKING MANAGEMENT SYSTEMS

The Business Roundtable report on modern management systems includes the observation that: "Planning and scheduling, cost estimating and control, quality assurance/quality control, and materials management are interrelated functions of project management. They fit together into a whole. Piecemeal use of one part or another will yield minimal results" (Business Roundtable, 1982). The report recommends that:

> Where their use is justified by the size of the project, automatic data processing systems for these four functions should be designed so that each is self-contained and reports the data required for control of the function. At the same time the systems should be linked so that a change of data in one function will immediately show its effect on all the other functions.

The report does not, however, indicate whether software to accomplish the desired linking currently exists and does not include any specific recommendations on what steps owners should take to ensure that linking systems are used on their projects. The absence of this information is, of course, not significant to most federal agencies since, as with many other matters relating to the management of fixed-price contracts, agencies generally are inclined to rely on the profit motive to stimulate contractors to seek better ways integrating different management systems rather than to force contractors to use some particular mechanism. Agencies would, of course, encourage contractors to continually look for and experiment with new promising ways of managing construction projects.

8
SUMMATION

Federal agencies subscribe to the basic theme of the Business Roundtable's 1982 report on modern management that owners should play an active role in the construction process. In fact, most agencies have held this view for many years. They agree with the Business Roundtable that since owners ultimately benefit from improvements in the cost, schedule and quality of construction, they have a duty to involve themselves in the process by which facilities are planned, designed, and constructed.

Many federal agencies have already implemented, or are planning to implement, a number of the Business Roundtable's recommendations regarding planning and scheduling, cost estimating, and quality assurance. However, most agencies have no plans to implement those Business Roundtable recommendations that call for owners to take actions aimed at forcing contractors to adopt certain management techniques that the Business Roundtable believes will save money. Federal agencies believe that the use of competitively-bid fixed-price contracts provides ample incentive for contractors to seek more efficient methods of operation and that it is generally not necessary or appropriate for agencies to dictate the use of specific management techniques in order to reduce construction time and costs. However, these agencies also agree that, on a selective basis, it is appropriate and often necessary to insist that contractors adopt specific new management techniques by making the use of these techniques a contract requirement. There was also a general consensus that the agencies represented are actively seeking new and innovative ways to improve the cost effectiveness in federal contracting and welcome the findings of the Business Roundtable as a major step toward that goal.

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