

Constructor's View of Quality in the Constructed Project

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A contractor's view of quality in the constructed project is given from two perspectives: estimating/bidding and actual construction. Contractors believe that quality should be a factor inherent in the prebid documents, constructability review, safety programs, and conflict avoidance. The constructability of a project should be reviewed concurrently with design. Effective safety programs for projects start with the owner. Treating safety as an incidental in a construction project is an error with grave consequences. Conflict avoidance requires detailed plans, special provisions, and specifications that include a fair allocation of risk included in the following clauses: changes, time extension, geotechnical information, differing site conditions, supervision of work, liquidated damages, variation in quantities, claims, and disputes.

Rehabilitation and expansion of the largest and most efficient highway transportation system in the world are necessary. The system is gridlocked in urban areas because of increased traffic demand and decay due to age and neglect. The work at hand is to replace, upgrade, design, and construct highways, bridges, and associated systems across the nation.

Our task as engineers and contractors is to construct safe and economic projects using quality contract documents to build quality projects.

QUESTIONS

"The true measure of a civilization is in how it maintains itself." What kind of a grade for quality would we give ourselves on a report card for the maintenance of our civilization in the categories of education, design, financing, specifications, materials, construction, and dispute resolution?

With the quality of some past materials and workmanship exceeding those of today, what distinguishes quality in the worlds of engineering and construction 20, 50, or 100 years ago?

THE "QUALITY" MANUAL

ASCE Manual 73 (1) is an attempt to define aspects of construction project quality. It is understood that there is no wise man atop the mountain with the truth about quality. Quality management means "conformance to requirements." "The cost of quality is the expense of doing things wrong." "Non-quality is nonconformance." The difficulties in the

implementation of "quality management" are summarized by Crosby (2).

Unfortunately, the business of quality management is not all that easy. It isn't all that hard either, but it does encompass more than a single gulp of philosophy. It also requires unblinking dedication, patience and time. The problem of quality management is not what people don't know about it. The problem is what they think they do know.

CONTRACTOR'S PERSPECTIVE

A contractor's view of quality in the constructed project is given from two perspectives: estimating/bidding and actual construction.

Contractors find the following typical problems with construction projects and the plans and specifications (3):

1. Constructability deficiencies due to incomplete, erroneous, or nonexistent details;
2. Shop drawing approval; and
3. Owner cooperation to resolve problems.

A contractor, from the initial viewpoint of estimating, should review the contract documents and assess the project throughout the plans and specifications. An initial contractor review lists the following: scope of work; scheduled duration (completion date); type of contract (lump sum, unit price, etc.); amount of liquidated damages; classified or unclassified excavation; differing site conditions; type of changes clause; type of damage for delay cause; geotechnical report—quantity and location of borings, test wells; equipment requirements for temporary structures; review of the project's special provisions; constructability; erection sequence; and so forth. From this list a contractor ascertains whether it is in the company's best interest to bid the project. This decision weighs the project risk, the identity of the owner and the owner's engineer and inspection agent, the competitive market, the current backlog, current bidding opportunities, and the quality of the plans and specifications.

A review of the plan's prebid looks for details and complete specifications. A list of questions is compiled to clarify the drawings in order to estimate the cost of construction. Quantity takeoff is performed and quantity comparisons made. The submittal of prebid questions is made by telecom or formally by mail or fax to the owner's engineer.

Although we exist in an electronic business age, the prebid process of drawings and specification clarifications can be in a "horse and buggy" age. A contractor sees a wide variation

of quality in the engineer's prebid response to requests for information and clarification.

Often plan quantities in bid documents are incorrect. In one state—1 week before bid date—a contractor is told, "There is not enough time to issue an addendum—bid the plan quantity." In another state, the revised quantity and proposal sheet would be faxed to all plan holders as late as the day of the bid.

Often the bid documents include information or drawings that contain items stamped with disclaimers such as, "This drawing is a conceptual schematic construction only. The contractor shall submit the detailed construction scheme for approval by the engineer" (3) attempting to make them invisible. Typical examples of these "nonexisting" attachments are geotechnical reports, boring logs, bridge erection procedures/sequences, and temporary shoring. An example of the language of invisibility is as follows: "The borings and project geotechnical report are available upon request for review at the engineer's office. These items are for the contractor's information only and are not a part of the bid documents" (3).

CONSTRUCTABILITY

The manual (1) contains two short paragraphs referencing constructability reviews. The impact of the suggestions made in these two paragraphs is potentially great. Constructability is unfortunately a cosmetically applied buzzword even though it is known to be of critical importance.

Construction and erection sequences are often afterthoughts in assembling a set of bid documents. The project's constructability should be reviewed concurrently with design.

It is common for the erection/construction sequence drawings to include a disclaimer stating either that they are conceptual only or that it is the contractor's responsibility to erect the bridge safely. The following is an example of a disclaimer placed on an erection sequence drawing: "The safe erection of the bridge is the sole responsibility of the contractor. The erection sequence shown in the contract plans is schematic only. The contractor shall prepare a complete erection analysis." The plans and specifications place extensive construction engineering responsibilities on contractors with little or no time for detailed analysis before bid.

Contractors believe that the owner and the designer are responsible for constructability and that they should provide one complete erection scheme that considers construction erection stress conditions. A contractor's alternative erection sequences would be his responsibility (4).

The designer "should state unequivocally that all parts of the permanent structure have been designed for loading conditions that will arise during construction if his method and sequence is followed" (5).

SAFETY

All parties to the construction process must be cognizant of the personal and monetary costs incurred as a result of construction accidents.

The Laborer's Health & Safety Fund, N.A. recently released a report stating that the construction industry is the most hazardous

and has the highest overall injury rate of any industry in the U.S. One in seven construction workers are injured on the job each year. In 1989 alone, the industry lost more than 6.3 million workdays due to accidents and injuries. And, while only 6% of American jobs are in construction, the industry accounts for over 20% of on-the-job deaths (6).

The manual (1) states that the contractor has primary responsibility to initiate a job safety and first aid program. In the real world, additional safety responsibilities exist for the owner and the owner's construction inspection engineer and designers.

There is debate about the involvement of the owner, design professionals, and the contractor in reference to safety. All parties ask for indemnification of their acts and omissions.

For the record, if you walk a job site in today's world and see and fail to act upon witnessing an unsafe act—no matter what your contractual responsibility to the project—you are responsible.

Effective safety programs for projects start with the owner. Treating safety as an incidental in a construction project is an error with grave consequences.

CONFLICT AVOIDANCE

The best way to avoid conflicts and subsequent litigation is to use common sense in the project design and bid documents. This application of common sense would include a detailed site investigation, use of unit prices, and equitable contract language for both changed conditions and delays. "Experience has demonstrated that if bidders are assured that the contract provides reasonable means to resolve contractual problems as they arise, the owner will receive lower bid prices" (7). Conflict avoidance requires impartial and objective dispute resolution. Pride of authorship and the application of standard specifications must yield to a team (owner, designer, contractor, and construction engineer) building a project from detailed plans, special provisions, and specifications that include a fair allocation of risk included in the following clauses: changes, time extensions, geotechnical information, differing site conditions, supervision of work, liquidated damages, variation in quantities, claims, and disputes (7).

CONCLUSION

The existence of the manual cannot be debated. The content must be understood, discussed, revised, and/or deleted by owners, engineers, and contractors in the construction of safe and economic projects. To quote from the manual's frontispiece, " 'Construction' quality is never an accident. It is always the result of high intention, sincere effort, intelligent direction, and skillful execution. It represents the wise choice of many alternatives" (1).

REFERENCES

1. *Quality in the Constructed Project*. Manual 73. ASCE, New York, 1990.
2. P. B. Crosby. *Quality is Free*. 1979.

3. T. P. McCarthy, R. Salame, and W. R. Nash, Segmental Bridge Construction—A Contractors' Perspective. International Bridge Conference, Pittsburgh, Pa., June 1989.
4. T. P. McCarthy. Quality of Contract Documents for Segmental and Cable Stayed Bridges. TRB, 1989.
5. A. F. Gee. Constructability of Bridges—A Construction Engineer's View. *Concrete International*, May 1989.
6. M. C. Loulakis and W. L. Cregger. Liability for On-the-job Safety. *Civil Engineering*, July 1991.
7. *Avoiding and Resolving Disputes in Underground Construction—Successful Practices and Guidelines*. ASCE, 1989.

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