In conclusion, as stated in the author's evaluation: "The objective of a quality control program is to verify achievement of the quality specified. Monitoring and testing methodology should be based on proven techniques that have consistently demonstrated the ability to provide statistically relevant information. That information is a tool to be used in making prudent decisions. The collection of such information in the CQC process should be free from any pressure to prove goodness or badness, acceptability or unacceptability." The writer would submit that this is the objective of any quality control program, and contractors or manufacturers who have shown a proven successful track record both in growth and recognition of their capability to complete a complex project on time and within the budget, with repeat business, and, in the case of manufacturers, continuing acceptance of their products, do not need this data to be "gathered by an unbiased third party."

A CQC program implemented by an unscrupulous contractor or manufacturer certainly would have many faults and limitations irrespective of who gathered the data. However, requiring competitive bidding for inspection and testing services does not automatically "encourage less follow through, less experienced personnel, less attention to detail, i.e., less quality." To say this is to say the same thing for all work that is performed or products that are manufactured under the competitive bidding system and to leave the impression that low price means less quality of product or service, and that the only way to assure quality is to develop an unbiased third party to gather the data to verify the quality specified is achieved.

The author's recommendations are, in my view, as unsound as his evaluation of the CQC program. The writers recommendations are as follows:

1. ASCE should take a leadership role in providing information and recommended training for CQC personnel. Accreditation by the ASCE of CQC programs and personnel should follow.
2. Design professionals should exercise their duty, that of basing their design on the current state of the art regarding materials and methods of construction and to perform design reviews to assure constructability, and reduce errors and omissions. This review should also include inspectability of the work.
3. The entire quality control process should receive closer and more detailed supervision with a greater emphasis on fitness for use of the product and not the imposition of more controls or controllers.

Discussion by George A. Stout,[4] M. ASCE

The author provided three recommendations, summarized, for ASCE assumption of leadership for CQC alteration, for exercise of duty by design professionals, and for qualified supervision of the CQC altered pro-

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cess. The writer finds none of these palatable. On construction, ASCE (with its 80,000 members) and design professionals are virtually synonymous; qualified supervision, many already in ASCE or PE's, and engaged on construction, will be "often at direct odds with quality." The author concludes his Additional Arguments: "Most conscientious contractors don't like CQC either." Who does appreciate contractor quality control? The owner! The Corps of Engineers, for one, attempted to obtain it. It was initially promulgated in contracts by a one sentence paragraph (3). Later, it was made specific and voluminous. The contractors didn't respond. The Corps' effort, no matter the originator, foundered not only on contractor reticence but also on internal resistance toward lack of first-hand control, failures of independent testers, reductions-in-force, propensity to avoid the more difficult enforcement of a "paper shuffle" as well as the construction quality, and the prodigious vageries of the government contract.

Prodding.—GAO, the "watchdog of Congress," prodded the Corps, in the writer's view, for two reasons: (1) As applied, it appeared that the government was paying twice for CQC—once to the contractor, and again to the Corps, who had not relinquished "control" pursuing it under the guise of "assurance;" and (2) the author's view was confirmed—nobody wanted it!

Analogies.—The writer finds three "terms and conditions" of the government contract worth mention; Accident Prevention, Network Analysis and Additional Superintendence. Each is no less important than CQC to effective, quality construction processes. No mention was made of these as contributing difficulty to construction execution. For each, the government believes it is paying for performance while its employees, the writer believes, must exercise heroic efforts to attain compliance for the contractor's and owner's benefit.

"Accident Prevention," (2) whose kinship to OSHA is manifest in the reading, merely requires adherence to a program of safe practices, specified and declared by the parties before commencement. In the private sector, OSHA is the "law of the land." Design professionals avoid enforcement responsibility as they would a plague. Court decisions, as an indicator confirm the necessity for that posture. The contractor and owner stand alone. All demand the contractor insure himself.

"Network Analysis," Defense Department lingo for any logical system for construction management through preplanning by assigning sequences of activities and events (meaningful bits of work, dollars, time, equipment, etc.) strung out on paper, then sorted through our high-speed "technician," is merely the visual extension of the more complex relationships not readily apparent on the Gantt chart. The writer has heard of few contractors, rather more construction managers, and mostly government agencies (by regulation only) *truly committed* to its use. As the old time road builder said to the Resident Engineer: "I'll get the thing for ya, but don't think it's gonna tell me how to build the road." It didn't.

"Superintendence of Subcontractors" (7) requires two added superintendents when more than 70% of the construction effort is subcontracted. On what large, or even small construction, is that not a commonplace? As in the author's "real world," these added supervisors will

report to the contractor's own as does the CQC inspector, the independent tester, and the CQC engineer. Perhaps their bonus will be sufficient to encourage each "sub" to do that which the contractor won't of his own accord.

The three analogies were cited to demonstrate the plight of the heinous contractor. The author states in Additional Arguments: "The contractor's business is construction, not quality control!". The writer submits that the substance of the analogies is as much a part of constructing as steel, bricks, sand densities, concrete cylinders, the designers' pet brands, ad infinitum, including quality control. In Review and Additional Arguments, the author has enumerated virtually every classic condemnation of contracting. It has been said: "Those who can—build; those who can't—criticize." (Attributed to Robert Moses.)

Conclusion

The author's statement of the CQC objective would be admirable had the words "by the contractor" been added. The government, which has been willing to absorb inspections costs, has extreme difficulty insuring the right man at the right place at the right time. Do the design professionals' efforts and budgets permit of "proven techniques" for monitoring and testing methodology? Refer to another GAO report (5). The writer submits that the design professionals have been most fortunate to avoid competitive dollar contracting (the Brooke's Bill, Ref. 6) more so than the testing laboratories who have been subject to such practices by government and contractor. Even so and despite state licensing, their performance cannot be indorsed with unanimity. The need for "outside independent auditing" applies to others associated with the construction process as well as contractors. The author emphasizes actions "without bias or self-interest by professionals." The writer submits that tossing such persons into the "real world" may soon destroy those inherent qualities. The conclusion is, simply, that conditions must be created in which the contractor will construct with execution of all he has promised, but no more. Coincidentally, the documents, the basis for his execution, must be made legible (drawings), readable (specifications) and forthright (disclaimers excluded).

Suggestions.—That Associated Engineering Organizations, not only ASCE, address clarity and fairness of contract provisions with equal emphasis on protection for contractor, engineer and owner.

That Associated Engineering Organizations, AIA, government, and the multitudinous trade organizations, strive for specifications which say what they mean, don't repeat plan information, and permit execution with less than a full library. Add contract drawings devoid of specifications—the contractor, his superintendent and foreman must then read.

That AGC, ABC, Insurance companies, and bankers produce imaginative management handouts, not monstrous tomes, and individual, short papers in construction language on safety, timeliness and quality for the foreman and mechanic (the root of quality).

That all associated with construction "sign up" on the same team.

Final Word.—Naive—yes; impossible—the writer hopes not!

APPENDIX.—REFERENCES

2. "Accident Prevention," DAR 7-602.42, 1981.
3. "Contractor Inspection System," DAR 7-602.10, Nov., 1964.
4. "Contractor-Prepared Network Analysis," DAR 7-604.7, Apr., 1963.
5. "Multibillion Dollar Construction Grant Program: Are Controls over Federal Funds Adequate?" Report B-166506 (CED-77-113), Sept. 12, 1977.
6. Public Law 92-582, 86 STAT 1278.
7. "Superintendence of Subcontractors," DAR 7-603.35, Jan., 1965.

Discussion by Ken Williams, M. ASCE[5]

The writer disagrees with the paper presented by Isaak. The author did not cover the subject completely and in what he did discuss, used unsubstantiated opinions to support his arguments.

The author neglected to discuss that the attainment of quality is the responsibility of the construction contractor. Conforming to the plans, specifications, and building codes is an important integral part of professional construction supervision, engineering, and management. The control or assurance of quality cannot be extracted from the construction contractor's role.

Quality must be engineered, supervised and managed into a construction project. It cannot simply be inspected or tested into existence.

The author's limited discussion could be summed up by the statement: "The objective of a quality control program is to verify achievement of the quality specified." The writer offers that the objective of a quality control program is the attainment of the quality specified. A secondary purpose is the verification of attainment. The author's statement is synonymous to stating that the chief objective of a business concern is a neat, well documented set of books—not a profit!

The author offered only one reference to support his many claims. It is the writer's opinion that arguments and claims need to be supported by evidence.

It is not satisfactory to say "Extensive experience has shown . . .," "Some agencies on some projects . . .," ". . . some resistance by contractors . . .," "Most contractors agree . . .," "Widespread abuses and misapplications . . .," "One can find no consensus . . .," "Several nationally known examples of such circumstances can be sited . . .," ". . . many times many industries . . .," "nearly everyone agrees . . .," and ". . . overwhelming testimony . . .," without submitting documented proof, study findings or other appropriate evidence.

In conclusion, the writer expresses his opinion that the paper on "Contractor Quality Control: An Evaluation" is not valid because it overlooked the construction contractor's important role in quality and presented unsubstantiated arguments to support its conclusion.

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