Module 1: INTRODUCTION

Submodule 1: What is Construction Quality Management (CQM)?

"PROACTIVE PREVENTION vs. REACTIVE INSPECTION"

Objectives: After completing this submodule, you will be able to:

- State the purpose of Construction Quality Management.
- Discuss the reasoning behind the Corps/NAVFAC policy on CQM.
- Discuss various characteristics that are peculiar to the construction industry.
- Define Contractor Quality Control (CQC).

  Define Government Quality Assurance (QA).

A. ***Introduction and Instructional Procedures:***

This training is presented as a result of partnering efforts with the Associated Builders and Contractors (ABC), Associated General Contractors (AGC), the U.S. Army Corps of Engineers (USACE), and the Naval Facilities Engineering Command (NAVFAC). This is appropriate as Construction Quality Management is a partnering effort between the Government and the contractor. The purpose of this training is to familiarize all quality control personnel, and other contractor management personnel, with CQM policies, requirements, and procedures. In addition to the filmed portions, this training package includes this Study Guide and pertinent classroom exercises provided by your Facilitator. As we proceed through the training, the broader and more general portions of the information will be presented on videotape/DVD. At the end of each segment (module or submodule), the Facilitator will stop the tape/DVD and give you any necessary detailed information. Then, you should read the text for that submodule and proceed to the related discussions and exercises.

B. ***Instructional Content:*** The content of this training package will include, in Module 1, an introduction covering the broad aspects of CQM, including its definition; discussions of quality control procedures and benefits; the characteristics of the construction industry and the responsibilities of the Government and the contractor. In Modules 2 through 6, the various reviews, plans, conferences, reports, and management requirements are described. In Module 7, the information in the first six modules will be integrated into a discussion of the ways and means of making the CQM system work effectively so that the level of quality required in the Corps' and NAVFAC's worldwide construction program is achieved. An optional module, Module 8, is an overview of the Resident Management System (RMS). RMS is a software package that automates and simplifies many project activities used by USACE. Optional Module 9, covers NAVFAC's WEB Construction Management (CM) system.

C. ***History of Construction Quality Management:*** In 1961 a new clause containing but two sentences began appearing in Department of Defense (DoD) solicitations. These same two sentences can still be found today in the Contract Clause entitled "Inspection of Construction" [subparagraph (b)]. These sentences require a contractor to be responsible for achieving and documenting contract quality. By 1968 the Construction Quality Management system had grown into a fairly loose structured process varying from field office to field office in which more paragraphs were placed into the contract defining specific items that were to be accomplished to better manage the task. Most often, in these early years, there were a wide variety of responses on how to manage quality into the job. The Corps and NAVFAC were faced with something of a balancing act. The contractor was either given great latitude in how he organized the effort to get quality or given specific expectations and processes. Over the years, the Corps and NAVFAC have tried many variations and made some very specific choices. With the involvement of industry representatives, including the AGC, it was recognized that the relatively structured method used today was the preferred contract method. The system has some very specific processes, these include the three-phases of control system, formal deficiency /rework items tracking systems, and well-defined submittals. On many jobs, the Corps and NAVFAC specify the contractor's manpower quantity and qualifications. And, of course, this training for contractor personnel is now a contract requirement. Keep in mind that these choices are not free -- there is a cost for them and by putting them into the job, the Corps and NAVFAC have made a choice from a spectrum of possibilities. By entering into a Corps or NAVFAC contract, the contractor has agreed to follow the chosen methods.

D. ***Construction Quality Management:*** CQM is the performance of tasks, which ensure that construction is performed according to plans and specifications, on time, within a defined budget, and a safe work environment. For purposes of this training, quality is defined as conformance to properly developed requirements. For a construction project, quality begins with requirements carefully developed, reviewed for adherence to existing guidance, and ultimately reflected in criteria and design documents which accurately address these needs. Therefore, the designer establishes the quality standards and the contractor, in building to the quality standards in the plans and specifications, controls the quality of the work. The purpose of CQM is the Government's efforts, separate from, but in coordination and cooperation with the contractor, assure that the quality set by the plans and specifications is achieved. CQM is the combined effort of the contractor and the Government. The contractor has primary responsibility for producing construction through compliance with plans, specifications, and accepted standards of the industry. CQM, if used as outlined in this course, enables contractor and Government personnel to be proactive and, thereby, prevent mishaps and deficiencies from occurring. Continuing to work in a reactive mode and relying on inspection to achieve required quality of product means that CQM is either not understood or that the philosophy has not been adopted.

E. ***Contractor Quality Control:*** The primary function of contractor quality control (CQC) is to assure that the completed project meets all quality requirements of the contract. To guide the contractor in this task, a CQC plan must be prepared to ensure that the required standards of quality construction are met. In the CQC plan, the contractor defines the procedures by which he will manage and control his own, all subcontractor's and supplier's' activities so that the completed project complies with contract requirements. At the end of this submodule is a list (Table 1.1-1) entitled Components of CQC.

F. ***Government Quality Assurance:*** Quality Assurance (QA) involves the means by which the Government protects its interests. Through reviews, inspections, and tests, the Government assures that CQC is working effectively, and that the end product complies with the quality established by the contract.

G. ***The Corps' and NAVFAC's CQM System:*** (Engineer Regulation) ER1180-1-6 and NAVFAC's P-445, and other references provide guidance to Corps and NAVFAC personnel in performing effective CQM in the field. While these regulations provide minimum requirements, each project must be tailored to suit its specific conditions and requirements.

H. ***The Benefits of CQM:*** Both the contractor and the Government must be interested in effective CQM. The benefits to the Government are many: work is performed according to plans and specifications, on time, within a defined budget, easily maintained, and a safe work environment. This can be summarized as "Getting our money's worth!" The benefits to the contractor are increased profit and production, better communication, planning, improved organizational skills, and outstanding performance evaluations to obtain future contracts.

I. ***Characteristics of the Construction Industry:***

1. The construction industry has become highly specialized because of the changing market. Increased technology and regulation have resulted in increasing numbers of specialty contractors (such as general building, heavy construction, and special trade contractors) that make coordination and management more difficult for the general contractor and complicates both CQC and QA.

2. Whether large or small, specialized or general, success for all contractors is based on their ability to:

    - manage personnel,
    - control costs,
    - finance work,
    - estimate jobs,
    - schedule the work,
    - manage cash flow,
    - manage an effective safety program, and
    - maintain an effective quality control system.

3. Over 80% of all construction companies are small firms that gross less than $500,000 annually. For every 1,000 firms in operation, 110 to 130 firms enter the field each year. A similar number leave the field each year. It is a fact that the rates of entry and failure are among the highest of all industries.

4. Construction projects are difficult to manage because:

   - construction projects are unique by nature, making standardization difficult,

   - construction operations involve many skills that are nonrepetitive and do not lend themselves to an assembly line approach,

   - construction projects are, to a large degree, dependent upon environmental conditions which are beyond the contractor's control, and

   - subject to varied regulations from numerous government agencies.

5. For the contractor, adequate technical performance is not sufficient to ensure profit. There simply is too much competition and too little profit. The typical gross profit on a commercial building project is 5%. After deducting home office overhead, the before tax gross profit is reduced to 2-3%. After taxes, the net profit percentage is minuscule. Construction contracting is a very high risk, volatile business. To run a successful and profitable business, contractors must employ effective management.

J. ***In the Future:***

1. New government regulations will impose more restrictive requirements, especially in the areas of environmental concerns, occupational health and safety, and employment.

2. There will be a greater degree of influence from the client/customer, to include their involvement in project design and construction, and the requirement to assure full documentation and timely response to all comments from them.

3. Items that will be of significant benefit to both the Government and the contractor are:

   - the improvement of QC and QA requirements;

   - construction-oriented management information systems, such as the Corps' Resident Management System (RMS) and NAVFAC's WEB CM system;

- formal partnering, involving all stakeholders, will become a way of doing business;

- there will be increased contractual requirements for exchange of data in electronic format for all communication required during the course of the project; i.e., drawings on Computer Aided Drafting and Design (CADD), correspondence, RFIs, submittals, invoices, contract changes, as-built drawings, reports, schedules, and electronic bid documents;

- Increased performance based requirements, less prescriptive;

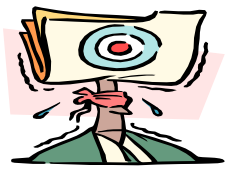
- More reliance on design-build; and

- More consideration on life cycle requirements as opposed to just construction.

4. Conversion to metric units and metric size components will require careful coordination, and

5. International competition will introduce ISO 9001: 2000 series standards of quality management on an important sector of our industry.

K. ***Conclusion:*** The construction industry will continue to be presented with complex, difficult challenges. To face the increasing challenges, we must have the best tools and properly utilize them. Even with a sound system structure, CQM requires the combined efforts of QC personnel and QA personnel to achieve our shared goals – a safe work environment, quality construction, built on time and within budget. The traditional, adversarial roles of Government versus contractor must be abandoned in favor of success through joint implementation of an effective construction quality management system. The CQM system presented here will, with our joint efforts, always be successful in providing desired quality.



EXERCISE

Submodule 1.1

1. In construction, what establishes the quality requirements?

2. What is the purpose of CQM?

3. Define CQM.

4. What are the two principal areas of CQM activity? Define each.

5. What are the benefits of CQM to the contractor? To the Government?

6. What two factors have caused the construction industry to become highly specialized?

7. Why are construction projects difficult to manage?

8. What factors will influence both the Government and the construction industry in the future?

Table 1.1-1

Components of CQC

Specification Sections
- 01330 Submittal Procedures
- 01450N Quality Control
- 01451A Contractor Quality Control
- 01525N Construction Safety
- 01770N Close-out Procedures
- 01781 Operation and Maintenance Data

Quality Control (QC) Plan
- List of Definable Features of Work (DFOW)

Preconstruction Conference

Preconstruction Safety Conference

Project Schedule
- List of Definable Features of Work (DFOW)

QC Plan Meeting

QC/QA Coordination Meeting or Mutual Understanding Meeting (Navy)

Three Phases of Control System
- Preparatory Control Phase and report
- Initial Control Phase and report
- Follow-up Control Phase

Safety
- Conduct and document daily safety inspections
- Activity Hazard Analysis (AHA)

Quality Control (QC) Documents
- Contractor Quality Control Daily Report
- Contractor Production Report
- Preparatory Phase Checklist
- Initial Phase Checklist
- Deficiency/Rework Items List
- Testing Plan and Log
- Submittal Register
- Contractor’s Submittal Transmittal Form
- AHA

Submittals
    List of Definable Features of Work (DFOW)

Offsite Fabrication, Testing and Inspection

Material Receipt and Check-Out

Deficiency/Rework Items Tracking and correcting

Non-compliance notice

Request for information (RFI)

Control Testing and recording/reporting

System Testing

Training of Government personnel in operation and maintenance of equipment

Commissioning

Punch-out Inspection

Pre-final Inspection

Final Acceptance Inspection

As-built drawings

Operation and Maintenance Manuals
    Operation and Maintenance System Instructions (OMSI)

Warranties

Turnover of keys and spare materials

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Submodule 2: Contractor Quality Control

Objectives: After completing this submodule, you will be able to:

- Differentiate between "inspection" and "control."
- Describe, in general, the contractor's and the Government's responsibilities in CQM.
- Describe the benefits of CQC to the contractor, the Government, and the client/customer.

A. ***Control Versus Inspection:*** The contractor has the contractual responsibilities to control construction quality and inspect the work. These are two distinct processes. Control is a continual system of planning future activities. Inspection is the process by which ongoing and completed work is examined. Inspection is ongoing or "after-the-fact" while control is "preventive." The objectives of control are to ensure that the contractor is adequately prepared to begin a phase of work, to eliminate deficiencies, and to follow through in accomplishing the work in accordance with the contract. The objective of inspection is to ensure that the work was accomplished in accordance with contract provisions. The control process is sometimes neglected. This course will emphasize the control aspects of the contractor's management system.

B. ***Responsibilities:*** By the contract, the responsibility for quality control is vested in the contractor. Historically, the construction industry accepted a system of control in which the contracting agency or owner continually advised the contractor on what was correct, what was wrong, and what remained to be done to comply with the contract. This not only restricted contractors and burdened contracting agencies and owners, but it placed the responsibility for control of construction quality with the contracting

agency or owner. Under the Construction Quality Management system, QC responsibility now belongs with the contractor. Government QA personnel are responsible for periodically verifying that the contractor's system of quality control is working effectively and that construction complies with contract requirements. In doing this, the Corps and NAVFAC are actually performing quality assurance, not assuming responsibility for quality control.

C. ***Benefits to the Contractor:***

- Effective CQC will greatly reduce the largest unnecessary cost to the contractor--the tear out and replacement cost stemming from deficient workmanship and materials.

- An effective CQC program causes work to be done correctly the first time. The contractor benefits from earlier completion, reduced field overhead costs, and the ability to do a greater volume of business.

- Reduced costs result in greater profits for the contractor.

- High quality performance improves the reputation and image of the contractor leading to possible future contracts.

- Since safety is an integral part of CQC, the contractor benefits by experiencing less lost-time and fewer insurance claims, which result in greater profit.

- Contractor personnel take pride in delivery of a quality product. While this benefit cannot be measured quantitatively, it is a real and very important benefit.

D. ***Benefits to the Government:***

- Manpower is more effectively used, which helps the contract administration offices to maintain effective operations in a time of diminishing resources.

- Effective CQC results in fewer deficiencies and corrective efforts, which may lead to an earlier completion since there is a reduction in corrective work by contractor forces.

- Public relations and client/customer satisfaction are improved when projects are completed on time.

- As with contractor personnel, Government personnel take pride in the delivery of a quality product.

- Cost and time growth are minimized.

E. ***Benefits to the Client/Customer*** : Effective CQC can be simply stated--a quality product delivered safely, on time, and within the budget.

F. ***Presenting the Program:*** It is the responsibility of both the Government and the contractor to develop and promote the CQC program. This effort in "partnering" will be a much more pleasant experience than the traditional use of enforcement to ensure that a quality product is delivered.

EXERCISE

Submodule 1.2

1. What is the difference between INSPECTION and CONTROL?

2. Who has contractual responsibility for quality control?

3. Is the following statement TRUE or FALSE: "CQC is principally concerned with inspection?" Explain.

4. How does the contractor benefit from effective CQC?

5. Name the benefits of effective CQC that accrue to the Government.

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Submodule 3: Contractor and Government Responsibilities

Objectives: After completing this submodule, you will be able to:

- Discuss the specific responsibilities of:
  - Contractor personnel engaged in CQC.
  - Government personnel engaged in QA.
- Discuss how the responsibilities of contractor and Government personnel interrelate and are mutually supportive.
- Discuss partnering relationships.

A. **Quality Control Personnel:** As stated previously, CQC is a contractor responsibility. The role and responsibilities of the contractor in CQC are clearly specified in the contract documents. The contractor is required to place a competent representative, the QC Manager, on the site to oversee the CQC system. He must have full written authority to act for the contractor on all CQC matters.

QC Manager's responsibilities per the specification include but are not limited to:

- Controlling the quality specified in the plans and specifications,
- developing and maintaining an effective CQC system,
- stopping work,
- performance of all control activities and tests, and
- preparation of acceptable documentation of CQC activities.

Contractor personnel must remember that only the Contracting Officer has the authority to change the contract. Therefore, all communication concerning contract changes must be with the Contracting Officer and/or an authorized representative of the Contracting Officer. No directions concerning the project work can be accepted from a third party, including representatives of the facility user or of the base, or post.

B. **The Government:** The role and responsibilities of the contractor in CQC are clearly specified in the contract documents. The roles and responsibilities of Government QA personnel are distinct. They are required to assure that the specified standard of workmanship with the specified materials and within the limits of the contract are provided. Further, they must require the contractor to maintain the quality specified in the plans and specifications from the very beginning.

Another responsibility of QA personnel is to conduct onsite business only with the contractor's QC Manager/superintendent. They should not deal directly with subcontractors and individual craftsmen, but should coordinate through the prime contractor.

QA personnel are trained to observe all activities of the CQC staff and to recommend to the Contracting Officer require changes in the CQC organization and/or system, if the contract requirements are not being met.

C. **Communications**: Most contractors want to build a quality product within the terms of the contract, as they perceive them. However, it is critical that the contractor and the Government interpret the plans and specifications in the same way. This requires clear and effective communication between Government and contractor. This is the very heart of the Construction Quality Management program, and is dependent on mutual cooperation. QA personnel must maintain an honest, candid, professional attitude; the contractor must respond in the same manner.

D. **Partnering:** Partnering is a long-term commitment between two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant's resources. Partnering relationships are based upon trust, dedication to common goals, understanding and assistance to reach each others individual expectations and values.

Partnering is not a legally binding relationship. Rather it is a commitment and agreement between the parties to:

- Remove organizational impediments to open communication within the team.

- Provide open and complete access to information (except information specifically excluded by law, regulation, or ethical requirements).

- Empower the working level staff to resolve as many issues as possible.

- Reach decisions by consensus as much as possible and when consensus is not possible, achieve resolution in a timely manner using an agreed upon process for resolving disagreements.

- Take joint responsibility for maintaining and nurturing the partnering relationship.

Partnering should not be interpreted as a means to open the door to the compromise of contract requirements established in the plans and specifications. The quality of the project is established by those requirements and the contractor is bound to provide the level of quality specified.

Partnering is entered into either formally or informally. A formally partnered job requires a trained, independent facilitator. Informally partnered jobs are those where there is no independent facilitator, but the parties meet using a mutually determined agenda and agreement on goals and procedures is informally reached. In either case, a written partnering charter is developed and signed by all stakeholders. The final result is the development of trust and effective communications.

E. **Summary:** Effective Construction Quality Management requires the complete cooperation of the contractor and the Government. When this partnership works effectively, the project will run smoothly and efficiently. The contractor improves his profit margin and the end product will satisfy the client/customer.

EXERCISE

Submodule 1.3

1. What is the role and responsibilities of the contractor in CQC?

2. What are the responsibilities of the contractor's QC Manager?

3. What are the QA responsibilities of the Government?

4. Name the items upon which partnering relationships are based.

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