Seattle Section Presentation

" I am with the Government and I am here to Help You"

by anonymous

Quality Control, Assurance and Verification in Service and Construction Contracts

- By
- Terry L. Borne P.E.,C.C.P.

Author Biography

- Degree: BSCE
- University: Indiana Institute of Technology
- Years of Experience: 37+
- Professional Field: Construction, Services and Manufacturing
- Something you do not know about me: President, Cost Engineering Consultants, Inc. and previous Project Engineer, USACE and PW.

Why is this information useful to you?

Specify , define and control the quality and scope of work.

Who can use it ?

Spec writers
Designers
Schedulers
Forensic Specialists
Estimators and others

Quality Control, Assurance and Verification in Service and Construction Contracts

- **SERVICES AND CONSTRUCTION QUALITY APPROACHES;**
  - Services are the act of providing a functional useable end product, including facility maintenance to a client.
  - Construction is the act of providing new real property facilities to a client.
  - Quality control (QC) is the contractor's responsibility.
  - Quality assurance (QA) is the owner or owner's representative responsibility.
    - Government – Contracting Officer
    - Private industry- A/E contract or Corporate Officer designee.
  - Quality verification is used for Design/Build (DB) contracts

QC/QA

- The contract should specify the requirement for a Contractor Quality Control Plan (QCP) and the owner representative should have a Quality Assurance Surveillance Plan (QASP).

- Depending on whether the contract is for services or construction will determine the content and requirements of both the QC and QA Plans.
  - The QC Plan describes the methods and procedures used to control the quality of the work.
  - The QA Plan describes the methods and procedures used to assure the contractor's QC is meeting the required quality of the contract scope.
    - The QA Plan is normally not part of the contract and would be provided to the contractor as information only. This allows the QA Plan to be changed as necessary without changing the contract.
  - For U.S. Government contracts, FAR Part 46 Quality Assurance provides further information on Quality Assurance and contract clauses [3].

- **SERVICES**

- **Service contracts: performance based –end product requirements that are inspected after completion.**

  - **Examples of contracts; janitorial, equipment maintenance, building maintenance, non-construction work.**

  - **There is a performance or requirements summary listed in the contract. The quality is:**

    - **either an industry standard, or a unique standard. Described in subjective terms such as clean, free from foreign material, operates freely, etc.**

REQUIREMENTS SUMMARY

REQUIREMENT	DESCRIPTION	ACCEPTABLE PERFORMANCE LEVEL
Preventative Maintenance of Compressors	Compressors are maintained periodically per the compressor manufacturer's checklist. **Oil is clean and full, belts are replaced and tight, bearings are greased. Compressors are clean of foreign material such as dirt, dust and grease.**	**95% of units or 95 out of 100 units initially checked are acceptable. Unacceptable units are corrected.**

Example of a contract Requirements Summary

– *The quality control and quality assurance activities must inspect these specified performance requirements.*

- **Unacceptable service must be re-performed, if possible. If re-performance cannot be done, payment deduction for unacceptable work may be taken.**

- **The quality assurance results should be used to evaluate the contractor's performance and can be used to troubleshoot problem areas by trend analysis**

– **The four methods of inspections for both the QC and QA functions to be utilized in service contracts are;**

- ***RANDOM, PLANNNED, UNPLANNED and 100% INSPECTIONS.***

- **Although not a true inspection method, *Validated Customer Complaints* can be used.**

- **There are reasons for utilizing each of these methods based upon *inspection resources available, end unit population size, geographic location of the work areas, criticality of the service and administrative effectiveness.***

- **Three attributes within each end product unit that is inspected are *quality of the service, timeliness of the service and reports or deliverables of the service.***

– *The Random Sampling Method is a powerful tool to inspect and assure required work is performed.*

- Takes a large population and selects a sample of the total. Based upon statistical tables, the sample can be extrapolated to the total population.

- Upheld in court cases.

- Random numbers can found on Websites such as *http://www.graphpad.com*, *http://www.random.org* and *http://www.randomizer.org* .

- Whatever the source of the numbers should be documented in the contract files.

- The important documents that align with the criteria for population, sample size, Acceptable Quality Level and accept/reject numbers are MIL standard 105E and ANSI Z1.4 [4].

- **Another criteria for use of random inspection is the population must be *the same* for each unit in the sample.**

- **For an example** of random inspection, assume 50 rooms in a hotel that require cleaning. All rooms are the same in dimension, furnishings and cleaning criteria (homogenous).

  - From Inspection Table obtain the sample size code letters based upon population size as 50.

  - Under the General Inspection Level II, the Sample Size Code Letter is D.

  - Using Sample Size Code Letter D in Table , a sample size of 8 rooms is required to be inspected to obtain a statistically valid sample.

  - The AQL is 6.5% and if 2 rooms are unacceptable when initially inspected a portion of the population could be determined to be unacceptable.

  - If there were 2 rooms rejected the calculation of uninspected rejected rooms is;

- Number of rejected rooms = ((Number or actual rejects in sample)/ (Number in sample size)
- =Number of projected rooms rejected in the population =(2)/(8) =25% that are rejectable, (13 rooms)
- So there 25% of the population of 50 room cleaning service that could be withheld from the cleaning service payment.

- As you can see this can be a powerful tool to withhold payments for defective work, but more importantly, indicates the deficiencies in the QC system and also saves on inspection time.

- The random sampling method should be used if the population is large, homogenous and limited in inspection resources.

- *Random sampling does require additional administration and planning costs above the other methods of inspections*.

- *This is the only inspection method that can be projected from a sample size to the total population or Lot.*

Sample size table (Excerpt from Mil-Std 105E)

LOT OR BATCH SIZE			GENERAL INSPECTION LEVELS		
			I	II	III
2	TO	8	A	A	B
9	TO	15	A	B	C
16	TO	25	B	C	D
26	TO	50	C	D	E
51	TO	90	C	E	F
91	TO	150	D	F	G
500001	AND	OVER	N	Q	R

Sample SIZE TABLE CON'T.

LOT OR BATCH SIZE				GENERAL INSPECTION LEVEL	
			I	**II**	III

INSPECTION LEVEL II IS USED FOR MOST INSPECTION REQUIREMENTS.

Use Inspection Level I when less discrimination is needed, or Level III when more discrimination is needed.

Table 2
Modified, highlighted table from MIL-STD-105E

QC/QA

Sample size and Accept/Reject Levels

SAMPLE SIZE CODE LETTER	SAMPLE SIZE	ACCEPTABLE QUALITY LEVELS (NORMAL INSPECTIONS)																
		0.40		0.65		1.0		1.5		2.5		4.0		6.5		10		15	
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re
A	2	V		V		V		V		V		V		0	1	V		V	
B	3	V		V		V		V		V		0	1	^		V		1	2
C	5	V		V		V		V		0	1	^		V		1	2	2	3
D	8	V		V		V		0	1	^		V		1	2	2	3	3	4
E	13	V		V		0	1	^		V		1	2	2	3	3	4	5	6
F	20	V		0	1	^		V		1	2	2	3	3	4	5	6	7	8
G	32	0	1	^		V		1	2	2	3	3	4	5	6	7	8	10	11
H	50	^		V		1	2	2	3	3	4	5	6	7	8	10	11	14	15
J	80	V		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22

16

Sample size and Accept/Reject Levels con't.

SAMPLE SIZE CODE LETTER	SAMPLE SIZE	ACCEPTABLE QUALITY LEVELS (NORMAL INSPECTIONS)								
		0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
K	125	1 2	2 4	3 4	5 6	7 8	10 11	14 15	21 22	^
L	200	2 3	3 4	5 6	7 8	10 11	14 15	21 22	^	^
M	315	3 4	5 6	7 8	10 11	14 15	21 22	^	^	^
N	500	5 6	7 8	10 11	14 15	21 22	^	^	^	^
P	800	7 8	10 11	14 15	21 22	^	^	^	^	^
Q	1250	10 11	14 15	21 22	^	^	^	^	^	^
R	2000	14 15	21 22	^	^	^	^	^	^	^

AC=Acceptance Number   Re=Reject Number

Table 3
Modified, highlighted table from MIL-STD-105E

- **Examples of payment deductions must be provided in the contract documents to inform the contactor of the deduction methodology.**

- _**The Planned Inspection method**_ **is based upon a percentage or number of end products or units to inspect.**
  - **For an example, if the QC Plan or the QA Plan calls for 20% of the population of 400 items to be looked at, then 80 items need to be inspected (i.e. 20% X 400).**
  - **An AQL can also be determined**_. Unlike the Random method, an extrapolation cannot be made. Only use of the items looked at as a basis for a conclusion on the overall quality of work._

- _**The Unplanned Inspection method**_ **is the most flexible and usually is based solely on inspection resources available. This method has no minimum percentages to be inspected and is usually used on non-critical items of work and when another work item is being inspected in the same physical area.**

- *The 100% inspection method* should only be used for very small populations when the item has a high life safety risk associated with it.
  - An example of this inspection method may be quarterly testing of an operating room generator.
  - This method is both labor and time intensive.
- A supplemental system that may be used, but only in conjunction with one or more of the four methods described above is the *Validated Customer Complaint.*
  - The inspector must validate that the service was not in compliance with the scope of the contract to accept the customer's complaint as valid.

- ## *CONSTRUCTION*

  - From the Corps of Engineer's Construction Quality Management for Contractors Study Guide [5].

  - *Phases of Construction Inspection- Three Phase Control System* requires the contractor to plan and schedule the work to ensure that they are prepared to start each definable feature of work.

  - The phased inspections provide the Contractor Quality Control (CQC) personnel the opportunity to be proactive in preventing deficiencies instead of reactive by only detecting deficiencies.

  - A definable feature of work is a separate item of construction and usually relates to a separate contract specification like Masonry specification section 40 00 00.

  - The CQC is required to document the phase of inspection by meeting minutes. The minutes need to be attached to the daily inspection report.

– The *Preparatory Inspection Phase* is completed just prior to beginning work on a definable feature.

- **This phase includes going over the contract specifications and related references or standards.**
- **Review of the contract drawings are also completed.**
- **Checks are needed to ensure that all submittals are approved and the materials are on site and correct.**
- **Equipment needs to be checked for safety and functionality.**
- **Required control inspection and testing procedures and processes must be in place to enter into the next phase of inspection. Sometimes a mock up of the feature of work like a sample masonry wall is required.**
- **A safety activity hazard analysis must be performed and reviewed for the definable feature of work.**
- **This is *one of the most important phases* of the inspection system since there are very little labor and equipment costs incurred and disagreements and interpretation can usually be settled before physical commencement of the work.**

- The *Initial Inspection Phase* consists of the following items to be accomplished and is completed at the beginning work on a definable feature.

- This phase establishes the mutually agreed upon workmanship standard of the work item.

  - This is an important phase of inspection because it can save costly re-dos that do not meet the standard workmanship and saves time when bringing on new workers.
  - After a representative sample is finished, an inspection is held to *resolve problems and establish the workmanship level standard.*
  - Safety is checked to include compliance with the safety analysis.
  - The initial phase shall be repeated when new crews are brought in or if the workmanship falls below the established standard.
  - The CQC shall document the Daily Inspection Report.

– The ***Follow-up Inspection Phase*** is accomplished by the CQC each workday to ensure that there is ongoing compliance with the standards of the contract.

- Any deficient work shall be corrected and not built upon.
- The CQC should refer back to the preparatory and initial inspections for accepted standards.
- In addition, if quality is becoming marginal to unsatisfactory, the CQC or the QA may require the Initial and/or Preparatory Inspection phases to be re-performed to re-establish the required work quality.

- **Under the heading of Construction, there is a specific type of contract that the contractor sets the quality known as a** *Design Build contract*.
  - The contractors bid or are selected to construct facilities based upon performance type criteria through a Request for Proposal (RFP) with input from the client during the awarded design phase.
  - In this case, the assurance aspect of the inspection becomes a quality verification of the accepted design. The design may be changed during construction as long as the RFP scope is not violated. A copy goes to the QA.
  - The construction contractor verifies changes through Requests for Information (RFI) to the Designer also known as the Designer of Record (DOR).
  - The CQC quality inspection still follows the phased inspection.
  - The QA must assure that the RFIs do not violate the RFP. The DOR has to follow codes and standards as specified in the RFP.

24

- **Design Build (con't.) The client usually has special requirements that may go above industry standards such as Fire Protection, Security, Communications, IT, Environmental, Anti-Terrorism Force Protection and other special requirements that must be addressed in the RFP. These special requirements will require client approval and additional inspection.**

CONCLUSION

Using Quality methods based upon proven procedures will improve quality and save money in both Service and Construction contracts.

Some processes used in Services contracts can be utilized for Construction contracts as well, such as random number inspection for large quantities.

Quality Control, Assurance and Verification in Service and Construction Contracts

- **Questions and Comments**

- **Terry L.Borne, P.E., C.C.P.**
- **360 .790.2644**
- **Olympia, WA**
- **Cost Engineering Consultants ,Inc.**
- **terry_l@comcast .net**
- **CECI_1@comcast.net**
- *beyond Cost , Scope and 'Time ...*
- **Professional Engineer**
- **Certified Cost Professional, AACEI**
- **Government Contract Experience**
- **Training and more**

Thank You