

QA and QC: Are They Different?

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Quality assurance (QA) and quality control (QC) are often used interchangeably to mean the same thing or together as if one could not occur without the other (QA/QC). The fact is that these two terms represent separate processes that may or may not coincide. Either way, they both have a direct impact on the final outcome of a work item, such as a manufactured product, a software program, a business procedure, or, in the case presented in this article, the design and construction of a structure.

Before delving into the details of quality assurance and quality control, it is best to start the discussion on the idea of what constitutes “quality” and the system to achieve it, otherwise known as *quality management*.

What is Quality?

Depending on whom you talk to or what you read, *quality* can be defined in many ways. Some will attach *quality* to those things that are the best available, while others will consider a very expensive item as being of high “quality.” Although these may be true to some extent, the determination of quality is rather simplistic.

According to Joseph M. Juran, a well-known author and expert on the subject of quality since the early 20th Century, the definition of *quality* can be distilled to “fitness for use,” where the customer determines what fitness is. In a variation of that definition, Philip B. Crosby, another expert in the field of quality, defined it as “conformance to requirements.” The latter definition seems to suit the construction industry since conforming to the requirements may not meet all of the owner’s expectations. Achieving quality in the construction industry is a two-step process that involves both the design of the project and then its eventual construction into a built structure.

During the design process, the architect/engineer’s (A/E’s) ability to achieve a quality design is based on the A/E’s solution to the owner’s program. However, achieving a quality design is not quite that objective. If the A/E satisfactorily addresses every requirement in the owner’s program, the design may still fall short of the

owner’s expectations because the owner failed to document those expectations in the form of specific design requirements. This is one reason why A/Es are an important part of the design process—they have the ability to interpret an owner’s expectations and convert them into requirements. Upon establishing the owner’s requirements, the A/E converts those requirements into a set of construction documents¹ from which a contractor can build the structure.

Even if the A/E delivers a quality solution to the owner’s program, a quality project is still not achieved until the project is built. For the contractor, achieving a quality project is complying with the requirements indicated in the contract documents. Therefore, any deviation from the contract documents would be considered “nonconformance with requirements,” and thus would not meet the definition of a quality project.

Quality Management

Achieving quality is not serendipitous—there has to be some level of effort applied in order to attain quality. This intentional effort comes in the form of *quality management*, and can be anything from a simple program to a full quality management system such as Six Sigma or one that implements ISO 9000 standards.

The American Society for Quality (ASQ) defines quality management as

[t]he application of a quality management system in managing a process to achieve maximum customer satisfaction at the lowest overall cost to the organization while continuing to improve the process.

This quality management system usually consists of four processes: quality planning, quality assurance, quality control, and quality improvement.

1. Quality Planning

Quality planning involves establishing a culture of “doing it right the first time,” as quoted by Philip Crosby. This means that the organization needs to under-

¹ Both “construction documents” and “contract documents” are used in this article. The term “contract documents” is used when referring to the documents identified in an agreement between an owner and contractor, and “construction documents” is used when referring to the documents prepared by an A/E prior to the execution of an owner-contractor agreement.

stand what quality standards are applicable and the processes that are needed to comply with those standards.

For A/Es, they have to take into consideration those quality processes that help them internally to achieve a quality design and those quality processes that help them ensure that a quality project is constructed. This requires the A/E to look at how they design projects and prepare construction documents in order to establish quality in their work.

For contractors, quality planning may differ depending on the delivery method used for a project. If a contractor is part of a delivery method that allows the contractor to participate in the design process, such as construction manager as constructor (also called “construction management at risk,” or CMAR) or design-negotiate-build, the contractor will have some influence on how quality is achieved by reviewing construction documents prior to submitting a proposal or guaranteed maximum price (GMP). For a common design-bid-build project, the contractor’s approach to quality is essentially restricted to the contract documents; however, the contractor should have internal processes to ensure compliance with the contract documents is achieved.

2. Quality Assurance

Quality assurance (QA) is a relatively new concept in quality management rising in popularity in the 1970s. Like other aspects of quality, quality assurance has a variety of definitions. ASQ defines quality assurance as:

all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality.

Quality assurance, as its name implies, assures that the outcome of a process will be a quality one. This involves taking measures that will reduce errors and omissions before and while performing the work. Some quality assurance processes may be verified using a quality control method.

3. Quality Control

In contrast, *quality control* (QC) has been the staple for determining quality since the earliest part of the 20th Century. The concept of quality control is to look at work after the work is completed. The definition by ASQ is “the operational techniques and activities used to

fulfill requirements for quality.” In essence, it is the process of testing and inspecting work to determine if it complies with the adopted quality standard.

In a quality management system, quality control should never be the primary process. However, it can be used to confirm that quality assurance processes are working properly. If a failure is detected during a quality control inspection or test, then it is evident that quality assurance is missing or, if not missing, the quality assurance process did not function properly and should be evaluated.

It is important to understand that a quality control process for previously completed work can be considered a quality assurance process for subsequent work. For example, Worker A has a quality plan that involves quality assurance processes that will ensure a quality work output. At the completion of the work output, Worker B inspects Worker A’s work to verify compliance with the quality standard before accepting Worker A’s work. Thus, Worker B’s inspection (a QC process) gives him confidence that his work output will be a quality one (a QA process), provided other aspects of Worker B’s performance meets the quality standard.

4. Quality Improvement

Any type of quality management system must include *quality improvement*; otherwise, the same mistakes will continue to be made and opportunities to reduce cost and waste will never see the light of day. Regardless of how thorough a quality plan is the plan is almost never perfect—there is always room for improvement. Every quality management system should have a process that allows improvement of the system, either through feedback from lessons learned or immediate actionable items from participants that improves the overall design and construction process or a portion thereof.

In Dr. W. Edwards Deming’s “Fourteen Points,” Point No. 5 is: “Improve constantly and forever the system of production and service.” Continuous improvement reduces waste in both material and cost. In the world of “green” design and construction, reduction of material could be considered a sustainable improvement. Likewise, reduction of costs will have a positive impact on a project at all levels starting from material and equipment suppliers through the contractors, subcontractors, and designers, up to the owner.

QA and QC during Design

A quality construction project does not begin with the contractor building a structure in conformance with the contract documents—it begins with a quality design. The goal of every A/E should be to prepare “clear, concise, correct, and complete” documents as recommended by the Construction Specifications Institute (CSI). In addition to these four C’s, a quality set of construction documents also need to be *coordinated*. However, before a set of construction documents can begin, the process of designing a quality project starts at the initial stages of design.

CSI defines *quality assurance* during design as “the procedures for guarding against defects before and during the execution of the work.” Additionally, CSI defines *quality control* during design as “the procedures for evaluating completed activities and elements of the design for conformance with requirements.”

In general, QA for the design firm starts with hiring qualified staff and continually training them to be current with the latest design and construction technologies. For project-specific QA, the first step is to review and understand the owner’s program and seek clarification on any ambiguities. Other QA processes include reviewing codes, regulations, ordinances, and standards that are applicable to the design of the project; establishing regular progress and coordination meetings with the design team including consultants; and reviewing geotechnical and site survey information provided by the owner.²

There are several quality processes that the A/E can implement that fall within the area of QC. These may include cost estimates, peer reviews, internal reviews, constructability reviews, and code plan reviews. Each of these may be conducted at each phase of the project and, therefore, become a QA process for the following phase.

Cost estimates should be prepared at each phase of the design to ensure the project remains within the owner’s stated budget. The design should not progress to the next phase until all budget issues are resolved.

The various types of reviews may also be conducted at the various phases of the project. Peer reviews in-

volve the evaluation of the design documents by a third-party reviewer—typically by another local architect or engineer in the same field. This type of review can be very beneficial since it is conducted by someone completely unfamiliar with the project. There are firms that specialize in peer reviews and the services could include a full review of all drawings and specifications prepared by the architect and its consultants.

Internal reviews are similar to peer reviews, but are conducted within the design firm. However, best results are achieved when the review is conducted by a firm staff member not associated with the project. One option is to have the person who will be responsible for the project’s construction contract administration conduct the review. This type of review can be conducted using a checklist and, if done in conjunction with a peer review, may need only focus on elements of the documents relating to standard firm practice.

Constructability reviews may overlap the previous two review types in scope, but are generally focused on the mechanics of physically constructing the structure. Thus, this type of review is best conducted by a contractor or construction manager. A constructability review looks at the design and determines if the work can be constructed as shown, or if special procedures or equipment may be necessary (thus adding cost) to achieve the indicated construction. The results of this review may offer alternate ways of achieving the same design goal but at a lower cost, which could be considered a form of *value analysis* (VA) (also called *value engineering*, or VE).

Code plan reviews are specific to the building design elements regulated by adopted codes. Each design discipline should ensure that their work complies with applicable codes, which should begin as a QA process as mentioned earlier. The code plan review should just be verification that compliance has been achieved with only correction of minor discrepancies.

QA and QC in the Contract Documents

QA and QC during design is not the only quality aspect of the project in which the A/E is involved. QA and QC during construction comes in two forms: those processes that the contractor implements to ensure they build a quality project and those processes that the A/E requires in the contract documents. To monitor the quality of construction, A/Es need to incorporate require-

² The geotechnical report and site survey could be generated by the design professional, but for risk management purposes, they should be owner-provided documents.

ments in the contract documents that establish certain procedures that contractors must follow.

For the A/E, monitoring quality during construction is limited to enforcing the contract documents—primarily the requirements in the specifications. The contract drawings show what is to be constructed, but the specifications establish the qualitative requirements of the construction contract.

Basic quality requirements are specified in Division 01 of the specifications—typically in Section 01 40 00 “Quality Requirements.” Individual sections in Divisions 02 through 49 will include quality requirements specific to the work results covered in each section. Some quality requirements that may be specified include submittals, mockups, tests and inspections, minimum qualifications, and manufacturer involvement.

Submittals,³ although not specifically identified in the specifications as quality assurance or quality control items, they definitely have a part in the quality process. Some submittals may be considered part of the QA process by allowing the A/E to review the products, materials, and equipment before the contractor is allowed to procure and install the items on the project. Quality control submittals include reports for tests and inspections performed on completed work.

Mockups, which are considered a QA process, are typically full-scale constructed assemblies that represent a portion of the work. Mockups, like submittals, are completed and reviewed prior to the actual installation on the project. However, some mockups may be integrated into the work and remain a part of the completed work if approved by the A/E. A mockup can also be an integrated assembly that incorporates several different components to see how each interfaces with the other and to establish the level of workmanship. A mockup can also be a completed room, such as a hospital patient room or hotel sleeping unit, to see if all elements (finishes, fixture and furniture locations, colors, etc.) are acceptable before proceeding with the work on all the other rooms. Some mockups may be required for laboratory testing to evaluate the performance of an assembly before installation in a building.

Tests and inspections are part of the quality control process since they are conducted on completed work.

Tests and inspections may be conducted at the fabrication shop (referred to as “source quality control” in PART 2 of a specification section) to evaluate completed work before delivery to the project site. Tests and inspections conducted at the project site (referred to as “field quality control” in PART 3 of a specification section) evaluate work installed on the project. Reports should be specified to summarize the findings of tests and inspections and forwarded to the A/E as an informational submittal.

Establishing minimum qualification requirements in the specifications is a QA process that ensures the work will be provided by experienced or trained installers. To verify that qualified installers are used, qualification statements, certifications, or other forms of verification may be required by the A/E as informational submittals.

For some work installations, the specifications may require the contractor to have representatives of manufacturers observe the installation.

Other requirements may be specified to assure a quality installation is provided, such as requiring installers to examine previously installed work for acceptability before beginning their work, setting specific conditions in which the work may or may not be installed, and requiring regular coordination meetings to resolve issues before portions of work commence.

QA and QC during Construction

The contractor, like the A/E, plays a key role in the quality success of a construction project. As previously mentioned, a quality construction project is based on the contractor’s conformance to the contract documents, which includes complying with the QA and QC requirements that the A/E has specified. However, that does not preclude the contractor from establishing internal QA and QC processes that help the contractor ensure compliance with the contract documents.

For the construction phase of a project, CSI defines *quality assurance* as “the procedures for discovering defects and deficiencies to the contract documents before and during the execution of the work.” For *quality control*, CSI defines it as “the procedures for evaluating completed activities and elements of the work for conformance with contract requirements.”

At first glance, it may appear that the CSI definition for QA could be one for QC since it states “discovering defects and deficiencies,” which is commonly associated

³ You can read more about submittals in [Keynotes No. 5 “Understanding Submittals.”](#)

with QC. But the fact that this discovery is done “before and during the execution of the work” makes it a QA process. It must be understood that the contractor cannot change the contract documents, except where “defects and deficiencies” are found. Thus, if the contractor reviews the contract documents prior to beginning portions of the work and “errors, omissions, or inconsistencies” are found, then they must be reported to the A/E for correction prior to beginning the work.⁴

Complying with QA and QC requirements in the contract documents is essential for the contractor, but the contractor may implement its own QA and QC processes that can supplement the contract documents. These supplemental processes may include asking manufacturer representatives to examine the work and provide installation oversight, or conducting inspections and tests in addition to those in the specifications.

Similar to the A/E’s design process, some construction QC processes may be the QA processes for following work. For example, checking flatness and levelness of a slab (a QC process) may be conducted to ensure it is within specified tolerance for the subsequent installation of a floor finish (a QA process).

QA and QC and Perfection

Owners would like perfection in the projects they construct and some even try to get perfection by working such requirements into their agreements. For the most part, A/E’s and contractors would like to provide the best possible projects they can deliver for the owners, but perfection in the business of constructing structures is virtually impossible. Unlike manufacturing, constructing a building is basically the construction of a prototype—there is no research and development process preceding the construction. Therefore, errors, omissions, inconsistencies, defects, and deficiencies will always be present to some degree.

For architects and engineers, the professional “standard of care” is typically applied to the services they provide. *Black’s Law Dictionary* (9th Edition, Abridged) defines *standard of care* as

that degree of care which a reasonably prudent person should exercise in same or similar circumstances. If a person’s conduct falls below such standard, he or

⁴ As required by Section 3.2.2 of AIA Document A201-2007, *General Conditions of the Contract for Construction*.

she may be liable in damages for injuries or damages resulting from his or her conduct.

Thus, perfection for architects and engineers is not ordained, but providing the same level of service that your peers provide is.

Instituting a quality management system should not be an indication that the A/E is raising the bar on performance. How the A/E implements and promotes the system may give the perception to prospective clients that the A/E has artificially elevated the standard of care. Any quality management system proposed should be flexible and not a “one size fits all” type of program—you do not want to apply the same level of effort on a strip mall tenant improvement project as you would for a full hospital.

For contractors, the performance standard was set in 1918 with the creation of the Spearin Doctrine. This doctrine is based on a court decision for the case of *United States v. Spearin*, 248 U.S. 132, which sets forth that there is an implied warranty by the owner to the contractor that, if constructed in accordance with the contract documents, the project would perform as intended. Therefore, the contractor is not liable to an owner for loss or damage resulting from defects or deficiencies in the contract documents.

Quality assurance and quality control are processes that should go hand-in-hand, but, by definition, they are different. Both the A/E and the contractor have responsibilities for providing quality in a construction project, so a system to maintain that quality should be a part of any company’s business plan.

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