

Quality Assurance and Certification – A Design for a Successful Project!

Certification is more than a checklist. Programs should be closely tied to an industry's "Body of Knowledge"

— By Brian Miller, PE, LEED AP, and Dean Frank, PE, LEED Green Assoc.

A tremendous amount of work goes into designing a project to ensure that it will meet its program goals, construction timelines, budgets, and be constructed and used safely. To accomplish this is no easy task when you consider that an average project has dozens, if not hundreds of companies involved, hundreds, if not thousands of people, and usually thousands of materials, parts or components from the foundation to the light bulbs. All of this must be coordinated, manufactured and constructed to meet specifications and stakeholder expectations.

The success of a project is measured in many ways, often in terms of budgets, quality, and schedules. But

what about safety? Society relies on professionals to design and build structures that are safe, not only during construction, but throughout their service lives and even during deconstruction. Therefore, having safe designs is only the beginning. The final structures must be built and perform as designed and specified—otherwise safety, along with the likelihood of a project's success, can be compromised.

So how is this accomplished when the design team is relatively small compared to the task, or in some cases just one person? The answer is quality assurance. Quality assurance is an ongoing system of knowledge, programs, activities, people, inspections, tests, documentation, and assessment, with the sole goal of making sure structures meet their intended design and specifications. Quality assurance is not only linked to the common expectations (i.e. aesthetics, durability, and performance), but also applies to safety. If quality is overlooked, then safety can be compromised.

Quality control, a term sometimes confused with quality assurance, refers to the daily tasks and routine actions that help ensure the quality according to the requirements of the quality assurance system. For example, a good quality assurance system may require 28-day compressive strength tests on concrete to help ensure that each batch meets the designed strength requirements. The act of testing cylinders is part of the quality control process. The testing regimen, specifications, inspection frequency, minimum strength requirements, etc. are part of the quality assurance system.

So how does Certification fit in?

Certification is a process to check the quality assurance system. It helps ensure the essential components of the quality assurance system are present and functioning properly, resulting in the highest probability of meeting specifications and building a successful project. Therefore, certification is a vital component of a quality assurance system, but does not itself constitute a quality assurance system.

Selecting the right certification program

A proliferation of certification options has caused some confusion in the marketplace. This has led some specifiers to believe all programs calling themselves 'certification' offer similar benefits and are interchangeable. Unfortunately, this is simply not the case.

The most effective certification programs are those that are part of a comprehensive quality system. These are the programs created and managed by industry-specific technical institutes, such as the Precast/Prestressed Concrete Institute (PCI), the American Institute for Steel Construction (AISC), and the American Concrete Institute (ACI). Institute-based certification programs are part of an integrated knowledge development and continuous improvement process connecting directly with the industry's body of knowledge. This is critical, since it is this knowledge that everything related to a specific industry is based on. (For more on this topic, see "Body of Knowledge—The Foundation of Certification," page 46.)

To highlight this, imagine you are reviewing a quality assurance system for an elevator manufacturer. Sure,



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we know the basics: there are codes that define the number of required elevators, proper sizing, as well as specifications about their speed of operation and safety features, among other things. However, are we knowledgeable enough to know what an appropriate quality assurance system for an elevator manufacturer should consist of? It is not likely. Who better to define these important elements than the technical institute for the elevator industry? They are plugged into the code development process. They develop, maintain, and disseminate the body of knowledge for that industry, and are best positioned to provide certification programs that help ensure that an elevator manufacturer's quality assurance system is complete and functioning correctly. This example can be applied to nearly any industry.

Certification programs established and monitored by industry-specific technical institutes provide architects, owners and all project stakeholders with the highest degree of quality assurance. Technical institutes are uniquely qualified to develop, implement, and maintain certification programs. Furthermore, companies going through the rigorous and ongoing procedures to become certified demonstrate their commitment to the quality and safety.

Essential elements of a quality system

Quality systems should contain essential elements that are offered by industry specific technical institutes. In 2009 the American Association of State and Highway Transportation Officials (AASHTO) subcommittee on materials and bridges/transportation structures resolved that certification should be provided by technical institutes. Afterward, PCI joined with the AISC to produce a white paper to help designers better understand what it takes to develop and maintain a certification program.

The white paper identifies 12 characteristics essential to any organization offering construction-industry certification. Typically, these are found within the national not-for-profit technical institutes established to provide a consensus-driven forum for the development and continuous refinement of engineering, design and quality standards, and related certification programs. The elements are:



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PCI's Plant Quality Personnel Certification Program provides instruction and evaluation for three levels of trained and certified quality control personnel.

Facts about certification

This section focuses on certification for fabricators of pre-manufactured components such as precast concrete.

Cost

Certification does not really increase the pre-manufactured component costs. Most of the cost typically associated with subscribing to a certification program represents the cost of doing the job right. If a fabricator is not executing all necessary steps required to be certified, one may ask, why not? What are the consequences to quality and safety? Or, what is the increased risk assumed?

The other certification cost involves administering audits by third-party entities to examine evidence that the fabricator is following the required procedures and processes. This is already incorporated into ongoing certification programs. The other option is to require special inspections for a project, typically increasing the owner's project costs.

Common standard

Specifying products from certified fabricators ensures a uniform yardstick of performance is being equally applied to all bidders. This reduces the temptation to cut corners, often in ways not readily apparent.

Reliable project partner

Certified fabricators have made significant investments in plants, procedures, and people to meet stringent certification standards. They have also developed a habit of measuring and achieving quality, and a documented history of consistent production to meet specifications. As noted in the article, this cannot be turned on or off for a given project, but must be part of the organization's culture.

As-designed becomes as-built

A designer's vision and reputation for quality depend heavily on the fabricator and installer's capabilities. Certification ensures the finished project meets the designer's expectations and requires less supervision and field inspection, saving time and money.

It is easy to understand certification programs provide many benefits. However, which certification program does one rely on to provide the highest probability of success? What makes a certification program work? The answers to these questions are important to understand.

How to Specify PCI Certification

To ensure accredited certification is used on each project, the Precast/Prestressed Concrete Institute (PCI) recommends specifying architects reference the following.

Manufacturer qualifications

The specifying process should begin with a list of required precast concrete products, from which the appropriate product group and category for each product can be determined based on the product's use, the reinforcement method, and special surface finishes. PCI recommends manufacturer qualifications according to the following specification:

The precast concrete manufacturing plant shall be certified under the PCI Certified Plant Program. The manufacturer shall be certified at the time of bidding. Certification shall be in the following product group(s) and category(ies):

[Choose one or more of the following, as applicable]

GROUP A: ARCHITECTURAL PRODUCTS

AT—Architectural Trim Units

A1—Architectural Precast Products

GROUP B OR BA: BRIDGE PRODUCTS

B1 or B1A—Precast Bridge Products (No Prestressed Reinforcement)

B2 or B2A—Prestressed Miscellaneous Bridge Products (Non-superstructure)

B3 or B3A—Prestressed Straight-Strand Bridge Beams (Superstructure)

B4 or B4A—Prestressed Deflected-Strand Bridge Beams (Superstructure)

[Group BA products require an architectural finish.]

GROUP C OR CA: COMMERCIAL (STRUCTURAL) PRODUCTS

C1 or C1A—Precast Concrete Products (No Prestressed Reinforcement)

C2 or C2A—Prestressed Hollow-Core and Repetitive Products

C3 or C3A—Prestressed Straight-Strand Structural Members

C4 or C4A—Prestressed Deflected-Strand Structural Members

[Group CA products require an architectural finish.]

GROUP G: GLASS-FIBER-REINFORCED CONCRETE PRODUCTS (GFRC)

In the specifications, list each precast concrete product and each required group and category included in the project's scope.

Personnel qualification guide specification

PCI's Plant Quality Personnel Certification Program provides instruction and evaluation for three levels of trained and certified quality-control personnel. The project specifications should require trained and certified quality-control personnel in the manufacturing plant. PCI recommends that the manufacturer employ personnel according to the following personnel qualifications specification:

The manufacturer shall employ a minimum of one person, regularly present in the plant, who is certified by PCI for Plant Quality Personnel, Level II.

Note: All PCI-certified plants are required to employ at least one PCI-certified individual.

Erection qualification

In addition to basic fabrication and manufacturing standards, the precast concrete industry offers certification for the erection of its components. This additional standard provides assurance the high-quality precast concrete components are erected to the exacting standards expected by the owners, developers, architects, contractors, and the precast industry itself. An erector may qualify in one of two structural classifications and/or an architectural classification, as follows:

CATEGORY S1

(Simple structural systems)

This includes horizontal decking members (such as hollow-core slabs on masonry walls), and single-lift wall panels attached to a structure.

CATEGORY S2

(Complex structural systems)

This includes everything contained in S1 as well as total-precast concrete construction, multi-product structures (those that combine vertical and horizontal members), and single- or multi-story load-bearing members, including those with architectural finishes.

CATEGORY A

(Architectural systems)

This includes non-load-bearing cladding and GFRC products, which may be attached to a supporting structure.

PCI recommends manufacturer qualifications according to the following specification:

Erector Qualification: Prior to beginning any work at the jobsite, the erecting organization, including all crews erecting precast concrete, shall be certified in category[ies] [A, S1, and/or S2] under the Precast/Prestressed Concrete Institute (PCI) Erector Certification Program.



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PCI's certified auditors compare products against project specifications and minimum requirements as spelled out in the institute's manuals.

Industry standing

Technical institutes serve as the principal body of knowledge within their industries. They facilitate exchanging and encouraging new ideas and test those concepts across the full spectrum of stakeholders. Their programs are based on decades of experience. They can also join together to assess noncompetitive issues aiding their industries, thanks to the all-encompassing scope of their membership and responsibilities.

Clearly stated purpose

Certification programs run by not-for-profit technical institutes state their purpose and foundation transparently. They ensure no hidden agenda in their direction, and no individual person or company stands to profit

from their programs.

Broad professional involvement

A technical institute's membership and committee participation reflect a diverse mix of industry professionals—including engineers, manufacturers, and academicians. In contrast, a trade association is generally dominated by a single interest. An institute's diversity of input ensures every perspective is considered and best practices are identified. Documents and other knowledge products created by the organization are subject to review by committees representing all interested parties.

Governance and consensus

Technical institutes are governed by boards with elected officers and

members having no ownership interest. They have formal, consistently applied procedures for making decisions and achieving consensus. This formalized process allows a technical institute to create and apply a comprehensive quality system in a fair and balanced manner that reflects a true consensus of the industry and its professions.

Research

Technical institutes base their programs on a body of knowledge that includes formal and informal research activities addressing current industry challenges, emerging technologies, and innovative practices. These activities are ongoing, and new and improved knowledge is directly applied to the institute's quality programs—in many cases, well before being incorporated into published codes and standards.

Institutes also monitor and disseminate results from the global independent research community, keeping the industry up-to-date on all types of data. Institutes' research credibility is evidenced by their ability to attract funding and collaborative assistance from outside sources, including corporations, universities, and associations. These vetted efforts further expand the available knowledge base and improve the effectiveness of the certification and quality programs.

Validation

Certification programs developed by technical institutes provide a rigorous review process that includes oversight committees and review panels of experts and stakeholders. Each element is examined and documented to ensure it helps meet the goal of achieving high quality standards.

Dissemination

Technical institutes have access to a wide range of communication media that can immediately alert the industry to concerns, best practices, regulatory issues, and technical matters. They also offer educational programs with qualified instructors to spread new information and explain new developments.

Certification of personnel

A comprehensive quality system must validate the competence of the personnel involved with quality con-

trol and other key activities. Quality is not an end point, but a continuous examination of best practices that continue to develop and improve quality performance consistently over time. Technical institutes ensure both fabricator personnel and auditors have the capabilities to review project requirements, audit records, interview personnel, and observe practices and equipment to ensure procedures reinforce quality goals.

Certification of fabrication process

The primary focus of a manufacturing certification program is to ensure fabrication of high-quality components meet specifications on a consistent basis. Technical institutes base their audits on their own promulgated standards, procedures, and research, creating a foundation for auditors and fabricators to understand the reasoning behind requirements.

Independent audits

Credible certification programs require periodic on-site audits by independent, technically qualified, and professionally accredited personnel who have no financial or employment interest in the institute or the audited

fabricators. Auditor-qualification programs should verify the quality and effectiveness of the individual auditors themselves and include periodic training to remain current with evolving quality standards.

Feedback and recourse

Technical institutes can take advantage of their various communication media—including publications, technical conferences, educational programs, and auditor feedback—to gather and immediately apply enhancements to the audit process. A credible certification program must include a formal procedure establishing consistent rules under which fabricators can dispute and/or address identified nonconformance. The goal is to raise the bar on quality to achieve a consistent, continuous level and ensure fabricators are accountable for their quality.

Continuing commitment

A vast array of stakeholders provide the foundation for technical institutes, which have provided long-term service to their industries and are supported through various funding sources. This history provides a stable basis

for certification programs and ensures they will remain in place as consistent, continuously improving systems for assessing quality processes.

Government agencies endorse institute certification

The Federal Office of Management and Budget (OMB) stated that government agencies are encouraged to reference nonprofit, consensus-based standards and participate with these institutes, rather than create their own requirements. Programs lacking the foundations of strong research, the organization of technical committees to gather consensus, or the ongoing commitment to a continuous-improvement process will fail to meet the standard development requirements of the American National Standards Institute (ANSI).

Quality and safety are a commitment

Quality and safety are a mindset and commitment, succeeding only when a system of plans, procedures, and events are in alignment. They are part of an integrated process that cannot be turned on or off for a given project, but must be an ongoing part of an operation, and also part of a company's culture. Therefore, it is difficult to raise your standards simply for one project.

Essentials of a quality system

Certification is more than just a checklist. It is part of an integrated, comprehensive, continuously improving quality system specific to the products or systems being addressed and directly linked to a substantial body of knowledge. Only a technical institute can provide all the essential components for a comprehensive quality system intimately connected to the evolving body of knowledge for the industry it serves.

Industry stakeholders and project decision-makers must recognize these distinctions and insist they take advantage of the highest levels of quality assurance and quality control available to them. With their vision and support, technical institutes can build on their strong base and provide the market with consistent, continuously improving programs that ensure best practices are used throughout the industry. Such systems are the only way to ensure the highest levels of safety, quality, and the ultimate successful project. ■

Body of Knowledge—The Foundation of Certification

The Body of Knowledge (BOK) refers to the collective knowledge of an industry that is relied upon to design and build with a specific material or system. It is from this BOK that building codes, design guides, education programs, certification, and everything else relied upon is derived.

Several key elements are integrated and required to develop and maintain a BOK. Some of these include industry experts and stakeholders who must be involved via multiple channels, such as committees of the technical institute and industry organizations. Industry organizations include codes and standards organizations, research and higher learning facilities, and government organizations. Additional elements are the research programs used to test and develop concepts, methodologies, or address concerns, all of which feed into the BOK, and the continuous feedback loop created from the end users and the inspection process that also feeds back.

As one can imagine, given the magnitude and complexity, it is impractical, inefficient, and even dangerous to have more than one BOK for a specific industry. Adopting certification programs outside an industry's nationally recognized technical institute effectively fragments the industry's quality assurance machinery and isolates groups of fabricators from immediate access to the industry's official, continuously evolving body of knowledge. More than that, new certification programs may create confusion by establishing parallel but inconsistent procedures, references, and benchmarks. An industry must be attuned to one national standard.

Fortunately, in the construction industry, technical institutes have clearly defined domains of expertise. While there may be many trade associations, there is typically only one technical institute for a specific industry. Quite often, technical institutes collaborate to ensure the quality and safety of the built environment. The white paper created by PCI and AISC is an example of institutes placing quality and safety above all else.

AIA Learning Units

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The Precast/Prestressed Concrete Institute (PCI) is a Registered Provider with the American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members are available on request.

Instructions

Review the learning objectives below.

Read the AIA Learning Units article.

Answer the 11 questions at the end of the article and submit to PCI. Submittal instructions are provided on the Learning Units form. You will need to answer at least 80% of the questions correctly to receive the 1.0 HSW Learning Units associated with this educational program. You will be notified when your Learning Units are submitted to AIA.

Learning Objectives

After reading this article, readers will be able to:

1. Define Quality Assurance
2. Describe the essential elements of a quality assurance system
3. After reading this article, readers will be able to explain the differences between certification offered by Institutes and other industry organizations
4. Describe how a good QA program impacts design and safety

Ascent 2011 – Quality Assurance

Name (please print): _____

Company Name: _____

Address: _____

City: _____ **State:** _____ **Zip:** _____

Phone Number: _____ **Email Address:** _____

Title: _____

Background (circle one): Architect – Engineer – Business – Marketing/Sales – Finance – Other

1. Quality Assurance
 - a. is an ongoing system of knowledge, programs, activities, people, inspections, tests, documentation, and assessment
 - b. is focused on making sure structures meet their intended design and specifications
 - c. is directly linked to safety
 - d. provides the highest probability of having a successful project
 - e. All of the above
2. Quality Control is
 - a. the same as Quality Assurance
 - b. refers to the daily tasks and routine actions that help ensure quality according to the requirements of the quality assurance system
 - c. is an ongoing system of knowledge, programs, activities, people, inspections, tests, documentation, and assessment
 - d. can serve as a certification program on its own
3. Quality Assurance should be a part of a company's mindset and culture.
 - a. True
 - b. False
4. Certification is
 - a. is part of quality control
 - b. is a way of checking that the quality assurance system is complete and working properly
 - c. is sufficient to serve as a quality assurance system by itself
5. The Body of Knowledge refers to the
 - a. any knowledge in an industry and does NOT need to be vetted
 - b. standard specifications of an industry
 - c. collective knowledge of an industry that is relied upon to design and build with a specific material or system
 - d. amount of knowledge you personally have
6. Technical Institutes are uniquely qualified to develop, implement and maintain certification programs because
 - a. they develop, maintain and disseminate a specific industry's Body of Knowledge
 - b. they are dominated by a single stakeholder interest
 - c. they are integrated into the codes and standards organizations
 - d. only a and c
 - e. only b and c
7. Which of the following are benefits of requiring institute-based certification?
 - a. a uniform yardstick of performance is being equally applied to all bidders
 - b. costs typically do not increase since most of the costs are related to what it takes to do the job right while providing a high level of quality assurance
 - c. certified producers have demonstrated a commitment to quality and have made it part of their culture
 - d. all of the above
 - e. a and c only
8. All Certification programs are essentially equal as long as they use the same checklist
 - a. True
 - b. False
9. Why is it important to have broad professional involvement in a quality system?
 - a. this ensures every perspective is considered and best practices are identified fairly for all stakeholders
 - b. it keeps people employed
 - c. it allows for one stakeholder group to dominate the outcome
10. Which of the following are NOT part of the 12 essential elements for a quality system?
 - a. Broad professional involvement
 - b. Independent audits
 - c. Validation
 - d. Feedback and recourse
 - e. None of the above
11. Many government agencies endorse certification by technical institutes
 - a. True
 - b. False

To receive credit, please submit completed forms to:
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