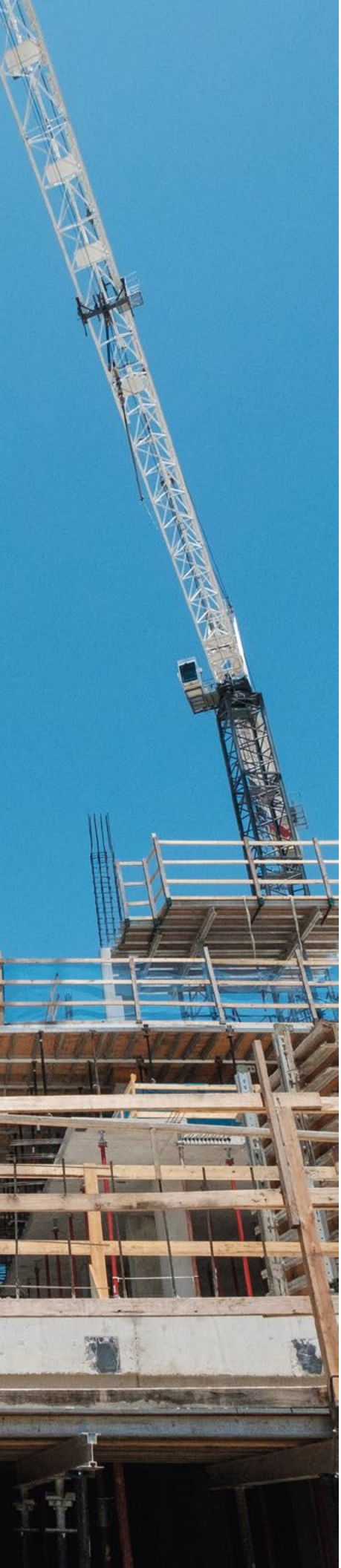
EBOOK

Construction Risk Management Guide

Avoid the high cost of injury with a tech-based quality & safety program.

PROCORE®



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Quality Control: Inspect It Now or Fix It Later

A quality control (QC) program can help drive the success of construction projects by ensuring contract and safety requirements are met—and work is done right the first time. For general contractors tasked with QC responsibilities, this means making sure the project is built to plan, specifications, industry and safety standards, and requirements set by the architect, engineer, and owner.

Typically part of a project-specific quality assurance and quality control (QA/QC) plan, QC relies heavily on inspections during all phases of construction. When superintendents, project managers, and/or dedicated QC staff follow a rigorous field inspection schedule and daily safety

checks, they can identify problems and take measures to correct any oversights before they lead to more expensive—or dangerous—issues.

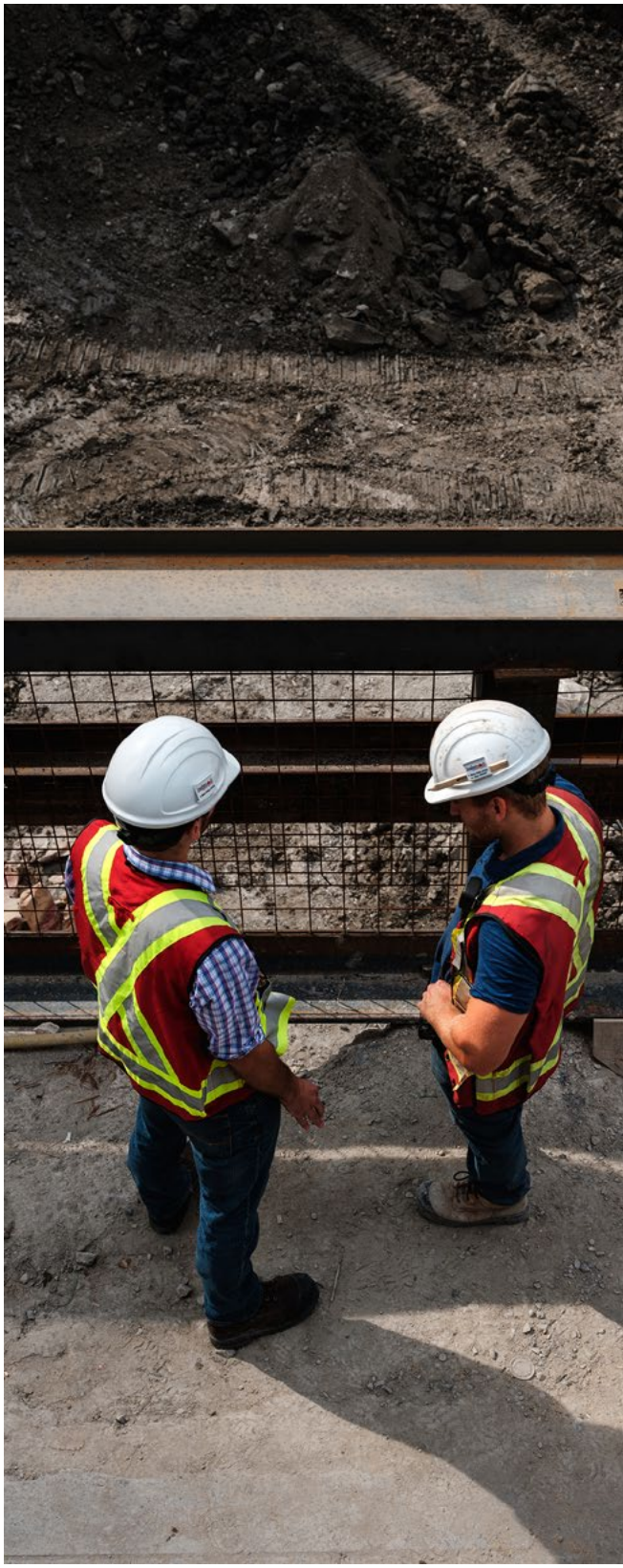
Whereas a QA plan is part of early-stage project planning to lay the groundwork and formulate processes that will lead to the best outcomes, QC activities occur throughout the project to determine whether the results of completed work meet criteria outlined in the QA plan. In addition to inspections of all types, QC includes conducting audits—based on metrics that have been established early in the project's front-end planning—to aggressively benchmark quality throughout construction. It is also essential to maintaining an ongoing list of corrective items that must be accomplished before the responsible subcontractor is paid or leaves the job.

It all boils down to identifying issues as they happen, and addressing them before they become bigger problems that could impact the project deadline and budget, your reputation, and—most importantly—the safety of jobsite workers and the end users.

Good Communication is Critical

Limited communication between field staff, contractors, designers, and engineers can lead to costly project delays as well as devastating construction defects. Detailed record-keeping that includes completed inspection forms, project photos illustrating issues, and dated sign-off forms can help provide project insight. But keeping records is only half the story; simply having records adds no value if nobody sees them. A key component of QC is making sure the appropriate stakeholders can access the records. These stakeholders can include:

+ Project owner
+ Architects
+ Engineers
+ Designers
+ General contractor
+ Subcontractors
+ Field staff (superintendents, project managers, project engineers, etc.)
+ Dedicated QC personnel



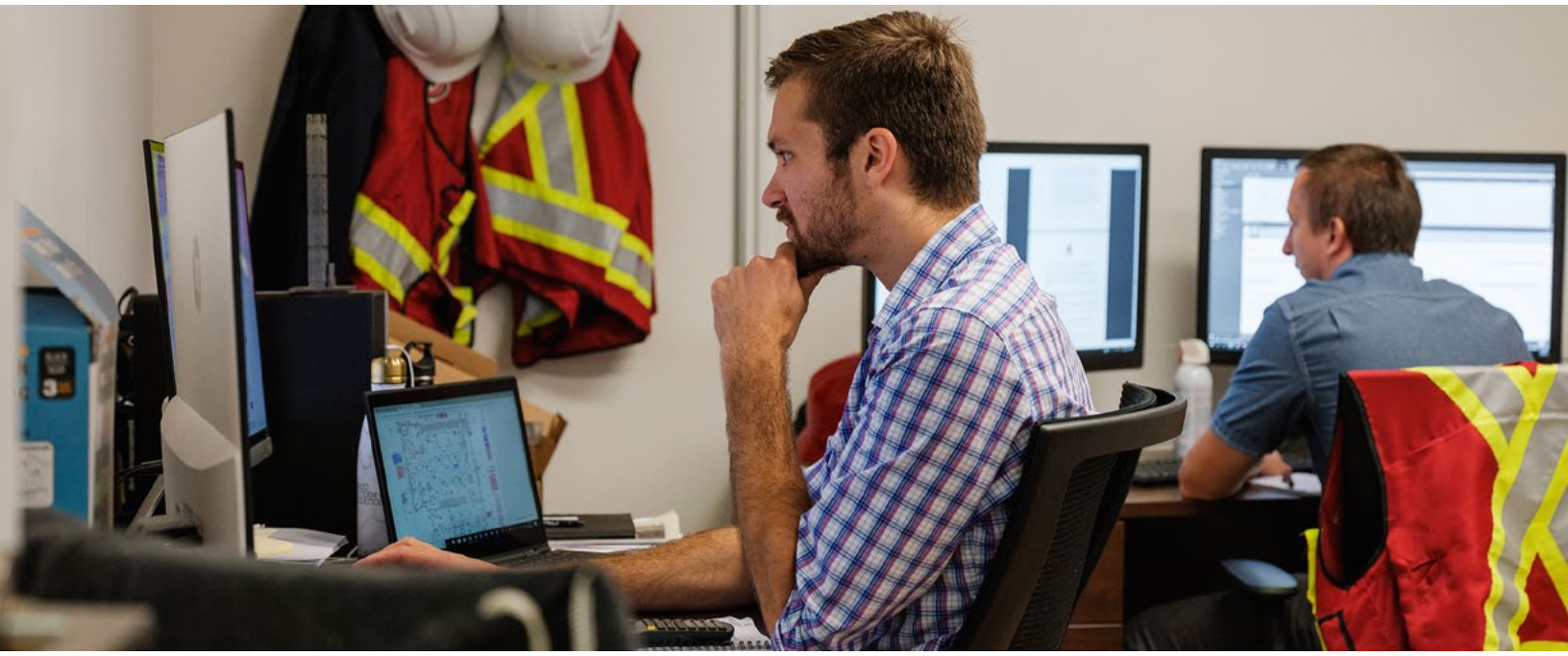
Quality Control: Inspect It Now or Fix It Later

Quality control involves several different players and inspections of all types. Consider the following:

+ Building inspectors must examine a variety of construction details and assess them for compliance with local and national building codes, zoning laws, and contract specifications.
+ Commercial construction inspections must be undertaken for all building systems (foundation work, framing, mechanical systems, roofing, plumbing, electrical, etc.) and be performed at multiple stages of building completion.
+ Quality control efforts also address owner requirements and material manufacturer recommendations.
+ Inspector responsibilities can range from materials and soil testing to regional issues of concern (such as seismic activity in California or wind loads along the hurricane-prone Atlantic coast).

Even a relatively small construction project can be complex, involving many players in the QC process to ensure its success. On large projects, the scale and number of details involved in construction inspections, and the paperwork they generate, can become staggering. Making inspection data transparent and available to team members and project partners can become a time-consuming, paper-shuffling nightmare. Hard copies can get lost, leading to deficient items going unnoticed and unresolved.

For this reason, an increasing number of construction firms are choosing to digitize their QC processes. New software is making the work easier, and the inspection results simpler to share across the entire project team. Important documents will no longer get lost in the paper shuffle, so decisions can be made based on the most complete and up-to-date information.



02

Record-Keeping: Digitizing Daily Logs, Binders

The key to QC is combining good inspections with thorough record-keeping. This means putting everything in "writing." Keeping inspection logs that include photographic evidence is critical to building the documentation case that can help resolve issues or protect your firm during litigation. Historically, the best tools for the job were pencil and paper, cameras, and daily logbooks that included detailed descriptions of project issues, times, locations, and signed or initialled pages.

These hard copy materials would be kept in a binder that would itself become part of the project record—and play a critical role in seeing the project completed on time and with expected quality maintained.

However, making this unwieldy physical binder available to those who need it, when and where they need it, could be problematic. The delivery time alone could slow the project as decision-making team members wait to review the necessary paperwork.

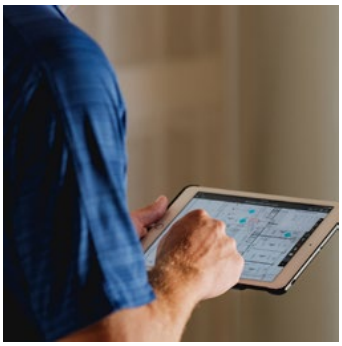
To remedy these issues, many construction firms have been turning to mobile, cloud-based software to digitize their QC activities.Benefits of this approach include:

+ By using digital inspection forms and securely storing them online, construction professionals can give the entire project team real-time access to commonly accessible inspection data so appropriate action can be taken without unnecessary delays.
+ Field staff equipped with tablets and smartphones can fill out inspection forms, take pictures with their mobile devices to attach to the forms, add notes and comments, and immediately share that information with others.
+ Project teams no longer have to wait for vital project information to make decisions and move the project forward. The necessary info is current and available 24/7.

Going Digital Standardizes Processes

QC activities tend to generate an overwhelming amount of data. Managing inspection forms becomes much easier if computers or tablets are used in lieu of paper and binders, since these are difficult to store and subsequently to locate and distribute when they are needed. Paper forms also lack flexibility and standardization across multiple projects, and can lead to missteps:

+ Contractors often mistakenly use forms that are outdated, causing insufficient documentation of the project. If an inspection is not properly and thoroughly documented, it can cause delays and significant costs.
+ Different types of essential augmenting information, particularly photographs, tend to become separated from completed inspection forms, resulting in valuable supporting materials getting lost in the system.



In-house, server-based software solutions have been used for years to streamline document management; however, until recently, it was difficult to access digitized forms from the jobsite. At the same time, the jobsite is exactly where inspections take place and decisions are made.

Mobile, cloud-based software solutions are taking inspection document management to a new level by establishing standard processes to create and fill out forms, track inspections, and notify responsible contractors—from the job site. These processes enhance the QC effort in several ways:

+ Forms and templates are kept in the cloud, rather than on an in-house server, so remote team members can easily retrieve them—wherever they are in the world— and use them from project to project.
+ Uniform inspection checklist forms ensure that the right questions are being asked, and the right steps taken, in every situation.
+ Templates can be updated over time to keep project portfolios current with evolving quality-management processes.
+ It is easier to train employees on quality control tasks when consistent, repeatable processes are in place.

Mobile, Cloud-Based Software Resolves Issues Faster

Digitally-stored inspection records offer a central repository for project information. Having real-time access to them can help team members track deficient items and communicate problems faster, so issues can be resolved more quickly. It also improves your firm's security and mitigates risk by creating more inclusive and complete records.

The benefits of these capabilities can be seen in other aspects of the project, including a reduction in deficiency list items (since standardized inspections are resulting in more efficient problem resolution). Plus, the ability to have all photographs present, organized, and linked to the digital drawing set at the end of a project simplifies commissioning and close-out.

03

A Trifecta of Improvements: Accuracy, Accessibility, Accountability

By adopting mobile-ready, cloud-based technology, you can improve the accuracy of your project's construction inspections, provide all team members with real-time access to inspection results, and increase team members' accountability in terms of inspections conducted and corrective actions taken. It is a level of professionalism that will distinguish your company in a project owner's eyes.

By following a regular inspection schedule, complete with safety checks and audits, your team can identify and resolve issues before they become bigger problems, to keep your project on time and within budget—without sacrificing your firm's reputation or others' safety.

Mobile, Cloud-Based Software Resolves Issues Faster

By using an inspection tool like Procore's, your team can:

+ Create standardized inspection checklist templates to use across projects
+ Generate and fill out inspection forms on mobile devices
+ Take photographs and link them to inspection items
+ Add comments and attach files to an item
+ Perform safety audits
+ Identify "conforming" and "deficient" items
+ Work offline on mobile devices and have that data sync automatically when connected
+ Create PDF files or other document formats to export data

Quality Control

+ Helps reach project goals/contract requirements
+ Ensures that construction projects are executed properly
+ Ensures quality of materials, equipment, and systems
+ Enhances jobsite safety
+ Makes sure that regulations are followed

04

The High Cost of Construction Defects

Most major building failures can be traced back to the designers' or builders' blatant disregard of codes or laws. But not every structural failure happens because of criminal negligence. Below are a few of the world's largest construction disasters—ones that stemmed from workday oversights, shortcuts, and gaps in communication, yet had deadly consequences. Unfortunately, all of these tragic examples could have been prevented by a good quality control program and better communication amongst project team members.

Quebec Bridge, Canada

In 1907, an engineer working on the cantilever bridge that stretched across the St. Lawrence River reported by telegraph that he'd noticed the frame starting to bend. The designer, who was not on site, at first disregarded the engineer's concerns. He later wired the bridge company with instructions to place no more load on the bridge until all facts were considered. The chief engineer, however, supposedly ignored that order. Work on the bridge continued. Not long afterwards, the 150-foot-tall bridge collapsed, killing 75 workers. The bridge weighed 8 million pounds more than was initially calculated, and the beams were unable to handle the excess weight. It was Canada's worst bridge disaster.

Willow Island Cooling Tower, West Virginia

In 1978, a cooling tower being built at the Willow Island, W.V., power plant collapsed. The falling concrete knocked over a scaffolding tower, killing 51 construction workers. The project had been significantly behind schedule, so workers found shortcuts to speed up construction including attaching scaffolding to concrete that hadn't set, using either worn or the wrong kind of bolts, and using a concrete hoisting system that was modified without proper engineering review. It's considered the largest construction site accident in U.S. history.

The project had been significantly behind schedule, so workers found shortcuts to speed up construction.

Hyatt Regency Walkway Collapse, Kansas City, Mo.

In 1981, two of the hotel's suspended walkways fell four floors onto the lobby below, where a dance competition was being held—killing 114 people and injuring an additional 200. An investigation found that late design changes altered the method in which the rods supporting the walkways were connected to them, inadvertently forcing the tie rods and support beams to hold the weight of both the second-floor and fourth-floor walkways. The added weight of people on the walkway was too much for the ties and beams to hold. The failure is now a standard case study from which many of today's engineering students learn about the importance of good communication between design engineers and contractors, rigorous checks on design, and especially contractor-proposed design changes.

Katowice International Fair Trade Hall, Poland

During a frigid January in 2006, heavy snow caused a section of the building's roof to smash down on the exhibition floor, trapping hundreds of people and exposing them to dangerous, sub-zero temperatures. A second section of the roof collapsed during rescue operations. The lacerated metal acted like a freezer, and rescuers couldn't heat the air under the ruins because parts of the building were supported by nothing more than piles of snow. In the end, 65 people died and more than 170 were injured. The roof, which had buckled under winter snow four years earlier, had been rebuilt without being properly inspected or tested.

Lotus Riverside Complex, Shanghai, China

In 2009, a nearly completed 13-story apartment building collapsed, killing one worker. The Wall Street Journal reported that investigations attributed the accident to excavations for the construction of a garage under the collapsed building. Large quantities of earth were removed and dumped into a landfill next to a nearby creek; the weight of the earth caused the river bank to collapse, which allowed water to seep into the ground and create a muddy foundation for the building. The building collapse led to an investigation of the 11 other buildings in the project.

These examples demonstrate that quality control is more than just a nicety on the job site. With procedures developed over years and in response to real-world conditions, managing quality goes far beyond product refinement and can have life or death consequences.

Still, not every structural defect or safety lapse ends in catastrophe. More commonly, the costs associated with such mistakes are small. But even these costs, when considered cumulatively, are significant.

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Procore is a leading provider of cloud-based applications for construction. Procore connects people, applications, and devices through a unified platform to help construction professionals manage risk and build quality projects—safely, on time, and within budget. Procore has a diversified business model with products for Project Management, Construction Financials, Quality & Safety, and Field Productivity. Headquartered in Carpinteria, California, with offices around the globe, Procore is used to manage billions of dollars in annual construction volume.

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