

Collaborative Reporting for Safer Structures:

The myth of quality assurance

This month we present a CROSS Safety Report discussing the need for regular site inspections to be conducted by the original design engineer. The report was submitted to, and processed by, CROSS-AUS, but the contents will also be of interest to readers within the UK and internationally.

Overview

This report argues that, to achieve the objective of good-quality construction that satisfies the design intent, there is no substitute for the practice of regular site inspections being conducted by the original design engineer.

It raises the question of whether there has been too much reliance on the process of quality assurance (QA) systems to the detriment of the quality of the end product.

Full report

Despite the enthusiasm of those who promoted the introduction of QA systems in the construction industry in the 1990s, the reporter's opinion is that it has not been very successful for engineering and construction, and that too many have assumed it replaced the need for regular and periodic inspections by engineers in the field.

The experience of 'ticking boxes' or a checklist in the office does not necessarily provide good-quality work on site (or in the factory) without understanding the practical issues about what is achievable and what is involved in achieving a high-quality outcome.

It is the reporter's opinion that relying on contractors and subcontractors (who may not understand the design process) to manage the inspection of work using the method of quality control is at best a very doubtful proposition and at worst a recipe for possible failures.

As Phil Stevens said in 1992¹, 'As for the future of quality management, I would like to think that the audit fraternity will come to realise that there is an enormous gap between the pedantic view of quality management and what happened successfully in practice'.

Site inspections

The reporter believes that there is no substitute for periodic and regular hands-on site inspections by all designers to understand the complications of their design and to receive feedback on their design.

As an example, consider a complicated reinforced concrete member where congestion of reinforcement can result in difficulties in placing wet concrete and maintaining correct covers. It is only by physically looking at and examining details on site (or in the factory) that engineers will have this direct feedback on their designs and understand the practicalities of construction.



THERE IS NO SUBSTITUTE FOR THE STRUCTURAL DESIGNER BEING ON SITE AT ALL SPECIFIED HOLD POINTS

Through their involvement with several major projects involving high-quality precast concrete, the reporter has been concerned that the original design engineers have not been prepared to inspect their work in the field. Possible future failures were avoided in two projects when the reporter observed significant design issues and took action to recommend changes.

Thus, the reporter believes it is imperative that regular and periodic inspections be carried out by design engineers (senior and junior) to understand their designs and what is practical in manufacture and construction. The sooner mandatory regular and periodic inspections are required by the designers of all projects, the better and safer will be the construction industry in Australasia.

Expert Panel comments

QA systems are required by most engineering companies, but it is the day-to-day decisions about what to audit and what to inspect that make the difference between genuine quality assurance and half-hearted

Key learning outcomes

For building owners and managers:

- | A quality assurance system for construction should focus on the end product and not be allowed to become a bureaucratic process of 'ticking boxes'
- | When appointing the Structural Design Engineer, include the requirement to carry out sufficient periodic site inspections to satisfy the design intent

For structural and civil design engineers:

- | Consider making it a requirement of your appointment that you will specify the designated hold points for inspection and ensure that the relevant inspections are carried out by members of the design team
- | Be aware of the risks of accepting a design-only commission that excludes site inspections
- | Take every opportunity to appropriately inspect the works during construction and to use this as training for less-experienced engineers

compliance. Some companies with very mature third-party audited QA systems may fall well short of achieving quality outcomes because 'the culture' within the organisation rewards speed and profit above the quality of the end product. It is not enough to have a QA system; it must form the cornerstone of the company's work ethic.

Historically the practice of the design engineer inspecting the work during construction provided dual benefits of ensuring that the work complies with the design intent, and providing feedback and learning for the designer.

While the construction industry cannot be held accountable for providing feedback and learning to designers, it is accountable for ensuring that the work complies with the design intent, and this aspect is not always well served by QA systems. Drawings cannot reflect the myriad of decisions that design entails.

When construction work is inspected by someone who was not involved in the design process, or (as is often the case) cannot contact someone who was involved in the design process, that inspector cannot focus on the parts of construction that are particularly important, and must not depart from the design drawings. As a result, important departures on site can be overlooked, and equally time is wasted when unimportant departures are required to be corrected. The outcome is a reduction in the quality of the constructed work.

Risks associated with poor on-site quality assurance and control

The risks associated with an inadequate on-site quality assurance and quality control (QA/QC) system include:

- non-compliance with the design intent
- not having sufficient hold points to allow for verification checking at critical stages of construction
- reliance on third parties who do not understand the basis of the design
- human factors including not allowing sufficient time for QA/QC
- not recording as-built construction correctly
- a safety incident occurring that results in property damage or injury to a person(s).

These risks could be mitigated by:

- legislation requiring designers to

inspect the works and enforced by the regulators

- designers specifying when, how, why, and where hold points are required and the competency requirements of the inspectors
- independent third-party verification and validation for all high-risk structural building work. The risk would be considered high if there were an increased likelihood and consequence of the design intent not being met, through lack of suitable QA/QC, and other factors as noted in this advice.

Thus, we would agree with the reporter that there is no substitute for the structural designer being on site at all specified hold points and ensuring that the design intent has been met.

As the reporter notes, there are some design engineers who believe that items that are shop-drawn (e.g. precast or steel) do not need to be inspected on the basis that off-site quality control is substantially better than on-site and therefore lower risk. While this may be the case with reputable off-site contractors, this does not mean that errors in design interpretation, drafting translation, or on the shop floor, cannot occur.

It should be noted, however, that the presence of the design team on site may lead to genuine disagreements on best practice for project decisions during construction. Project documents should ensure a clear and efficient procedure is in place to resolve these disagreements (e.g. contractual hold points, RFI process).

Further expert panel comments regarding *Quality Assurance in New Zealand* and *Legislation in Australia-Mandatory Inspections* can be found within the full report located on the CROSS website (report ID: 960) at www.cross-safety.org/aus/safety-information/cross-safety-report/myth-quality-assurance-960.

REFERENCE

- 1) Stevens P. (1992) 'Quality Management Documentation and Auditing – Is it Out of Control?', *Concrete in Australia*, 18 (4), pp. 12–13

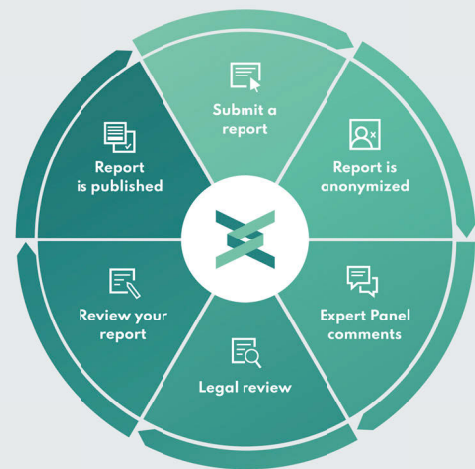


A QUALITY ASSURANCE SYSTEM MUST FORM THE CORNERSTONE OF THE COMPANY'S WORK ETHIC

What is CROSS?

Collaborative Reporting for Safer Structures (CROSS) helps professionals to make structures safer by publishing safety information based on the reports it receives and information in the public domain.

CROSS operates internationally in the UK, US, and Australasia. All regions cover structural safety, while CROSS-UK also covers fire safety.



How reporting to CROSS works

The secure and confidential safety reporting system allows professionals to share their experiences to help others.

Professionals can submit reports on safety issues related to buildings and other structures in the built environment. Reports typically relate to concerns, near misses or incidents.

Find out more, including how to submit a safety report, at <https://bit.ly/cross-safety>. Your report will make a difference.

