



Construction Quality Advancements Utilizing New Technology

By **Corey S Zussman**, Director of Quality Management, Pepper Construction

Today is an important day. We're reviewing the installation of steel reinforcement in concrete masonry blocks for a new data center in Chicago. Though on the surface it sounds like a simple installation, it actually can be a daunting task that entails detailed coordination among trades.

Designed to withstand a tornado, the walls require one-inch steel reinforcing bars in each concrete masonry block cell. The steel reinforcing must be located near the center of the concrete masonry blocks' open cells, and the bars cannot be repositioned after the concrete is installed. Due to the wind rating required, post-installation of the bars is not permitted. The difficulty lies in planning and placing these steel bars before the concrete masonry units are installed, which takes a lot of coordination and installation precision between the concrete and mason contractors.

During the pre-installation and coordination meeting, we determined that the location of the reinforcing bars had to be installed with precision, even though the exact location of the concrete masonry cores were unknown at the time of the concrete and reinforcing installation. At that point, we turned to our virtual design and construction department and augmented reality, which provided a clear view of the locations of the concrete masonry block cores and the steel reinforcing on site in real time, right in front of the mason. Utilizing augmented reality technology made the daunting task of precisely locating the coordinating elements quicker, more reliable and less expensive.

As the Quality Director for a large construction company in Chicago, I have the opportunity to work with highly skilled construction technology professionals. Whether it is working with augmented reality or creating a virtual three-dimensional mock-up of an extremely complex detail showing sequencing of installation, technology has provided a risk management tool for construction that benefits the entire project team.

I deal with construction risk as it relates to defects in construction. There are three types of construction defects that we look to reduce or eliminate.

1. Faulty materials or wrong material choices
2. Faulty workmanship
3. Faulty design

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The industry has developed new and exciting technology to allow me to be proactive in my pursuit of construction quality and eliminating construction risk.

3D printed models and 3D PDFs help us examine specific details more productively before the final design documents, thereby helping reduce faulty design. These tools also help us monitor for quality in the field.

Technology's role in utilizing data

Technology is particularly helpful in managing the data and identifying trends to improve how we build. We developed a web-based database to track construction concerns and materials throughout the company and the industry. Powerful software allows us to easily identify potential concerns, track and assist the project team in choosing the correct material for the project – or even subcontractors for the project based on their unique skill sets and experience. Based on lagging indicators, the industry provides us with information we can use proactively, such as our experience with different materials in the field and construction mistakes found during construction observation. This helps to prevent future concerns throughout the company and, potentially, the industry.

This data also provides information for our pre-installation meetings, where we coordinate with the trades and ensure that the drawings are correct regarding sequencing, compatibility, and coordination. The information gathered allows us to ask the appropriate questions and address the concerns ahead



Corey S Zussman

of time, which results in better installations and makes construction monitoring more efficient.

Technology's role in the field

During construction, we frequently use laser scanners throughout the process for verification and documentation of construction in-place with precise and definable results. Examples include evaluating reinforcement in a concrete structure and determining the floor flatness as required by most specifications. Scanning allows us to make changes to the process in real-time rather than waiting days for the typical results using a testing service's procedures.

Drones are typically utilized during construction reviews and existing building evaluations in areas that are difficult or dangerous for safe observation. Our in-house drone operators work with our quality department to assist in the review. We also use the drone to confirm excavation quantities, site logistics, and with the addition of the thermal camera mounted on the drone, envelope integrity.

We have more confidence now that we are communicating more effectively the problem and solution strategies. This gives our clients the ability to make informed decisions and we can provide a better product. For us, understanding how, when, and where to use these new technologies has resulted in an average rework cost of 0.32 percent of the project cost. In

comparison, the industry average is 3-5% of the project cost.

Technology's role in leveraging data in the field

During construction, we capture countless photos on-site and then identify basic construction detailing to confirm installations with the contract documents. The use of Artificial Intelligence (AI) in photos has reached a point where basic installation can be verified quickly and reliably. More complex detailing could be verified, tagged, qualified for cost and time required to correct, and quantified with more data and understanding, all with just a few photographs and limited time.

One of the oldest professions in the world is at an exciting tipping point. New technologies are finding their way into everyday construction in a multitude of ways, and they are making the industry more efficient and profitable. Companies are starting to create new uses for RFID sensors to better monitor and control material on-site, making the project more streamlined and efficient. Video is used to evaluate techniques and provide informative feedback to the user on equipment handling and material control.

In an industry that has essentially performed the same way for 100s of years, we're on the verge of a technological boom that is taking the industry to a better, more precise and more productive future. [XIT](#)