

Construction Safety as a Process of Inquiry and Observation: An Architect's View

JUNE 1 2013

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I am an architect because my father, an engineer who ran a construction company, took me to heavy construction sites throughout my childhood. Among the many things he taught me was that job sites were not like the rest of the world—different rules applied and I was expected to know them: I was expected to look out for myself, and most importantly, I was expected to be knowledgeable of how both the equipment and the work itself could create hazards that changed from moment to moment.

It is essential to consider how the young architect, often well trained theoretically, but not much exposed to the construction site, might today acquire an intuitive awareness of how building design and construction interact to create hazards. This knowledge is essential for the architect's own safety in visiting job sites, but it is also crucial to enable the architect to fulfill his or her responsibility to the public. The best way to acquire this knowledge is through job site visits with experienced mentors combined with a joy and alertness to engagement rather than avoidance of the unique knowledge of building performance that is created during the design process.

Architects need to apply and share technical knowledge related to safety

Architects are not responsible for job site safety nor should they be, after all, we only have to design the building and administer the construction process itself! However, as the leader of the design team the architect may be the only person on site who understands the nature of the subtle technical interactions between building design and construction practice that can change a situation from safe to hazardous in an instant. When, through our training, we notice such conditions, we have a moral responsibility to share this knowledge and provide information to contractor and owner employees. We cannot walk away from hazardous situations that we alone may have the knowledge and training to understand. A few examples illustrate the breadth of our knowledge and potential to contribute:

Earthwork: Soils and excavations are a constant source of hazard. The collapse of trenches and retaining walls occurs with alarming regularity. Architects should have enough basic knowledge of soil and site work to be able to understand excavation safety issues. Soils behavior is often dangerous because there is little or no warning of collapse. An otherwise safe embankment, for example, can collapse when the soil is overloaded by improper placement of equipment or construction loads.

- **Structural potential energy:** Most conventional structural systems give warning of failure—architects need to know these warning signs and also be aware of those structural systems that do not give these warnings most of which rely on tensile or brittle materials. Such designs may behave in ways that ordinary workers would not expect. Architects should understand these conditions adequately to protect both themselves and offer warning if necessary. The Kansas City hotel balcony collapse could have been avoided had someone with adequate knowledge looked with a critical eye at the shop drawings and understood the non fail-safe behavior of the deadly detail.
- **Passive systems:** In many buildings safety systems are passive in nature—fire rated partitions with smoke seals, drainage overflows to prevent roof deck failure, etc. – architects should understand these systems and be alert to their presence or adequate functioning at different times during construction. If they are not built correctly, they become a latent hazard that may only show up years later.
- **Construction loads:** Although the means and methods of construction are the responsibility of the contractor, the architect should have both the knowledge and motivation to understand the basic safety of the structure at each point in construction. Good designers habitually visualize the construction process to ensure constructability and desired performance. This gives the thoughtful architect an intuitive sense of safe construction that may be unique to a project team. The architect should be constantly observing and evaluating the behavior of the structure under the conditions on the construction site and comparing it to the design assumptions. If, for example, a heavy roof top mechanical unit is installed on a steel frame that is just temporarily bolted, that should be enough to set off appropriate inquiries as to its stability. The architect (or engineer) may be the only one in a position to notice that a different sequence of erection is being employed from that contemplated by the designers. This may be perfectly safe, but the question should be asked.
- **Listening:** Designers on site are in a position to hear the opinions of those not in the official feedback loop. These opinions should be respected and evaluated. Workers at the Hartford Arena were said to have raised a red flag, only to be told by the designers that their concerns were not important – after all the space frame (that would later collapse just after a capacity crowd left the building) had been

designed by a computer! Structural engineer William LeMesurier told of how his realization of the inadequacy of the original construction of the Citicorp tower only came to him through a chain of conversations that was initiated by a student's question.

- **Emergency Situations:** Large buildings have increasingly complex and active life safety systems. Architects may possess the knowledge and training to advise emergency service workers on how to employ these systems in fighting fires or other emergency situations. In Philadelphia's Meridian high rise fire, for example, the severity of the fire and the loss of life occurred in part because neither the fire department nor any representatives of building management could make the safety systems of the building perform properly during the fire. There were failures of the standpipe system, the electrical system, and the fire pumps that worsened the situation. Both the architect and the engineer have presumably designed the life safety elements of the building, and should therefore, be in an excellent position to offer advice on how to deploy these systems in unexpected or unusual situations.
- **Natural Disasters:** The AIA has since 1972 recognized the valuable role that architects can play during and after natural disasters. Charles Harper FAIA and Lawrence Millelo FAIA have edited a manual on disaster assistance that provides an exemplary structure to the daunting tasks faced by trained professionals in these situations.

The architect is, thus, uniquely situated in the building process by to create, understand, and disseminate project-specific knowledge that can contribute to buildings that are both safe to build and safe to be in.

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