

## Design the Hazards Away Prevention Is the Cure

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Simply realizing something needs to be done is not the way to fix it. At times, one must try repeatedly to reach one's goal. The traditional methodology for addressing safety for facilities, machines or products is for owners, architects, engineers, consultants, contractors and vendors to complete the design, engineering, construction or fabrication of a project based on past knowledge, experience and training. Safety, however, has typically not been among the skills required of all project participants.

### The Problem

The norm has not been to consider at the conceptual stage the safety of the people performing site work, construction, maintenance, fabrication, operation and decommissioning. Rather, each party has been left to consider and create an individual safety strategy for its portion of the project activity. The focus of identified safety hazards remains on how the exposed worker can abate or avoid the hazard rather than how the design team, during the design stage, can eliminate the creation of that hazard or provide a safe work process.

As safety professionals, our mantra should be nothing less than *sustainable safety*, which can be defined as integrating safety methods throughout the life cycle of a project, process or machine. A key element to sustainable safety is the ability to identify and address foreseeable hazards and integrate an effective countermeasure. So why do the commonly used statistics from the U.S. Department of Labor paint such a bleak picture?

- Yearly, 2.8 million people are injured at work.
- Monthly, 64 people die in construction-related incidents.
- Weekly, disabling injuries cost employers more than \$1 billion.
- Daily, 12 people die on the job.

According to OSHA, fall protection was the most-cited violation in FY2013. Currently, OSHA lists the top 10 most-cited violations as:

- 1) 1926.501: Fall Protection
- 2) 1910.1200: Hazard Communication
- 3) 1926.451: Scaffolding
- 4) 1910.134: Respiratory Protection
- 5) 1910.305: Electrical, Wiring Methods

- 6) 1910.178: Powered Industrial Trucks
- 7) 1926.1053: Ladders
- 8) 1910.147: Lockout/Tagout
- 9) 1910.303: Electrical, General Requirements

10) 1910.212: Machine Guarding  
If a work activity is listed in the top 10 most-cited standards, it means workers, employees and/or people are being put in harm's way. The work associated with much of this list is directly associated with the requirements passed down by the project's owner and design professionals. Not addressing hazards up front, that is, during the project concept stage is placing the burden of safety countermeasures on contractors and maintenance personnel—who, as noted, still face significant hazards. This safety strategy is not sustainable safety.

### The Solution

For the hazards to be eliminated, the entire building construction and maintenance process must be considered. Design professionals have a duty to design safety for each worker into every phase of every building project, from construction to maintenance. Owners, employers and safety professionals have the ability to stop paying for hazards by requiring that design professionals design out hazards with the same professional attention given to the technical detail as they would to designing or planning the building project.

Certain industries such as window washing, amusement parks and demolition have taken or are taking steps through consensus standards and laws to force safety to be addressed earlier. The terms *prevention through design*, *construction hazards prevention through design* and *sustainable safety* have a commonality in that each addresses the need for a new approach to design out hazards.

The problem with the solution rests in the fact that design professionals:

- 1) are not trained to recognize hazards;
- 2) feel they would be dictating ways and means that could expose them to greater liability;
- 3) do not think they have a legal, regulatory or contractual requirement to assess their designs for created hazards.

Currently in the U.S., the only thing policing the industry is litigation, or the

fear of litigation. Consensus documents from ANSI and ASSE address this issue, but these are not laws. An official statement from American Society of Civil Engineers (ASCE) reiterates that design engineers have a responsibility for:

... recognizing that safety and constructability are important considerations when preparing construction plans and specifications; and providing through the specifications that the design or details of critical elements of temporary construction, erection and lifting schemes, complicated form work and scaffolding be prepared by a professional engineer. (ASCE, 2012)

Prevention is clearly the cure. But what prevents owners from providing a sustainable hazard-free work environment in which employees can be confident that they will go home from work in the same condition as they arrived?

### Designing Out Construction Hazards

At the center of the discussion is the construction industry, which is traditionally burdened with the task of assessing and addressing hazards created by others' design. The increased focus on protecting that industry from the failure of design professionals to keep workers' safety in mind is understandable, considering that 18.5% of all worker fatalities are in construction and the construction industry accounts for 7% of the U.S. workforce but 21% of fatalities.

The OSHA Alliance program spawned a Design for Safety Workgroup that created the Prevention Through Design, Design for Construction Safety website ([www.designforconstructionsafety.org](http://www.designforconstructionsafety.org)). It clearly explains why PTD is important in construction: "The injury and fatality rates in construction are so high that all parties—including owners, design professionals, contractors, subcontractors and material vendors—must proactively attempt to reduce injuries to the extent that is feasible for them." It continues:

Although typical contract terms clearly state that designers are not responsible for the safety of construction workers, nearly all designers would feel an ethical obligation to take action to prevent a serious injury to a construction worker if the hazard was imminent and obvious

to the designer. Shouldn't designers feel a similar ethical obligation to take reasonable actions to prevent injuries that are not as imminent or obvious?

Designers already address several life safety issues such as earthquakes, fires, wind, snow, terrorism and other code-required design criteria. These design criteria have evolved throughout the years in direct response to new and continually updated information. Past failures in any of these life safety issues prompts the design community to reassess how those issues were considered and what future actions should be codified. Those issues are addressed by design so that incidents like the Northridge earthquake collapses, the Chicago fires or school gym roof collapses from too much snow don't happen again.

Therefore, design professionals' responsibility for project constructability and how that directly affects safety should be addressed. To do this, we need to increase the level of safety

experience of all participants involved in the design phase.

An example of designing out a hazard during the design phase is an architectural spire that was specified to project approximately 30 ft above a building's roof level. This height triggered an FAA requirement for installation of a light at the top of the spire. The architect hired a structural engineer from STE Inc. with extensive safety experience and discussed several options for safely accessing the light, ranging from vertical lifeline systems to hidden ladders and platforms—along with each option's pros and cons for safety and architectural acceptance.

As the discussions progressed, other design team members joined the discussion—several with little or no experience in safety—and the available countermeasures crept lower and lower on the hierarchy of controls, thus becoming less and less sustainable. At one point in the process, it was determined that the

solution was to “require the work to be performed by an outside contractor so that owner liability was limited.”

Finally, it was determined that the best solution meeting the requirements of sustainable safety was to incorporate a separate rooftop pole in another area of the roof that was just a little taller than the spire. This pole would be hinged at the bottom allowing it to be laid down so the light could be safely accessed at the roof level.

Including this level of involvement from experienced safety design professionals is not typical for most projects. The current pressure for achieving the goal of designing out the hazards remains the threat of litigation or contractual requirements.

### Industries Are Designing Out Hazards

The window washing industry is a prime example of an industry that is designing out hazards. That industry's anchorage design requirements and the specific guidance that was written into ANSI A120.1-70, Safety Code for Powered Platforms for Exterior Building Maintenance, was adopted by reference by OSHA.

Specific sections of the U.S. Navy have detailed requirements that outline what every contractor and design professional must take into account for each new project in order to design out the hazards.

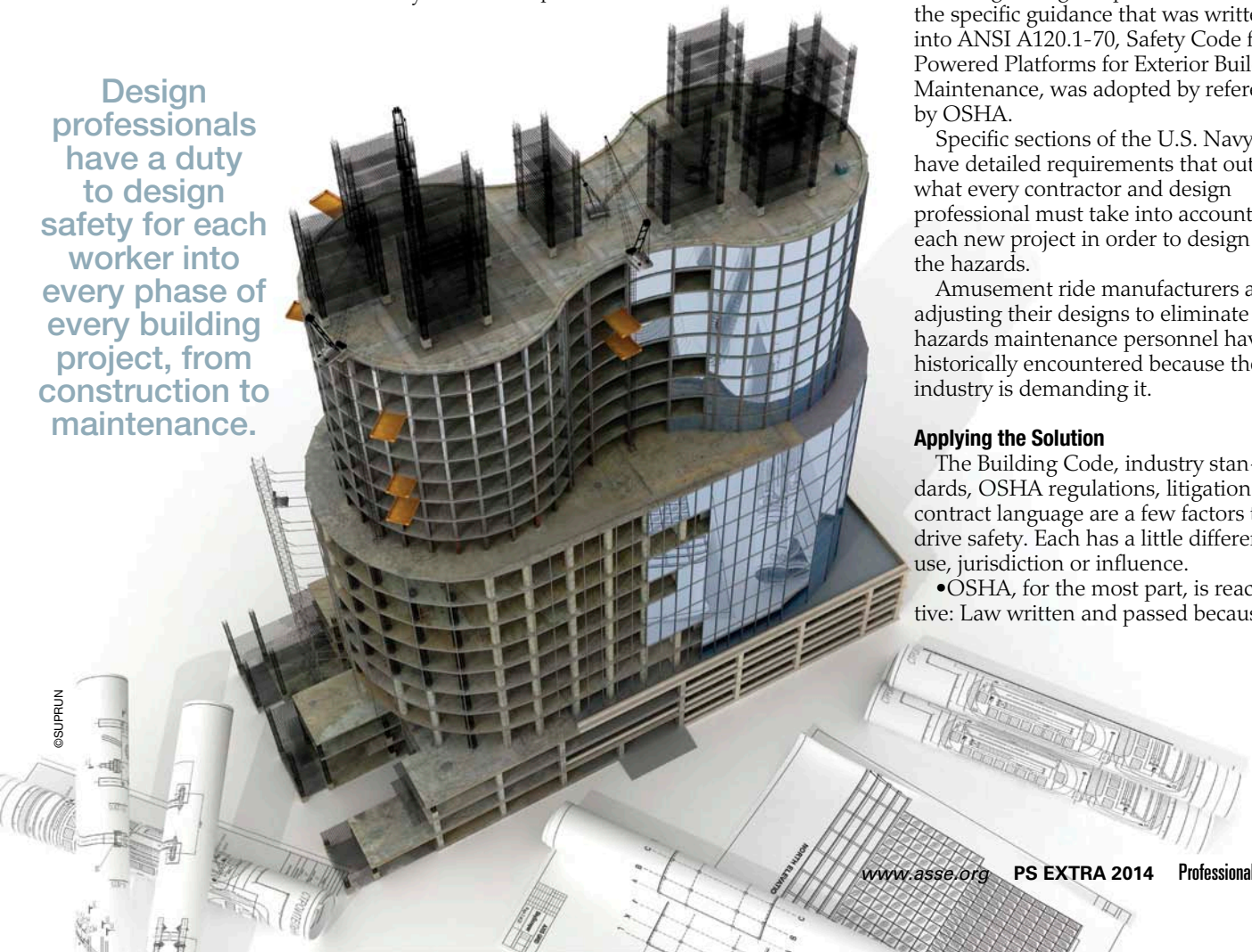
Amusement ride manufacturers are adjusting their designs to eliminate the hazards maintenance personnel have historically encountered because the industry is demanding it.

### Applying the Solution

The Building Code, industry standards, OSHA regulations, litigation and contract language are a few factors that drive safety. Each has a little different use, jurisdiction or influence.

- OSHA, for the most part, is reactive: Law written and passed because

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enough injuries and fatalities occurred to justify saying “you cannot operate in this manner anymore.” It is the minimum standard for protecting employees from hazards.

- Architectural and engineering professionals use the Building Code to create safe structures and facilities. Similar to OSHA regulations, much of the code is based on trial and error. Failed structures are analyzed to discover why they failed, and the code is then updated accordingly.

- Industry consensus standards provide the agreed manner of operation or best practices within a particular industry. Sometimes OSHA adopts standards by reference and sometimes they are referenced in a general duty clause citation.

- Contractual language can be the factor on which many owners have the most influence to prevent hazards before they own them. Purchasing power can change an industry.

- Litigation can create incentive for manufacturers and design professionals to correct or address potential hazards but remain uncitable by OSHA. Often, litigation paves the way for development of consensus standards.

If given the option, why would we continue to purchase new hazards? The power of the purse goes a long way when change is desired. Industry leaders are stepping up and require manufacturers and designers to supply products or services that provide detailed instructions or engineered protection from hazards.

To influence our own industries, we must change the current design professional culture to address safety as an inherent part of the project—not as an afterthought. Challenges to implementing this sustainable safety mind-set can be summarized as:

- 1) Design professionals are not trained to recognize hazards. It is true that the pool of trained design professionals is not large. But some individuals can review drawings in the design phase to identify potential hazards. Sometimes incorporating the safety department into the design phase is enough to make sure that known hazards are not purchased again.

- 2) Design professionals feel they would be dictating ways and means that could expose them to greater liability.

The contracts should be written in such a manner as to spur on designing out the hazards without making the design professionals feel that they are taking over the duties of the safety department.

- 3) Design professionals do not think they have a legal, regulatory or contractual requirement to assess their designs for created hazards. As discussed, ANSI and ASCE have verbiage that states that design professionals should perform this task and companies should require in their contracts that foreseeable hazards be designed out.

Sustainable safety provides a safety strategy to the design team, owners and managers for incorporating continuous employee safety into designs, products, educational programs and services. Certified building planners, design engineers and design architects have become aware of and consider, at the conceptual stage, the safety of the project’s construction, maintenance and operation personnel and their equipment as they create their projects. Sustainable safety certified building

managers will have clearly defined policies and safety procedures established, implemented and enforced throughout the project life cycle.

These certified planners, engineers and architects will meet the sustainable safety requirements of a safe workplace with all known and foreseeable safety hazards eliminated or controlled for each of the project’s functions and required work activities. This will establish a sustainably safe culture for future personnel.

Owners, employers and safety professionals must contractually require design professionals to learn and incorporate sustainable safety design principles into every project or facility. Once preplanning to design out the hazards is implemented at the design phase, the direct result will be a drastic reduction in serious injuries.

## References

**American Society of Civil Engineers (ASCE).** (2012). Construction site safety (Policy statement 350). Retrieved from [www.asce.org/content.aspx?id=8544](http://www.asce.org/content.aspx?id=8544)

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