

Safety In Design Practices: Comparison Between The U.S. And Abroad

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Safety in Design is an effort made in the design phase of a construction project to consider the safety of workers who will be constructing the project. It is a structured process in the planning and design phases of the project. In the United States, such a focus on worker safety in the early stages of a project is neither a part of the traditional aspects of design nor a part of the traditional aspects of construction safety practices.

Rather, the focus of designers is on the safety of the end users of the facility: Its occupants, maintenance personnel, and the public who utilize the facility, and not the worker who builds it. Construction safety requirements fall primarily on general contractors and subcontractors. The safety emphasis is on the means and methods practiced in the construction phase.

In other countries, effective ways of addressing construction safety, in addition to proactive safety management during construction have been pioneered and implemented. The objective has been to improve construction safety by making the working environment safer before construction begins.

The United Kingdom and Australia are two countries that have aggressively taken the lead to regulate and implement Safety in Design. They have enacted laws, rules, and regulations that require the designer to proactively design for safety, and in developing best practices models for designers to use to incorporate into design. For example, in Australia, health and safety law and supporting guidelines for industry practice have been established, requiring designers to ensure health and safety in design and construction of buildings, facilities, and infrastructure. Professionals in design, and others including the owner, and the developer, are all under the jurisdiction of Australia's Occupational Health and Safety Laws. The laws require a process of interaction between designers and the end users, manufacturers, suppliers, and contractors.

In the UK, the Construction Design and Management Regulations of 2007 (CDM) require every designer preparing a design for construction to "avoid foreseeable risks to the health and safety" of workers on construction projects. Designers are required to incorporate regulatory requirements that address hazards created by design when a construction process is being specified and provide safer alternatives. In order to do this, UK designers must identify prohibited practices, such as the lifting of loads over a large radius, or painting steelwork on site, exposing workers to toxic vapors.

Designers are also required to assist contractors in meeting safety requirements through safety policies. These include, for example, the provision of holes in steelwork to anchor lanyards, lifting points in precast or preassembled panels, and use of lightweight blocks. Despite these successes in the UK, there has been resistance to compliance. Certainly the added cost associated with compliance and the need to cut costs and meet schedules is one reason for this. Also the Health and Safety Executive (HSE), which is similar in many respects to Occupational Safety and Health Administration, has been underfunded to enforce these requirements. A rise in fatalities in the UK from 2005/2006 to the following year and inspections by the HSE that identify non compliance in one of three work sites inspected indicate that even abroad, Safety in Design has more distance to travel.

The implementation of Safety in Design is likely to be a part of the evolution of the construction industry in the United States. Much like the embracing of Green Construction, which has taken many years to take hold, Safety in Design is a concept whose time has come.

Safety in Design is highly complementary to Green Design principles. Both concepts speak to a choice of processes in engineering and architectural design that lead to safer and healthier environments. The Green Design movement has been slow in its implementation but is now gaining momentum. Similarly, Safety in Design has gotten off to a slow start, but there are signs that the movement is growing. It stands to reason, because Safety in Design not only reduces accidents and illnesses, but is cost effective. In the United States, Safety in Design is in the early stages.

A review of the literature on the subject of Safety in Design shows that there are only a handful of design firms that will even take credit for performing Safety in Design functions. As costs of litigation and liability insurance increase, along with the concern for construction worker safety, there is recognition that improved safety can improve worker productivity and the quality of construction. Why the resistance? The current notion is that liability should remain in the province of the general contractor. The general contractor is rewarded for the risks it takes. The design community fears that the embrace of Safety in Design will increase their professional liability. There is great reluctance for American architects and engineers to interfere with, recommend or suggest construction means and methods to contractors, and great reluctance by contractors to accept them. This is because it goes against the culture, custom, and norms of the practice of construction in the United States.

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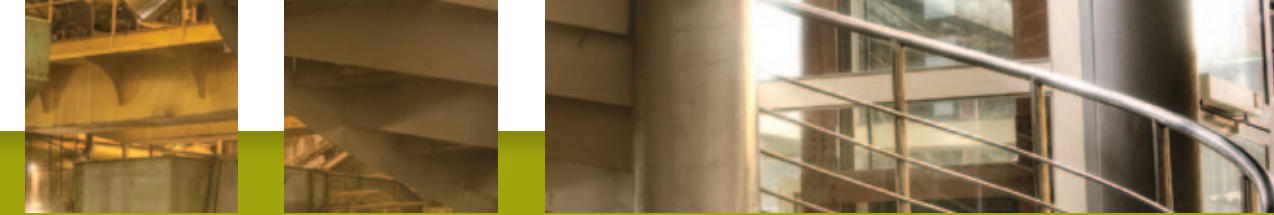
The construction contract documents published by the industry and used by owners, and even the OSHA regulations, reinforce the notion that safety is squarely in the province of the general contractor and not the designer. OSHA clearly establishes the role of contractors in providing safe work conditions and practicing OSHA standards. A review of OSHA regulations show that OSHA standards addressed such operations as scaffolding, material hoists, hazardous locations, cranes and derricks, and protective systems, but defined the role of the professional engineer as an inspector or designer for the contractor, providing no role to perform prevention through design services before the start of construction.

There are encouraging signs that Safety in Design is beginning to take root in the United States. For example, the American Society of Civil Engineers has entered into discussions with OSHA to improve construction worker safety, which could directly involve design engineers in the process at a future time. A key initiative is to develop model safety programs that can be used by engineers and architects in their designs, such as already exist in the UK and elsewhere.

The U.S. Department of Energy has taken concrete steps to incorporate safety into the design phase for nuclear power plant facilities. For example, a project at Los Alamos serves as a model for Safety in Design. During the design of a recent project for a chemistry and metallurgy research facility, many aspects of safety were integrated into the design phase. This was done by identifying and addressing safety issues on a daily basis through the interface of designers and safety professionals, and further supplemented by monthly formal design meetings and safety committee meetings for review and debate of issues identified and means to resolve them.

Another DOE project undertaken by the Washington Group International (now the Washington Division of URS Corporation) that serves as a model was a design build project for an advanced mixed waste processing facility. A core mission was to integrate safety input into the design, engineering, and planning stages of the project. The firm believed that designing for safety in the engineering phase would have a great impact on safety during construction of the project and later on in the operation of the facility. Thus, safety measures were built into the design, construction, operations, and future decommissioning and demolition stages. A formal process was developed to identify ideas that would enhance safety. Design managers incorporated safety concepts early in the design. These inputs were reviewed for their appropriateness and effectiveness by other team members. During construction, design took into account hazards of electric shock, confined space, fire, toxic substances, vehicle traffic, falls, and rigging for heavy lifts. On the operational side, some of the Safety in Design measures included the design of a waste handling system that would be remotely handled by operators.

Safety in Design cannot be successfully implemented without the participation of the Construction Manager. When we think about constructability reviews we associate these reviews with the incorporation of our knowledge and expertise in practical construction methods and incorporating this into the design process. The goal is to produce a project that is cost effective and buildable. Why not take this to another level by incorporating design and constructability review for safety?



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This does not only mean ensuring that design documents address the permanent facility's safe operation, but also allows for construction site safety to begin at the start of construction for the protection of the trades, general public, and other parties in proximity of construction sites. The following constructability safety review criteria simply illustrate how constructability review by Construction Managers can incorporate a review for safety during construction:

- Ensure that the design provides for tie-off points for attaching lanyards and other fall protection devices.
- Ensure that the floor perimeter beams and beams above floor openings are designed to support lanyards.
- Ensure that the contract drawings identify which beams are designed to support lanyards, how many lanyards, and at what locations along the beams.
- Ensure that permanent guardrails are designed to be installed around skylights.
- Recommend domed, rather than flat, skylights with shatter-proof glass or strengthening wires.
- Recommend design of skylights to be installed on a raised curb.
- Recommend that upper story windows be designed to be at least 1.07 m (42 in.) above the floor level, and that the window sills act as guardrails during construction.
- Recommend design of roof parapets at 1.07 m (42 in.) high to eliminate the need for additional guardrails.
- Recommend design of building components that can be prefabricated and installed as assemblies rather than as individual pieces at height.

We are slowly beginning to embrace Safety in Design. The embrace of safety has taken time, but just think of the strides that have been made since the early 20th Century. When the Hoover Dam was constructed, more than 120 workers were killed, and this was an acceptable cost of construction. When the Verrazano Narrows Bridge was being constructed, there were no safety nets until three workers fell to their deaths and a work stoppage forced change. There is growing evidence that the domestic construction industry is becoming more aware and more receptive to safety and health requirements on the job. This awareness is not only motivated by the concern for the well being of the construction workforce. Increasing costs associated with accidents and illnesses, lost productivity, and legal liability have combined to increase awareness. **CM**

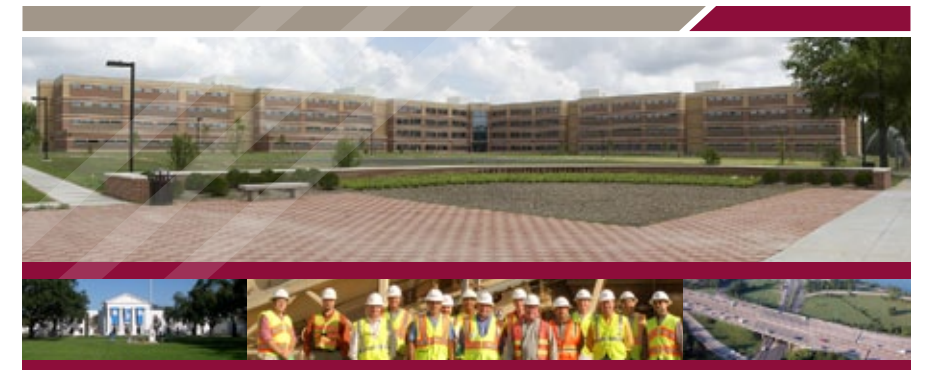


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