

Designer's Liability

Why Applying PTD Principles Is Necessary

By Ali A. Karakhan

Prevention through design (PTD), also known as design for construction safety, is the concept of protecting construction workers who build the designs by addressing their safety through the design process. Toole and Carpenter (2011) define PTD as "safety constructability." PTD is not related to managing safety of construction sites during construction, rather, its steps should only be conducted during the design phase of constructing a facility, whether by addressing safety in the design explicitly or by communicating hazards to contractors that cannot be reduced or eliminated.

PTD can have a significant influence on construction projects by reducing the number of injuries and fatalities. PTD is the most effective way to eliminate hazards associated with construction activities as shown in the hierarchy of controls (Figure 1, p. 54). The hierarchy of controls is defined by Tymvios (2013) as "a means to understand the importance of considering safety early in the life-cycle of a project." Figure 1 clarifies the five levels of control:

- 1) elimination;
- 2) substitution;
- 3) engineering control;
- 4) administrative control;
- 5) PPE.

Consider a typical example of a guardrail on a multistory construction building. Guardrails not only take a long time to install, but they also are not reliable. On a particular project, two fatalities occurred due to a broken guardrail on the seventh floor of the building during construction (CBC News, 2012). Conversely, guardrails can be installed using PTD concepts, for example, specifying

ing holes in steel frames at 21 and 42 in. above the floor slab so that temporary guardrails can be attached using cables. In this case, a guardrail is not needed; the cables can act as a guardrail. The design delivers several economic and safety advantages. It is:

- inexpensive;
- easy to design (minimal design effort);
- quick to install;
- safe to build;
- highly efficient.

Why PTD Targeting Design Process

The construction industry is one of the most dangerous industries in the U.S. Many studies have attributed the industry's high incident rate to the lack of safety input during the design stage. Design professionals focus primarily on end-user safety, and disregard the influence that their design has on worker safety during the construction process. Behm (2005) points out that 42% of the 224 fatal injuries in U.S. between 1990 and 2003 were associated with design errors. Similarly, more than 60% of construction injuries and fatalities between 1986 and 1989 in the U.K. were attributed to design decisions or lack of

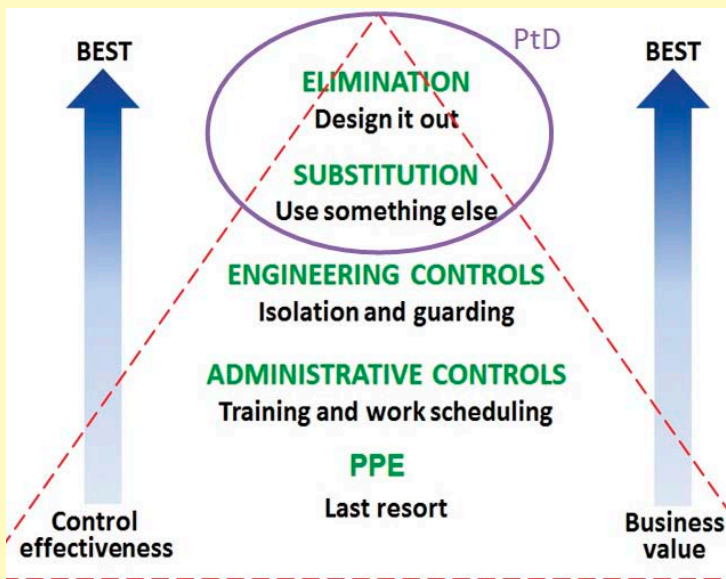
IN BRIEF

- Design professionals can be held liable for construction safety even though they do not show authority, demonstrate control or are not contractually obligated to address safety.
- Implementing prevention through design (PTD) on construction projects could help eliminate hazards associated with construction activities.
- Implementing PTD not only reduces construction incidents, but also yields great benefits for project parties relative to schedule, morale, constructability, cost and quality.

Ali A. Karakhan was a faculty member at University of Baghdad in 2012-13. He holds a B.S. in Building and Construction Engineering from University of Technology, and an M.S. in Civil Engineering from University of Baghdad. Currently, he is a Ph.D. student in the School of Civil and Construction Engineering at Oregon State University.

Figure 1

Hierarchy of Controls



Note. Adapted from “The State of the National Initiative on Prevention Through Design: Progress Report 2014,” by NIOSH, 2014, Washington, DC: Department of Health and Human Services, CDC, Author.

proper planning (Mroszczyk, 2015). In addition, from 1997 through 2002, poor design was the cause of 42% of work-related fatalities in Australia (Mroszczyk, 2015). Other studies revealed that 37% of workplace fatalities are attributed to design issues, and 22% of 226 injuries that occurred in Oregon, Washington and California between 2000 and 2002 were connected to design errors (Bach, 2014; Tymvios, 2013).

Incident causation models affirm these statistics. The Swiss cheese model, one of the most accepted theories in explaining the causes of construction site incidents, states that if not corrected, the same problem in different phases of the project leads to an incident. That is, incidents occur when the project team fails to detect the hazard in multiple stages of a project.

Because design is the first step in construction projects, preventing incidents should begin at that stage. Designers must start thinking explicitly about the safety and health of construction workers and PTD is the most effective strategy to do so because it eliminates the hazards altogether.

Historically, the responsibility for construction safety has been placed primarily on general contractors. It is worth mentioning that even OSHA places responsibility of construction worker safety and health primarily on contractors. Other organizations do the same, including American Society of Civil Engineers (ASCE) and American Institute

of Architects (AIA), which will be addressed later in this article.

Due to the increases of lawsuits, escalation of workers' compensation insurance and the negative impact of injuries on project time, cost and quality, owners have become more concerned about safety performance. Accordingly, they have taken steps to provide safer work conditions.

Generally speaking, U.S. design professionals have only been required to address safety of end users, and not the safety of construction workers, in their designs.

Design professionals typically do not participate in the effort to ensure construction site safety, yet they influence many decisions about how construction activities are performed. This has prompted many calls for designers to explicitly address safety throughout a project's life cycle, including the safety of construction workers.

Legal Perspective of PTD

In general, design professionals are not liable for safety precautions during construction under OSHA regulations. Wildman and Castelli (2004) indicate that engineers and architects can be held liable for a serious incident on a construction project if they demonstrate control, show authority during construction, act as an employer instead of an employee, or are contractually obligated to address safety, which is rarely the case.

Therefore, important questions include:

- Do design professionals have a legal immunity for construction site incidents?
- Are they always held nonliable for a construction site injury/fatality if they were not contractually obligated for safety during construction and did not show any authority or demonstrate control over construction workers?
- How does the law address these questions, and how do courts interpret the laws?

If courts have expressed a different opinion, then all these considerations are not valid, and design professionals should address construction site safety in their design not only because it is safer for construction workers, but also because it is more reliable for them in case of an injury. That is, if designers did their job diligently and addressed construction site safety in their design, they might not be held liable for construction incidents even when the designs are at fault as long as they did not demonstrate control according to the standard of care rule. In other words, design professionals are only required to provide professional services that other peers of the same occupation would typically provide in the same locality at the same time, and under similar circumstances and conditions (Hinze, 2011), regardless of the correctness of the design.

Accordingly, one might argue that designers do not need to address construction site safety because it is not a common practice, and most de-

signers do not do so. In that case, designers would never be held liable for construction incidents.

However, this is not a valid argument. Courts sometimes set the standard of care expected of design professionals. This was examined in *Holt v. A.L. Salzman and Sons* (1967), in which the architect's plans did not meet the standards that were set by the municipal code. A judgment against the architect was affirmed by the Supreme Court despite a peer testifying that the architect's plans represented "good architectural and engineering practice" and were in accordance with what was "customarily done in the construction of other buildings." The judge said, "Courts must in the end say what [standard of care] is required" (*Holt v. A.L. Salzman & Sons*, 1967).

Interestingly, AIA's code of ethics has not established any obligations related to the safety of construction workers. The commentary of rule 2.105 under canon 2 states (emphasis added), "[Taking action related to safety] extends only to violations of the building laws that threaten the public safety. The obligation under this rule applies *only to the safety of the finished project*, an obligation coextensive with the usual undertaking of an architect" (AIA, 2012). To explain, designers are solely responsible for the safety of end users, *excluding construction workers*. Similarly, ASCE's code of ethics is vague in terms of construction site safety. Canon 1 states (emphasis added), "Engineers shall hold paramount the safety, health and welfare of *the public* and shall strive to comply with the principles of sustainable development in the performance of their professional duties." The question is whether construction workers are considered part of the general public.

Globally, the use of PTD is widespread. Many countries have started to implement PTD in many different forms. Tymvios (2013) reports that many European countries began using PTD to curb the increasing number of construction incidents. Countries that have implemented PTD include Denmark, Sweden, Finland and France. Spain, U.K. and Australia enacted regulations to enforce the use of PTD in the construction industry. Countries such as Singapore and South Africa also have incorporated the concept of PTD in construction.

The U.S. is not one of these countries, as few design-build construction firms in the U.S. have adopted the concept of designing for construction safety. Why are some construction firms in the U.S. reluctant to use PTD? A complete answer to this question is beyond the scope of this article. In part, the reason may be that designers believe that if they participate in safety efforts, they might be held liable. Others suggest that U.S. construction laws are to blame.

Studies have shown that since the U.K. government mandated the use of PTD by enacting the Construction (Design and Management) regulations in 1994, the number of injuries and fatalities associated with construction operations have

significantly been reduced (Mendeloff & Staetsky, 2014). In the U.S., the lack of formal regulations and the increased liability concerns have hindered the effort toward designing for construction safety. Therefore, the lack of motivation for designers to be more engaged in the effort of construction site safety remains an issue.

Following is an examination of three legal cases that address the issue of design professionals' liability for construction site incidents.

Case Study 1: *Evans v. Green*

The legal case, *Evans v. Howard R. Green Co.* (1975), concerns two construction-related fatalities in 1967. Following are the project information and contractual relationships:

Project name and location: Water Pollution Control Plant for Cedar Rapids, IA.

Owner: City of Cedar Rapids.

Designer: Howard R. Green Co., an architectural and engineering firm.

Contractor: Dory Builders Inc., a construction firm.

Victims: Evans (superintendent) and Scholten (carpenter); both worked for Dory.

Background

The contractor (Dory) was working to improve a water pollution control plant in Iowa. Dory received the contract from the owner in July 1966. The designer, Green, is the architectural and engineering firm that developed the plans and specifications for the project prior to contracting with Dory. In September 1967, two workers, Evans and Scholten, died while they were working on the project as construction employees for Dory. The incident was associated with exposure to poisonous hydrogen sulfide gas.

The victims' estates filed a lawsuit against the design firm claiming that its designers did not address construction safety in their plans. The plaintiffs claimed that the design firm was negligent in preparing plans and specifications. The design firm claimed a contractual immunity for any incident associated with construction operations. The district court awarded compensation to the plaintiffs, and declared that the design firm should be indemnified by the contractor.

On appeal, the Supreme Court of Iowa held that the designer was liable, stating "Architects' duty of reasonable care was not suspended during the construction operation." The court also revised on Dory's appeal, stating that the designers had no right to be indemnified by the contractor since contractors are not responsible for design negligence (i.e., not addressing construction safety). It is worth mentioning that the design of the finished product adequately addressed the dissipation of the poisonous gas, but did not account for any control measures for such gases during the construction phase.



Designing for safety is the responsibility of all parties, including design professionals.

Argument

Green's argument is that an architect cannot be held liable for design negligence before the completion of the project. The plans and specifications were not made to eliminate hazards until the project was complete. In other words, designers are only responsible for the safety of end users. Green also claims that all safety precautions are solely the contractor's responsibility according to the contract. On the other hand, Dory claims that it had nothing to do with the defective design, and that it is not responsible to inspect or examine the plans and specifications made by the design firm.

The court relied on a previous decision made by a trial court (*McCarthy v. J.P. Cullen & Son Corp.*, 1972). The court states, "If defendant architect negligently prepared plans and specifications and if plaintiffs were thereby damaged, defendant architect—like everyone else—is responsible for the consequences of that negligence." At the end, the jury announced that the designer had been negligent about its design and, therefore, Green should be responsible for the settlement claims. Thus, Green is wrong in claiming that the designers' duty for safety precautions are only valid after construction operations.

Final Decision

The court ruled that the designer (Green) was liable for a construction site incident. The court also added that the settlement claims are taxed to the designer who had no right to be indemnified by the contractor (Dory).

Case Study 2: Mallow v. Tucker

The following summary describes *Mallow v. Tucker, Sadler and Bennett, Architects etc., Inc.* (1966), in which a construction worker died after an electrical shock. The worker was jackhammering in the ground relying on the designer's drawings. Suddenly, the jackhammer broke into a high-voltage cable line causing a site fatality.

The victim's family filed a lawsuit against the design firm accusing it of negligence because it failed to show the high voltage transmission line

on the plans. A trial court found the designer liable for not addressing safety of construction workers in the design drawings prepared for construction. Even though the architect appealed the decision, the Court of Appeals of California insisted that the designer should have addressed safety of construction workers in the plans prepared for construction (Behm, 2004).

Case Study 3: Frampton v. Dauphin

The court in *Frampton v. Dauphin Distribution Services Co.* (1994) tried to answer the following question: "Does an architect who has been hired to prepare construction drawings and a foundation design for a proposed warehouse have a duty to warn construction workers of the presence of an existing, overhead power line?"

In this case, two construction employees were involved in an incident while installing metal siding on a building during the construction phase. While maneuvering scaffolding around the corner of a building, two workers came in contact with an overhead power line. One worker was injured; the other was electrocuted. The injured worker brought an action against the designer (Dauphin) claiming that it was negligent in failing to take appropriate action to address the danger, or to warn the workers of the overhead power line involved in this operation.

Since the designer was not responsible for safety either by contract or actions, the Superior Court of Pennsylvania ruled in favor of Dauphin, contending that the designer "had no superior knowledge regarding the location of the electric line" and therefore was not liable. The electric power line was above the ground, and readily visible to all workers on the job site. Even though the designer was not liable for worker safety, he could have been held liable if the danger was not visible to the contractor and his employees. The case description indicates only one difference between this case and *Mallow v. Tucker*, implying that designers should always address a construction hazard if they are aware of it, especially when it is not readily observable to construction employees.

Conclusions Based on Court Decisions

Based on the earlier discussion, it is reasonable to say that designers were questioned seriously by courts with regard to their involvement in worker safety. ASCE (2006) indicates that engineers are responsible for the safety of the general public. Toole (2011) points out that a common interpretation for the term *general public* is almost always the safety of occupants of a building rather than construction workers. However, the contractor's employees in *Evans v. Green* and *Mallow v. Tucker* were considered part of the general public.

It is possible that design professionals would be held liable even though they did not demonstrate control or show authority regardless of whether standard forms of agreement by professional organizations, AIA's code of ethics and contracts might state that architects are solely responsible for the safety of the end users. Thus, the author believes that designing for safety is the responsibility of all parties, including design professionals.

However, in reality designers are not always held responsible for construction safety. In many cases, courts faced a real dilemma, which caused conflicting decisions between trial courts and supreme courts. *Hanna v. Huer, Johns, Neel, Rivers and Webb* (1983) involved two steel construction workers who were seriously injured due to a steel tie joist failure. At first, Sedgwick District Court in Kansas found the defendant architect, Huer, negligent and, therefore, liable for the construction site incident even though neither contractual obligation regarding safety, nor supervisory role was found to exist.

Huer sought review of the decision and appealed the trial court's judgment. The Supreme Court of Kansas reversed the judgment and ruled in favor of Huer, contending that there is nothing on record that could support a finding that Huer was liable for two work-related injuries that occurred on the construction site. Interestingly, the state's supreme court also stated that if the designer had "actual knowledge" of the hazard, he must have taken an action, implying that addressing construction site safety is required by designers whenever a hazard is foreseeable. A similar dilemma was encountered in *Shepherd Components Inc. v. Brice Petrides-Donohue and Associates Inc.* (1991).

One might argue that by participating actively in an effort to address construction site safety, designers would become more liable for construction injuries. This is a common perception in the industry, yet it is not necessarily true.

Construction incidents are one of the main reasons behind lawsuits and litigations. Accounting for construction worker safety would help decrease injuries and, thereby, litigations regarding occupational injuries would decrease as well. In fact, owners and designers who are proactive and participate in the effort to eliminate risk associated with construction operations actually reduce their liability (Hinze, Godfrey & Sullivan, 2013).

However, as noted, design professionals are not typically held liable for construction site safety. The courts have ruled inconsistently regarding this issue. That is, the courts have made sharply conflicting decisions when confronted with similar cases that involve construction site incidents with regard to the architect's liability and whether the architect is negligent. One clear rule is that designers are responsible for addressing workers' safety as long as they have actual knowledge of hazard prior to construction.

To avoid such liability and dilemma, architects and designers can implement PTD principles. PTD is not about specifying means and methods; rather, PTD's main goal is to create different designs that are safer and easier to build on the job site, or communicate the hazard to contractors if eliminating it is impossible.

Other Motivations for Applying PTD

In addition to the economical and safety benefits of PTD, ethics should also motivate designers to implement PTD in their work. Ethics play an important role in enhancing reputation and reinforcing professionalism. Many organizations have started to turn their eyes to construction site safety. ASCE (2012) states, "ASCE believes improving construction site safety requires attention and commitment from *all parties* involved" (emphasis added). It also states that designers should have the responsibility for considering *safety* when they prepare *construction plans* and *specifications*. As a result, it would not be surprising if a court sets ASCE's Policy Statement 350 as the appropriate standard of care that designers should follow, as the judge in *Holt v. Salzman* (1967) stated that courts must decide the appropriate standard of care. Yet, ASCE's Policy Statement 350 has not been broadly adopted in the construction industry.

Furthermore, not addressing construction worker safety explicitly might represent an issue of social equality. Conventionally, designers are not asked to address safety of construction workers. However, they have been mandated to ensure that the safety of future building occupants is met. This raises a question of social equality and fairness.

In other words, the trend that designers are required to address the safety of some groups (e.g., occupants) explicitly, while not required to explicitly address the safety of others (e.g., construction workers) does not sound fair. This might be inconsistent with the Equal Protection Clause that is a part of the 14th Amendment to the U.S. Constitution. The clause states that no individual/group should be denied the equal protection of the laws. This might also be inconsistent with the Civil Rights Act of 1866, which guarantees equal rights to all citizens of the U.S. As a consequence, validating social equality and providing fair treatment could be another motivation for applying PTD.

Finally, sustainable development is another compelling reason to apply PTD throughout the construction industry. Sustainable designs and green buildings have received considerable attention over the past few decades. Sustainability is a holistic view that must encompass environmental, economic and social considerations, the three pillars of sustainable development.

In construction, however, attention has only been brought to economic and environmental aspects of sustainability (Hinze, et al., 2013). Social equity has been left out. Construction workplace safety and health has been found to be an essential element of social sustainability, and, therefore, it might be argued that there is no real sustainability unless social factors are addressed. Recently, PTD has been incorporated into the USGBC's LEED rating system as a pilot credit to address safety throughout a project's life cycle.

Conclusion

Even though the literature has shown that designers might choose not to address construction site safety in their designs because of liability concerns, the case studies revealed that design professionals have no legal immunity and can still be held liable for construction site incidents even if they were not responsible either by contract or by course of action. Courts might not take into consideration what OSHA regulations and professional codes of ethics state as long as there is a negligent behavior or design resulting from the lack of addressing construction site safety in the design process.

Beyond liability concerns, professionalism, ethics and sustainability are other important motivations of designing for worker safety and health. Therefore, it is recommended that design professionals explicitly consider the safety and health of construction workers by applying PTD principles as they make design decisions on a facility's permanent features. This will not only eliminate hazards associated with construction, but also positively influence project constructability, cost, quality and schedule. **PS**

References

American Institute of Architects. (2012, September). Code of ethics and professional conduct [PDF]. Retrieved from www.aia.org/aiaucmp/groups/aia/documents/pdf/aiap074122.pdf

American Society of Civil Engineers (ASCE). (2006, July 23). Code of ethics. Retrieved from www.asce.org/code-of-ethics

ASCE. (2012, July 12). Policy statement 350: Construction site safety. Retrieved from www.asce.org/issues-and-advocacy/public-policy/policy-statement-350---construction-site-safety

Bach, J. (2014). The national initiative for PTD. Retrieved from NIOSH website: <https://nanohub.org/resources/21945/download/2014.11.04-Bach-NIOSH.pdf>

Behm, M. (2004). *Establishing the link between construction fatalities and disabling injuries and the design for construction safety concept* (Unpublished doctoral dissertation). Oregon State University.

Behm, M. (2005). Linking construction fatalities to the design for construction safety concept. *Safety Science*, 43(8), 589-611. doi:10.1016/j.ssci.2005.04.002

CBC News. (2012, Oct. 26). 2nd death confirmed at Fortis construction site. Retrieved from www.cbc.ca/news/canada/newfoundland-labrador/2nd-death-confirmed-at-fortis-construction-site-1.1179765

Evans v. Howard R. Green Co. (1975). Supreme Court of Iowa, 231 N.W. 2d 907.

Frampton v. Dauphin Distribution Services Co. (1994). Superior Court of Pennsylvania, 648 A. 2d 326.

Hanna v. Huer, Johns, Neel, Rivers & Webb. (1983). Supreme Court of Kansas, 233 Kan. 206, 662 P.2d 243.

Hinze, J. (2010). *Construction contracts* (3rd ed.). New York, NY: McGraw.

Hinze, J., Godfrey, R. & Sullivan, J. (2013). Integration of construction worker safety and health in assessment of sustainable construction. *Journal of Construction Engineering and Management*, 139(6), 594-600. doi:10.1061/(asce)co.1943-7862.0000651

Holt v. A.L. Salzman & Sons. (1967). 88 Ill. App. 2d 306, 232 N.E.2d 537.

Mallow v. Tucker, Sadler & Bennett, Architects etc., Inc. (1966). Civ. No. 7933. Fourth Dist., Div. One.

McCarthy v. J.P. Cullen & Son Corp. (1972). Supreme Court of Iowa, 199 N.W.2d 362.

Mendeloff, J. & Staetsky, L. (2014). Occupational fatality risks in the U.S. and the U.K. *American Journal of Industrial Medicine*, 57(1), 4-14.

Mroszczyk, J. (2015, June). Improving construction safety: A team work. *Professional Safety*, 60(6), 55-69.

NIOSH. (2014). *The state of the national initiative on prevention through design: Progress report 2014*. Washington, DC: Department of Health and Human Services, CDC, Author.

Shepherd Components Inc. v. Brice Petrides-Donohue & Associates Inc. (1991). Supreme Court of Iowa, 473 N.W.2d 612.

Toole, T.M. (2011). Internal impediments to ASCE's Vision 2025. *Leadership Management in Engineering*, 11(2), 197-207. doi:10.1061/(asce)lm.1943-5630.0000120

Toole, M. & Carpenter, G. (2011). Prevention through design: An important aspect of social sustainability. *ICSDC 2011: Proceedings of Integrating Sustainability Practices in the Construction Industry* (pp. 187-195). doi:10.1061/41204(426)25

Tymvios, N. (2013). *Direction, method and model for implementing design for construction worker safety in the U.S.* Retrieved from Oregon State University Scholars-Archive@OSU. <http://hdl.handle.net/1957/41056>

Wildman, W.R. & Castelli, T.H. (2004). Minimizing liability for construction accidents through good contracting. *Journal of Professional Issues in Engineering Education and Practice*, 130(4), 306-310. doi:10.1061/(asce)1052-3928(2004)130:4(306)

Acknowledgments

The author thanks John Gambatese and Weston Wood for their invaluable comments while drafting this article.