

Key Findings from Research:

Design for Safety Techniques for Green Building Components

Reports and Authors:

Collective results of this study have been organized into three manuscripts, which have been accepted or are in review by the *Journal of Construction Engineering and Management*.

- **[Safety Risk Identification for High Performance Sustainable Building Construction](#)**
Bernard R. Fortunato III, Matthew R. Hallowell, Michael Behm, Katherine Dewlaney
- **Safety Risk Quantification for High Performance Sustainable Building Construction**
Katherine S. Dewlaney, Matthew R. Hallowell, and Bernard R. Fortunato III
- **Safety Risk Mitigation for High Performance Sustainable Building Construction**
Katherine S. Dewlaney and Matthew R. Hallowell

Overview:

The US Green Building Council's Leadership in Energy and Environmental Design (LEED) program represents the largest program in the United States for the measurement, verification, and certification of green buildings. A recent study found that LEED certified buildings have a recordable injury rate that is 9% higher than traditional, non-LEED buildings. This finding served as the impetus for the present study, which aimed to (1) identify and evaluate the safety and health risks associated with the design elements and construction management practices implemented to achieve LEED certification by conducting eight detailed case studies; (2) quantify the percent increase in base-level safety risk through 37 interviews with designers and contractors who had completed an average of four LEED projects and 100 traditional projects in their average of 18 years of experience in the architecture, engineering, and construction industry; and (3) identify and describe strategies that reduce the safety risk associated with the design and construction of high performance sustainable projects by conducting 26 additional interviews with experienced designers and constructors. The study revealed 12 LEED credits that increase safety risks on construction projects when compared with traditional, non-LEED alternatives. The study also revealed that there are feasible prevention through design techniques, technologies and controls, and management strategies that can be implemented to mitigate these risks. The results of the study were packaged into a first-generation decision support tool that provides designers and construction managers with safety suggestions for their LEED projects.

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Key Findings:

- Workers on LEED construction projects are exposed to work at height, with electrical current, near unstable soils, and near heavy equipment for a greater period of time than on traditional projects.
- Workers are exposed to new high risk tasks such as constructing atria, installing vegetated roofs, and installing photovoltaic (PV) panels that are not present on traditional projects.
- The most significant impacts are a 36% increase in lacerations, strains and sprains from recycling construction materials; a 24% increase in falls to lower level during roof work because of the installation of on-site renewable energy (e.g., PV panels); a 19% increase in eye strain when installing reflective roof membranes; and a 14% increase in exposure to harmful substances when installing innovative wastewater technologies.
- Designers and contractors identified prefabrication, effective site layout, and alternative products as methods to prevent injuries that specifically relate the hazards of each sustainable element.
- Specifying low VOC materials reduces health-related risks for construction workers who perform work in enclosed environments.

Conclusions:

- This research has revealed the substantial need for a detailed lifecycle analysis of the safety impacts of high risk and common sustainable building technologies. Although these technologies may have substantial environmental benefits, many have been shown to result in greater exposures to known occupational hazards during the construction process. Further research is needed to evaluate the safety risks during manufacturing of sustainable materials, shipping, installation, and maintenance.

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