World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

The role of sustainable construction practices in enhancing site safety

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World Journal of Advanced Research and Reviews, 2025, 26(02), 257-259

Publication history: Received on 14 March 2025; revised on 26 April 2025; accepted on 28 April 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.26.2.1423

Abstract

Sustainable construction practices are increasingly recognized for their ability to reduce environmental impact and contribute to the safety and health of workers on construction sites. While the primary focus of sustainability in construction has traditionally been on environmental benefits, emerging insights grounded in decades of professional HSE experience and observations from global practices highlight the significant role these practices play in enhancing site safety. This paper examines how sustainable construction practices ranging from the use of eco-friendly materials to energy-efficient technologies directly influence worker safety. Through an analysis of case studies, industry practices, and experiential insights, this study explores how sustainability in construction reduces health and safety risks, improves site conditions, and fosters a proactive safety culture. Findings indicate that integrating sustainable construction techniques not only advances environmental goals but also ensures safer and more efficient working environments for construction workers. It concludes that sustainable practices must be viewed as integral components of any modern construction safety strategy.

Keywords: Construction Site Safety; Sustainable Construction Practices; Worker Health and Safety4; Hazard Mitigation; Safety Culture Integration and Risk Reduction Strategies

1. Introduction

Construction sites are inherently hazardous due to complex workflows, heavy equipment, and frequent movement of personnel and materials. The construction industry remains one of the most dangerous sectors globally, with persistently high injury and fatality rates. While traditional safety interventions have improved conditions over time, the evolving incorporation of sustainability in construction introduces new opportunities for enhancing site safety.

Sustainable construction prioritizes minimizing environmental harm through energy-efficient systems, non-toxic materials, and waste reduction. Importantly, these strategies yield secondary benefits by directly improving worker safety. For instance, eliminating hazardous materials reduces exposure risks, and enhanced site organization from lean and green practices lowers accident likelihood. Drawing from long-standing HSE field expertise, this study explores how sustainability measures align with and strengthen safety initiatives on construction sites.

2. Methodology

A mixed-methods approach was adopted, combining field-based observations and decades of professional health and safety management experience with the reading of related articles and relevant literature. The research integrated insights from global construction projects where sustainable methods were implemented, with an emphasis on evaluating their impact on site safety.

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2.1. Sources and Scope

The article and data sources included the safety and construction Industry Institute among others. Key search terms included "sustainable construction safety," "green building practices," "worker safety," and "construction health management

3. Results

3.1. Sustainable Practices That Enhance Site Safety

- Eco-Friendly Materials and Waste Reduction: The use of low-VOC (volatile organic compounds) materials reduces workers' exposure to respiratory hazards. Waste management strategies contribute to cleaner and safer workspaces, minimizing trip hazards and fire risks (Hughes & Ferrett, 2016; Azman, 2021; Abidin & Pasquire, 2007).
- Energy-Efficient Equipment: Energy-efficient machinery and tools reduce emissions and the risk of malfunctions. Utilizing renewable energy sources like solar reduces dependency on flammable fuel-based systems (Lipman & McKernan, 2018; Kibert, 2016).
- Ergonomic and Green Building Designs: Sustainable design principles incorporate ergonomic considerations that lower musculoskeletal injury risks. Enhanced ventilation, natural lighting, and noise reduction improve overall site conditions (Coleman & Eppel, 2020; Tam et al., 2006).
- Technology and Monitoring: Real-time monitoring systems and Building Information Modeling assist in hazard identification and communication, enabling preventive actions before risks materialize (Kohn & Schilling, 2020; Azhar, 2011).
- Prefabrication and Modular Methods: Off-site construction minimizes on-site risks such as falls, exposure to adverse weather, and site congestion (Griffiths & Brown, 2017).

3.2. Organizational and Cultural Drivers

- Leadership and Policy Integration: Leadership commitment is vital to embedding safety into sustainability initiatives. Clear policies support consistent application across all levels (Zohar, 2019).
- Worker Education and Involvement: Training programs that demonstrate the synergy between sustainability and safety improve compliance and situational awareness (Jackson & Turner, 2017).
- Safety-First Culture: Integrating sustainability into the safety culture reinforces proactive risk management and employee engagement (Zohar, 2019).

4. Discussion

The intersection of sustainability and safety presents a transformative approach to construction site management. The benefits include reduced chemical exposure, enhanced air and noise quality, and greater predictability in operations. However, the transition requires overcoming barriers such as initial investment costs, resistance to new methods, and the need for specialized training. Nevertheless, the return on investment in terms of worker health, regulatory compliance, and project reputation is substantial.

5. Conclusion

Sustainable construction is not only an environmental necessity but also a strategic imperative for improving site safety. This study, informed by decades of HSE field experience, reveals that sustainability-driven strategies enhance hazard mitigation and foster safer workplaces. Construction firms should embed sustainability within their core safety protocols, adopt modern technologies, and promote leadership models that support a culture of continuous safety and environmental improvement.

Recommendations

- Prioritize the procurement of non-toxic, low-emission construction materials.
- Mandate sustainability modules in safety training curricula.
- Utilize real-time data systems to monitor and enforce sustainable safety protocols.
- Encourage leadership to advocate for and model sustainability as a key safety value.

- Conduct longitudinal studies to quantify the safety ROI of sustainable practices.

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