Rapport de veille n° 85

BIM

31/08/2026

Objectif : *L'utilisation du BIM en phase de conception et de ses potentiels applications pour la prévention des risques*

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l'INRS.

Les liens mentionnés dans le bulletin donnent accès aux documents sous réserve d'un abonnement à la ressource.

Table des matières

1. Articles scientifiques

Automated compliance checking for construction health and safety: an exploratory study in the UK [PDF]

Z Zhang, T Kasim, A Tezel, MF Antwi-Afari - Building Research & Information, 2026, 19 p.
DOI:10.1080/09613218.2026.2711760

The UK construction industry faces persistent health and safety risks. The Construction (Design and Management) Regulations 2015 (CDM 2015) aim to improve outcomes by embedding safety at the design stage, whilst their outcome-based structure and reliance on duty-holder competence make compliance difficult to achieve and demonstrate. Although automated compliance checking (ACC) tools exist in other sectors, none address CDM 2015. This study develops a digital compliance- checking system to verify regulatory compliance in construction projects. Using a Design Science Research approach, the artefact was co-designed with users and stakeholders and evaluated by industry experts. It features initial and duty-holder-specific questions generated through built-in logic based on scenario-specific responses. This work formalises CDM 2015 duties into actionable compliance logic, providing an essential foundation for proactive, project team-led compliance checking and future ACC development. Expert evaluation described the system as comprehensive and effective, with potential for integration into wider organisational platforms. Recommendations included refining question structures, enhancing visualisation and reporting, and adding mechanisms for action tracking and evidence provision. Overall, this system is functionally suitable and has potential to improve efficiency, consistency, and transparency in compliance practices. This research delivers practical CDM 2015 compliance questions, a novel digital tool for project teams, and insights for future development.

BIM-Based Construction Accidents Knowledge Database Management System: Centralized Accessible Information Repository for Enhanced Learning from the Past [PDF]

WI Usman, KM Mazher, W Umer, IY Wuni, A Alshibani… - Journal of Construction Engineering and Management, 2026, Volume 152, Issue 9
DOI : https://doi.org/10.1061/JCEMD4.COENG-17678

Knowledge management (KM) for project safety is crucial to prevent repeated construction accidents, including fatalities, injuries, near misses, and property damage. This research examined widespread issues in managing historical accident data that impact effective learning from past accidents. Subsequently, a prototype building information modeling (BIM)-based construction accidents knowledge database management system (BIM-CAKDMS) was developed that exploits the structured database management and three-dimensional (3D) visualization capabilities of BIM and was validated using three construction accident case studies, expert interviews, and a lab experiment. The proposed system's primary innovation lies in its ability to integrate accident investigation data directly into the 3D BIM model, creating high-fidelity construction accident animations and simulations that allow stakeholders to analyze the chain of events, understand contributing factors in their actual spatial and temporal context, and internalize lessons learned through experiential rather than abstract learning. Results show that BIM-CAKDMS provides a centralized repository, standardizes data entry, and improves information accessibility. Moreover, its 3D visualization capability and the construction accident animations enhance collaboration, safety communication, and training effectiveness, and reduce the cognitive load of learning from accidents compared with text-based approaches. Overall, this study contributes to automation in construction by enabling enhanced access to accident knowledge, streamlining data-sharing among stakeholders, and learning from 3D accident animations, which potentially may lead to proactive accident prevention strategies.

Integrating 4D and 5D BIM into occupational risk prevention in construction sites

EKS da Silva - Revista ft, 2026, 30(160), 01-10
DOI : https://doi.org/10.69849/frgfrs79

Occupational risk prevention in construction requires methods capable of anticipating hazards before workers are exposed to them on site. This article analyzes how Building Information Modeling, particularly 4D and 5D BIM, can support preventive safety planning by connecting geometric information, construction sequencing, temporary facilities, regulatory requirements, and cost-related safety decisions. The discussion is based on scientific literature addressing BIM-enabled safety management, fall hazard prevention, workspace planning, virtual reality training, automated rule checking, and smart construction site monitoring. The central argument is that BIM does not replace professional safety judgment, but strengthens it by making hazards visible, schedulable, measurable, and easier to coordinate before execution begins. BIM 4D supports the identification of spatial-temporal exposure, while BIM 5D may improve the visibility of prevention-related costs, including collective protective systems and temporary safety facilities. Although the direct reduction of occupational accident costs depends on implementation maturity and cannot be assumed without project-specific evidence, BIM-based planning may contribute to safer construction processes and more rational allocation of preventive resources.

Health and safety in the construction industry: a scoping review of challenges and emerging technologies

M Umar, F Haque - Discover Civil Engineering, 2026, Volume 3
DOI : https://doi.org/10.1007/s44290-026-00563-2

Occupational Safety and Health (OSH) remain major concerns in the construction industry, which continues to report high numbers of accidents, injuries, and fatalities worldwide. Despite the availability of modern safety practices and advanced technologies, the industry still struggles to maintain safe working conditions. The current review adopts the Joanna Briggs Institute (JBI) scoping review methodology and is reported in accordance with the PRISMA-ScR reporting guidelines. Three stages of screening were carried out and finally 76 articles were selected for this study. This review paper aims to understand the key causes of safety issues and explores various strategies to reduce risks on construction sites. It examines common hazards, such as falls, electrocutions, and equipment-related incidents, along with the factors that contribute to them—including poor safety culture, worker fatigue, inadequate training, and weak management support. The paper highlights the growing role of technology in improving safety, including the use of IoT devices, Building Information Modeling (BIM), robotics, and virtual/augmented reality (VR/AR). These innovations offer promising solutions for real-time monitoring, immersive training, and risk prediction. Based on the findings, several practical recommendations are proposed to enhance safety culture, update regulations, improve management practices, and invest in continuous training. While technology holds great potential, its success depends on proper implementation and organizational commitment. This study provides a critical overview about the current state of modern safety technologies in construction industry. It highlights the significance of integration of these technologies into construction industry to improve safety. Finally, it provides a foundation for future research and offers insights for policymakers, industry professionals, and researchers aiming to build safer construction environments. The findings of this review contribute to the advancement of Sustainable Development Goal (SDG) 3 (Good Health and Well-being) and SDG 8 (Decent Work and Economic Growth) by highlighting strategies and emerging technologies aimed at improving occupational health and safety in the construction industry.

desAIner: Design, Implementation, and Evaluation of an AI Tool for Construction Hazard Prevention Through Design (CHPtD) Education [PDF]

N Chaudhary, SMJ Uddin, Z Jin - Computer Applications in Engineering Education, 2026
DOI : https://doi.org/10.1002/cae.70231

Construction Hazard Prevention through Design (CHPtD) is widely recognized as a proactive strategy for reducing worker risk by addressing hazards during planning and design. However, its integration into architecture, engineering, and construction (AEC) education remains limited, leaving many students, who represent the next generation of industry professionals, underprepared to identify design-related hazards and apply effective safety controls. If hazards remain unrecognized, they cannot be effectively addressed early in the project lifecycle. This study developed and evaluated desAIner, a domain-specific, multimodal, human-in-the-loop educational tool designed to support CHPtD learning through structured hazard recognition and mitigation planning grounded in the hierarchy of controls (HOC). Using a quasi-experimental repeated-measure counterbalanced design with construction management students, the study examined whether AI-assisted support could strengthen students' ability to identify design-related hazards and propose more effective prevention strategies. The findings indicate that desAIner improved students' CHPtD performance and supported more consistent application of prevention-oriented reasoning across multiple construction scenarios. More broadly, the results suggest that carefully structured generative AI tools can help bridge persistent instructional gaps in CHPtD education by making design-stage safety analysis more interactive and scalable within existing AEC curricula. This study contributes to the growing literature on AI in construction education by demonstrating how domain-specific, human-in-the-loop systems can support the development of safer design thinking among future construction professionals.

Study on Disaster Prevention and Improvement of Safety Management Systems through Risk Factor Analysis of Temporary Construction Works [PDF]

HY KIM, JW LEE - Journal of Wellbeing Management and Applied Psychology,Vol 9, No 3, (2026), 137-154
DOI : http://dx.doi.org/10.13106/jwmap.2026.vol9.no3.137

This study proposes safety management and institutional improvement measures to prevent accidents intemporary construction works. Literature reviews, regulatory analysis, accident case studies, and surveys were conducted. Falls, collapses, and falling-object accidents were the most common, mainly caused by inadequate structural review, poor safety management, and insufficient training. Strengthening structural safety, systematic management, worker-centered education, smart technologies, and institutional improvements can effectively reduce construction-site accidents.

2. Conférence / ouvrage / thèse

Integrating Safety Across the Building Lifecycle Using Prevention Through Design Factors

MB Mahmood, MZ Mohammad, NNM Pauzi… - In Engineering and Technology, CRC Press, 2026, 14 p.

This study extensively evaluates the Prevention through Design (PtD) framework as a proactive methodology for incorporating safety throughout the building lifecycle. PtD lowers the risks of work-related injuries during construction, commissioning, operation, maintenance, and renovation by including strategies for reducing hazards in the earliest design phases. The study integrates the theoretical basis for PtD, historical development, and real-world uses and compares how well it works with traditional safety practices in life cycle building. A literature review covering the period from 2015 to 2025 examined 47 relevant studies to identify the most important PtD factors during the five stages of building. The results suggest that PtD is important to reduce accidents, increase compliance, and help achieve safety goals. The study ends with strategic signals to improve PTD acceptance through education, policy development and relationships between different fields.

Integrating VR and BIM into Job Hazard Analysis to Improve Task Understanding and Safety in Construction

A Bhowmik, Z Ud Din, L Gao, K Kim, A Senouci, N Cho - Construction Research Congress 2026

DOI : https://doi.org/10.1061/9780784486993.081

Workplace injuries remain a persistent challenge in the construction industry. Conventional job hazard analysis (JHA) methods, such as checklists, written procedures, and paper-based drawings, often fall short in conveying the spatial and procedural information required for proper task planning. This limitation is compounded by the industry's high workforce turnover and personnel from diverse educational and cultural backgrounds. Many workers struggle to understand task requirements communicated solely through verbal instructions or static visuals, which leads to unsafe practices and potentially fatal incidents. This study examines whether integrating the existing JHA process with a Virtual Reality (VR) and Building Information Modeling (BIM)-based system can improve workers' comprehension of construction tasks and hazard identification. A plumbing installation task was modeled in Autodesk Revit and visualized using VREX with the Oculus Quest 2 headset. Forty participants, including construction professionals and graduate students, engaged with the scenario and completed pre- and post-assessments. Results revealed statistically significant improvements in task understanding and hazard identification ($p < 0.001$). Participants with some VR experience performed slightly better than those with none, though no consistent trends emerged based on age or industry experience. Qualitative feedback highlighted connectivity issues and navigation challenges during the VR experience.

4D BIM Integrated Rule-Based Safety Checking System for Identifying Safety Hazards in Construction Robot Operations

H Oyediran, K Kim, PC Huang, T Stentz, K Kopocis - Construction Research Congress 2026

DOI : https://doi.org/10.1061/9780784486993.081

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