Rapport de veille n° 73

BIM

31/07/2025

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 fall hazard analysis in the design stage using Building Information Modeling (BIM)
MH Tamanaeifar, V Shahhosseini - Civil Engineering and Environmental Systems, 2025, 1-28
DOI : https://doi.org/10.1080/10286608.2025.2524412
Despite significant efforts made to address safety issues, the construction industry still faces high rates of fall-related injuries and fatalities. Meanwhile, Building Information Modeling (BIM), which is increasingly being adopted, offers a proactive approach to safety management by enabling detailed hazard visualisation and analysis during design. Accordingly, this study proposes a novel BIM-based method for the automatic detection, assessment, and mitigation of fall risks in building projects. This method automatically identifies fall hazard areas, computes Risk Priority Numbers (RPNs) based on likelihood and consequence, and visualises risks within the BIM environment, thereby facilitating targeted mitigation. To evaluate the proposed method, a case study is conducted comparing this approach with traditional 2D drawings and 3D Revit models. While experts detected 81–93% of risks, assessed 46–67%, and mitigated 31–38% of risks in the 2D drawings and 3D Revit models, the proposed approach identified, assessed, and facilitated the design of mitigation approaches for all detected fall risks, significantly reducing the required time. Therefore, the findings confirm the effectiveness of the proposed method. This integrated BIM-based approach offers construction professionals a proactive tool for fall hazard management, enhancing safety planning and promoting a safer work environment.

Innovative Applications of Information Technology in Work Safety Guarantee: A Literature Review
R Tao, Z Baofeng, F Zhenlin, C Fangzi - Journal of Computer Science and Technology Studies, 2025, 7(7), pp. 42-45
DOI : https://doi.org/10.32996/jcsts.2025.7.7.4
This literature review delves into creative uses of information technology in challenges at work that ensure the overcoming of problems within traditional practice on safety and safety enhancement. The analysis, however, would be done for the specific role of the technologies as it involves the roles of AI, IoT, AR/VR, wearable devices, and BIM, where there is high-quality risk assessment, monitoring, and training implemented and enhanced. This method involves a systematic review of recent scholarly articles, industry reports, and case studies in the last five years, Findings: It shows that these technologies are useful for monitoring in real-time, predicting risks, and training in an immersive environment in ways compliant with safety regulations across industries. Wearable technologies ensure real-time alerts ensure worker safety; IoT enables continuous monitoring; and AI-based systems enhance predictive analytics. Still, these can be fully leveraged only when the data privacy issue, adaptability of the technology, and interoperability issues are addressed. Therefore, the aftermath of this review demands that organizations include these technologies in reducing workplace hazards, improving operational efficiency, and creating a proactive safety culture. In the future, it will be more about data security, including blockchain, advanced AI models for the prediction of risk, and unified platforms for cross-sector collaboration in sustainably enhancing workplace safety.

Integration of Health and Safety (H&S) into Construction Procurement System: A Systematic Review
D Olapade, JN Agumba, RG Muthelo - Journal of African Real Estate Research, 2025, 10(1), pp. 59-73
DOI : 10.15641/jarer.v10i1.1756
The construction industry is a major contributor to the economy of many nations; however, the industry is bedevilled by poor health and safety (H&S) records, leading to significant human and economic losses. This study systematically reviews the integration of H&S into the construction procurement system, identifying key drivers and barriers. Using a systematic literature review approach, 71 articles were analysed out of 21,407

records that were retrieved from Scopus and Web of Science databases to uncover the drivers and barriers to H&S incorporation into the procurement system. The study discovered the ambivalent influence of procurement methods, digital technology, legislation, and project ecosystem on H&S integration. The findings reveal that traditional procurement methods, low technology adoption, inadequate legislation, and negative management actions are major barriers. Conversely, modern procurement methods, robust digital technologies, clear legislative frameworks, and positive management actions serve as drivers. The study highlights significant research gaps, including limited empirical evidence on the long-term impact of procurement methods on H&S outcomes, especially in developing countries, and proposes future research directions to enhance H&S integration in construction procurement. There is a need for the enactment and enforcement of robust legislative frameworks that mandate H&S considerations in the construction procurement system. Also, contractors need to adopt modern procurement methods and leverage digital technologies to enhance H&S.

Building Information Modelling for Prevention through Design: An Exploratory Structural Model of Factors Influencing Its Adoption [PDF]

R Labadan, K Panuwatwanich, S Takahashi - Journal of Construction in Developing Countries, 30(1): 221–246
DOI : https://doi.org/10.21315/jcdc.2025.30.1.9

Prevention through design (PtD) is an approach to construction safety management. However, previous research has shown that its adoption rate in the construction industry is considerably slow because of the lack of PtD tools among designers. Previous research suggested that building information modelling (BIM) has the potential to support construction safety assessments, specifically in PtD. This study aimed to explore socio-technical factors influencing the adoption of BIM for PtD. The study examined how socio-technical aspects of BIM affected designers' decisions to adopt BIM for PtD. A theoretical model was developed by extending the technology acceptance model. The structural equation modelling analysis was utilised to substantiate the model's components based on data collected from 131 structural designers in the Philippines. The model shed light on the impact of BIM's socio-technical qualities on adopting BIM for PtD. Results determined that the perceived usefulness and the relative advantage of BIM for PtD influence the behavioural intention of designers to adopt BIM for PtD directly. However, the perceived benefit and ease of use of BIM for PtD indirectly affected the designer's intent to adopt PtD. The study further synthesised and explained the model's theoretical and practical implications. As an exploratory effort to empirically model the adoption of BIM for PtD through integrating the socio-technical qualities of BIM, this study contributes to a deepened understanding of how designers will interact with BIM to implement such innovative technology for PtD.

The BIM Based Hospital Safety Engineering Management During the Construction Phase [PDF]

Q Tang, Z Liu, L Wang, B Chen - Journal of Engineering, 2025, Vol. 3 No. 2, 8 p.

As the scale of construction projects continues to expand, construction safety management has encountered great challenges. Traditional safety management methods mainly rely on manual inspection and post-processing, which is difficult to meet the complex needs of modern construction projects. The Building Information Modeling (BIM) technology, as an emerging information tool, has gradually been applied to various stages of construction by relying on its visualization, integration and collaboration characteristics, showing great potential in safety management. This paper takes the Building Project of Pingxiang People's Hospital in Guangxi as an example to analyze the application of BIM technology in safety management during the construction stage of construction projects. This study presents the application advantages of BIM technology in construction safety management and provides practical guidance for subsequent construction project safety management.

2. Conférence / ouvrage / thèse

The Alliance of BIM and Artificial Intelligence: Challenges for a Reinvented Future–The State of the Art
E Abdelmoula, M Zammel, N Allani - Proceedings of 8th International Conference of Contemporary Affairs in Architecture and Urbanism (ICCAUA2025), 2025
DOI : https://doi.org/10.38027/ICCAUA2025EN0244
The alliance of Building Information Modeling (BIM) and Artificial Intelligence (AI) is critical for transforming construction management, particularly to fostering more efficient and innovative practices. Despite the progress made in integrating BIM and AI, challenges remain, such as interoperability between different platforms and data structures, as well as concerns over data security concerns when AI algorithms are applied in construction projects. This study aims to examine these challenges and to propose strategies for successfully integrating AI into BIM workflows, enhancing efficiency and safety in construction management. A literature review was conducted to examine research published on the integration of BIM and AI, identifying key challenges, gaps and proposed solutions to improve interoperability, data security and workflow optimization. The study advocates the adoption of standards protocols and unified application programming interfaces (APIs) to improve data exchange between BIM and AI systems. It also highlights the importance of data encryption, AI skills development and a comprehensive training framework within organizations to ensure successful implementation of AI-integrated BIM.

An Assessment of Virtual Reality and BIM-Based Job Hazard Analysis in the Construction Industry
A Bhowmik – University of Houston, Thesis, 2025
URI : https://hdl.handle.net/10657/19845
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 further compounded by the industry's high workforce turnover and the presence of personnel from diverse educational and cultural backgrounds. Due to varying levels of technical proficiency, many workers struggle to understand task requirements when communicated solely through verbal instructions or static visuals. Such miscommunication or misinterpretation frequently results in unsafe practices and, in severe cases, fatal incidents. This study investigates whether complementing the existing JHA process with a Virtual Reality (VR) and Building Information Modeling (BIM)-based system can enhance workers' understanding of construction tasks and ability to identify potential hazards. The primary objective is to assess whether this interactive approach improves the effectiveness of JHA in terms of task understanding and hazard recognition. The research also examines factors influencing its effectiveness and explores challenges participants face during implementation in construction settings. A mixed-methods design was employed to capture both quantitative performance outcomes and qualitative user experiences. The study involved a plumbing installation task modeled in Autodesk Revit and visualized using VREX software with the Oculus Quest 2 headset. Forty participants, including construction professionals and graduate students, engaged with the virtual scenario and completed pre- and post-assessments to evaluate improvement in task understanding and hazard recognition. Professionals' answers to the open-ended interview questions provided qualitative insights into user experience and implementation-related challenges, to support the quantitative data. Quantitative results revealed statistically significant improvements in task understanding and hazard identification following the VR- and BIM-supported JHA process ($p < 0.001$). Participants with limited prior VR experience performed slightly better than those with none, although no consistent trends were observed for age or industry experience.

Qualitative findings highlighted connectivity issues, model integration challenges, and navigation learning curves during the VR experience. Overall, the study contributes to construction safety research by demonstrating that VR with BIM can introduce a visual dimension to the existing JHA process. This added visual layer enhances spatial understanding and task visualization, supporting better communication across a diverse workforce and reinforcing existing JHA practices in construction environments.

Conceptual Framework Integration of Building Information Modelling (BIM) and Internet of Things (IOT) Technology in the Application of Construction Safety Management Systems in Construction Projects

WDPRU Latief, R Arifuddin - In: Strauss, E.J. (eds) Proceedings of the 9th International Conference on Civil Engineering. ICOCE 2025. Lecture Notes in Civil Engineering, vol 714. Springer, Singapore, pp.280-294
DOI : 10.1007/978-981-96-8990-3_25

The implementation of a construction safety management system is one of the main challenges in the construction industry which often faces high risks to worker safety. This research aims to integrate Building Information Modelling (BIM) and Internet of Things (IoT) technologies in the application of construction safety management systems in construction projects. BIM technology is used to provide comprehensive visualization of the construction process, while IoT allows for real-time data collection through smart devices to detect potential hazards in the field. The research methodology involves literature study, development of BIM-IoT integration systems, and testing on small-scale construction projects as case studies. The results of the research are expected to integrate BIM and IoT which can improve the efficiency of risk identification, monitoring of working conditions, and responding to incidents in real-time. In addition, the implementation of this system is expected to be able to reduce the potential for work accidents to above 35% based on simulation and testing data. The technology also allows project managers to make faster, more informed data-driven decisions. Thus, this research makes a significant contribution to the development of construction safety management technology, especially in the context of projects in Indonesia. The integration of BIM and IoT is recommended as an innovative solution to improve work safety and productivity in construction projects.