Rapport de veille n° 67

BIM

31/01/2025

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. Article scientifique 3
2. Conférence / ouvrage / thèse 5

1. Article scientifique

Tomorrow's Buildings: What Are the Occupational Health and Safety Issues?
M Malenfer, M Hery – Qeios, 2025
DOI : https://doi.org/10.32388/9R0YQZ
Climate change, the need to save raw materials and energy, the development of information and communication technologies that will enable the automation of construction sites, but also change the administrative management of these sites, etc. All these changes are opportunities to improve working conditions in a sector which, even if significant progress has been made in recent decades, is still too often lagging behind when it comes to occupational risk prevention. As part of an overall forward-looking analysis of changes in the building industry in France over the next 30 years, specific work has been devoted to the question of working conditions and the possibilities for improving them (or avoiding their deterioration). As techniques and professions are bound to evolve, what are the main levers we can use to ensure safer, more fulfilling working conditions?

Investigating the Role of Internet of Things (IoT) Sensors in Enhancing Construction Site Safety and Efficiency [PDF]
KN Anjum, A Luz - International Journal of Advances in Engineering and Management (IJAEM), Volume 6, Issue 12 Dec. 2024, pp. 463-470
DOI : 10.35629/5252-0612463470
The construction industry is one of the most hazardous and resource-intensive sectors, often facing challenges related to worker safety, operational inefficiencies, and project delays. The emergence of the Internet of Things (IoT) offers innovative solutions to address these issues by leveraging interconnected sensors, real-time monitoring, and data analytics. This study investigates the role of IoT sensors in enhancing construction site safety and efficiency. The research examines how IoT-enabled technologies, such as wearable sensors, environmental monitors, and asset-tracking devices, contribute to hazard detection, accident prevention, and resource optimization. A mixed- method approach is adopted, combining case studies, interviews with industry professionals, and data analysis to evaluate the implementation and outcomes of IoT solutions on construction sites. Findings reveal that IoT sensors significantly improve safety by enabling real-time risk identification, worker tracking, and environmental monitoring. Additionally, IoT enhances operational efficiency through predictive maintenance, equipment tracking, and automated data-driven decision-making, resulting in reduced downtime and improved resource allocation. Despite the proven benefits, challenges such as implementation costs, technical integration, and user adoption remain significant barriers. The study concludes that IoT sensors play a pivotal role in modernizing the construction industry, offering substantial improvements in safety and efficiency. Recommendations for integrating IoT technologies into construction workflows are provided, alongside suggestions for future research to explore cost-benefit analyses and the integration of IoT with complementary technologies like Artificial Intelligence (AI) and Building Information Modeling (BIM).

Prevention of accidents in project design in the BIM process: a bibliometric review [PDF]
VFB de Azevedo, ERK Rabbani, BM Vasconcelos – National Journal of City Management, v. 12, n. 86, 2024, 16 p.
DOI : 10.17271/23188472128620245308
In recent decades, urban development has been marked by a growing search for solutions that promote the intelligence and sustainability of cities. In this context, the Prevention through Design (PtD) approach emerges as an important tool to enhance the safety and sustainable development of projects, from conception to deconstruction. This study aims to present a bibliometric analysis of academic productions on PtD that employ

BIM, contributing to the advancement of knowledge in this field and the construction of safer, smarter, and more sustainable cities. Using the PRISMA methodology and the PICo approach, 37 articles were analyzed. The results highlight a significant increase in publications, particularly in 2022, led by China, followed by the USA. A probable future research trend is the use of PtD for subway stations. Journals such as Automation in Construction emerge as influential in this field. Co-authorship analysis indicates limited collaborations, while the citation network reveals the influence of journals like Automation in Construction and Safety Science. It is concluded that BIM for PtD represents an expanding research area with international relevance for the construction of safer and more efficient cities.

Exploring the Role of BIM in Knowledge Management in Construction Projects [PDF]

IA Rodrigues, VFB de Azevedo, VE da Silva Neto et coll. – National Journal of City Management, v. 12, n. 86, 2024, 11 p.

DOI : 10.13140/RG.2.1.3067.7527

The non-serialized nature of the construction industry, the dynamic environment of construction sites, and the high turnover of workers are conditions that hinder the application of knowledge management (KM) in the sector. Given this, several studies highlight the use of BIM as a platform capable of optimizing KM. The main objective of this study was to investigate the potential of BIM for KM in construction. To this end, a systematic literature review was conducted, revealing a variety of practical applications of BIM in KM in areas such as occupational safety, project management, and sustainability in facilities management. However, studies are still in the early stages, with limited activities and risks included in the analyses. Moreover, ontology is widely used to structure knowledge in conjunction with a BIM model, followed by case-based reasoning (CBR). Although BIM can optimize KM, its application needs to be scaled up. Future studies should explore the use of machine learning to accelerate the knowledge modeling process.

Managing workforce productivity in the post-pandemic construction industry [PDF]

G Nwaogbe, E Ekpenyong, O Urhoghide – World Journal of Advanced Research and Reviews, 2025, 25(01), 572-588

DOI : https://doi.org/10.30574/wjarr.2025.25.1.0051

The construction industry has been significantly impacted by the COVID-19 pandemic, presenting both unprecedented challenges and transformative opportunities. Labor shortages, compliance with enhanced health and safety regulations, and the rapid acceleration of digital technology adoption have collectively reshaped how the industry operates. These disruptions necessitated a reevaluation of traditional workforce management practices, emphasizing resilience and innovation. This paper explores key strategies to enhance workforce productivity in the post-pandemic era. Central themes include leveraging advanced technologies such as automation, Building Information Modeling (BIM), and wearable safety devices; adopting flexible work practices to meet evolving workforce needs; and implementing comprehensive training programs to bridge skill gaps and foster adaptability. The paper also examines the role of policy and industry collaboration in shaping sustainable practices, highlighting the importance of public-private partnerships and government support for technological investments. Recommendations provided focus on fostering a culture of resilience, adaptability, and inclusion within construction teams to mitigate labor shortages and improve overall operational efficiency. Case studies illustrating the successful integration of digital tools and innovative workforce strategies underscore the feasibility and benefits of these approaches. By embracing these strategies, the construction industry can position itself for sustainable growth, increased productivity, and heightened resilience in the face of futurevuncertainties.

2. Conférence / ouvrage / thèse

Co-design and Development of Building Information Modelling for Work Health and Safety Design, Construction and Management Industry Guidelines

K London, Z Pablo – IN Alcínia Zita Almeida Sampaio, « Digital Transformation in Architecture and Construction », 2025

DOI: 10.5772/intechopen.1008418

The construction industry has one of the highest high fatality and injury rates globally. Building Information Modelling (BIM) as an enabling technology can significantly eliminate and mitigate risks and improve work health and safety (WHS) management. Adoption is inconsistent, although various guidelines and legislation have been developed to reduce incidents and injuries in the workplace. Our literature review indicates that the UK, Singapore, Hong Kong, US, Germany, Spain and Finland public and private sectors are relatively advanced in the development of BIM technology. The US has been a significant contributor through its collaborative links with the UK, Australia, South Korea, Germany and Spain. In contrast, the integration of BIM and WHS management is less advanced. Australia, the site of this study has lacked research that evaluates WHS management in a BIM-environment. To increase BIM-WHS management integration across the industry, a government, industry and academic collaboration in Australia was undertaken, resulting in the development of comprehensive evidence-based guidelines comprising four key components: (1) Developing Information Requirements, (2) BIM for WHS Best Practice, (3) Procurement, Tendering and Supply Chain Monitoring and (4) Developing Project Information Requirements. The comprehensive iterative collaborative process that underpinned the development and distribution of the guidelines is described.

Research on Safety Risk Evaluation in High-Rise Building Construction

C Fan - In: Al-Turjman, F. (eds) Smart Infrastructures in the IoT Era. Sustainable Civil Infrastructures. Springer, Cham, pp. 343-356

DOI : 0/1007/978-3-031-72509-8_29

Due to the reasons of complexity and uncertainty in the construction of high-rise buildings, the problem of safety risk in the construction process is particularly prominent. For this reason, this paper is based on the entropy right method, combined with the characteristics from the high-rise building construction, the four key factors of personnel risk, material risk, environmental risk and management risk are screened and analysed. The safety risk assessment system for high-rise building construction based on computer BIM technology can intelligently recognise the safety risks in high-rise building implementation and weight the various safety administration indexes in the process of high-rise building construction, which improves the scientificity of the weight setting. The safety risk evaluation level of computer BIM technology in high-rise building construction was determined, and the entropy weighting method was used to evaluate the safety risk of computer BIM technology. The findings show as follows, the weights of the first-level indicators are in descending order: personnel risk (0.3338) > material risk (0.2585) > environmental risk (0.2391) > management risk (0.1756); and among the 12 s-level indicators, the three indicators with the highest weights are compliant construction C1, safety protection facilities C5, and safety technology management C11.Therefore, it is necessary to have targeted improve the safety technology of risk source analysis in the construction of tall buildings and apply new information technology, such as BIM, to the safety risk management of tall building works in such a way as to make certain that the construction unit finds the dangers in a timely manner and takes measures towards the improvement of the management of the basic security construction technology. Moreover, it can provide theoretical basis and guidance for the future safety risk assessment of high-rise building structures based on computerised BIM technology.

Research on the Application of Building Engineering Informatization and Security Management Based on BIM Technology

Z Cao - In: Al-Turjman, F. (eds) Smart Infrastructures in the IoT Era. Sustainable Civil Infrastructures. Springer, Cham, pp. 495-511

DOI : https://doi.org/10.1007/978-3-031-72509-8_42

Following the current stage of social and economic development, the construction industry has also increased certain progress, and construction safety management is very important in the construction of construction projects. When they compare with the classical construction safety management, it is possible for BIM technology to discover the latent dangers in the construction project and check the potential safety hazards in time, so as to ensure the security of the construction. To this end, first of all, this paper analyzes the main risk elements and problems that exist in engineering security management, and then investigates the advantages of BIM technology application on construction security analysis. Secondly, based on an entropy weight method and combining the construction characteristics of construction projects, this paper screens and analyzes five key factors, such as personnel factors, material factors, environmental factors, equipment factors and management factors, and constructs a risk management index system of information technology safety management of construction projects based on computer BIM technology, and introduces the entropy weight method into the evaluation of the risk of safety management. Finally, its evaluation outcomes are as follows: Table 5 shows that the weights of the first-level indicators are arranged in the following order from the largest to the smallest: equipment factors (0.2882) > management factors (0.2294) > personnel factors (0.1852) > material factors (0.1772) > environmental factors (0.1200); among the 17 s-level indicators, the four indicators whose weights are ranked in the top of the list are the safety and security measures, on-site safety management system, deep foundation pit and support equipment management, and construction workers' safety education and training. This study not only provides a scientific theoretical structure for the safety of construction project management, but also clarifies various risk factors' weights through specific data analysis, which provides a powerful data support for safety management decision-making in engineering practice. The application of informationized safety management based on bioinformatics (BIM) technology does to improve not only the efficiency as well as the accuracy in safety management of construction projects, but also provides a new direction and idea for the research and practice of safety management in future projects.

Health and Safety in Stealth Construction

SS Stephen, AE Oke, CO Aigbavboa, OI Akinradewo… - In Stealth Construction: Integrating Practices for Resilience and Sustainability, Emerald Publishing Limited, Leeds, pp. 21-47

DOI : https://doi.org/10.1108/978-1-83608-182-120251002

This chapter explored health and safety considerations in stealth construction, emphasising the integration of advanced technologies and innovative practices. It commences with a general introduction, followed by a historical overview of safety practices in the construction industry, highlighting the evolution of a safety culture. The chapter examined various health and safety management techniques, including policy formulation, safety training programs, and job safety analysis. Additionally, it discussed current trends such as wearable technology, IoT, VR/AR, and predictive analytics. The unique requirements of stealth construction are addressed, focusing on building cross-section design, visibility, application of radio frequency emission and countermeasures. Finally, it presents a comprehensive approach to achieving stealth construction, emphasising environmental protection, safety, speed, economy, and aesthetics, and provides practical examples to illustrate these concepts.