Rapport de veille n° 62

BIM

31/08/2024

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. Références anglophones

1.1 Articles scientifiques

Automated Safety Risk Assessment Framework by Integrating Safety Regulation and 4D BIM-Based Rule Modeling

D Kim, T Yoo, SVT Tran, D Lee, C Park, D Lee - Buildings, 2024, 14(8), 2529

DOI : https://doi.org/10.3390/buildings14082529

Performing risk assessments in construction requires collecting and analyzing project data and historical safety accident data, which is challenging due to the inherent complexities and dynamic nature of construction projects. To address these challenges, building information modeling (BIM) has been leveraged as a centralized digital repository that integrates data and provides a holistic 3D view of a project. Previous studies have highlighted BIM's significant functions for risk assessment, such as visualization, simulation, and clash detection. However, these studies often overlook the incorporation of temporal information, which is crucial for assessing risks accounting for the dynamic conditions of construction sites. This study develops a 4D BIM-based risk-assessment framework by integrating spatial and temporal data to respond to dynamic site changes. The framework leverages 4D BIM to combine 3D model data with time-, resource-, and logistics-related information, enhancing the tracking and evaluation of construction progress. The study involves investigating major construction accidents, classifying their risk factors, establishing risk-factor identification algorithms, and implementing the framework on a web-based platform for validation. This approach offers a comprehensive risk-identification strategy, applicable to multiple accident types, with intuitive visualization using BIM models, benefiting from managers' experiential knowledge and enabling effective risk assessments and mitigation strategies. Consequently, potential safety risks at construction sites can be efficiently identified using interconnected spatial and temporal data while tracking changes in risk levels in real time and visualizing them on a web-based platform.

Research On the Application of Intelligent Management Technology in Construction Engineering [PDF]

Y Jiang - Highlights in Science, Engineering and Technology, 2024, Volume 106, 7 p.

Under the background of rapid economic and urbanization, the management mode of construction engineering is undergoing a transformation to adapt to the increasing complexity and dynamic nature. With the help of modern information technology, intelligent project management provides a full-cycle solution for construction projects. This study explores the multiple applicationsof intelligent technology in construction project management, including the integrated application of (Building Information Modeling) BIM technology in design, construction and operation, as well as the practice of intelligent schedule management, cost control and site safety supervision. The study found that although the application of BIM technology in construction schedule management is still in its infancy, it shows great potential in improving design and construction quality and optimizing resource management. By integrating the smart site platform and the Internet of Things (IoT) technology, the intelligent progress management system realizes the real-time monitoring of the construction process and improves the accuracy and response speed of project management. In terms of cost management, the application of intelligent technology significantly improves the accuracy of cost control and management transparency through real-time monitoring, data integration and predictive optimization. At the same time, the application of smart wearable devices and image recognition technology provides new solutions for the safety management of construction sites, and improves the efficiency of worker safety and site supervision.

Barriers to the Application of Digital Technologies in Construction Health and Safety: A Systematic Review

EI Daniel, OS Oshodi, N Nwankwo, FA Emuze… - Buildings, 2024, 14(8)

DOI : https://doi.org/10.3390/buildings14082386

Construction is one of the most dangerous industries, with workers frequently exposed to hazardous environments, resulting in numerous occupational injuries and illnesses globally. While digital technology (DT) can improve construction health and safety management, there are barriers to its global adoption. This research examines these barriers in both developed and developing countries. A systematic review of 88 articles identified critical barriers, including technical issues, training and knowledge gaps, implementation challenges, data analysis limitations, and system efficiency problems. Standardising the use of new technology is challenging due to the constantly changing nature of construction projects. There is a lack of knowledge on increasing the use of DT in construction. Future research should focus on targeted strategies, pilot studies, and prioritising workers' health to overcome context-specific barriers and maximise the benefits of these innovative tools to prevent injuries and improve health and safety management.

Safety Management in the Construction Industry: Bibliometric Analysis [PDF]

K Ganiyev, S Alizada, A Asgarov, M Gasimli… - Problems and Perspectives in Management, Volume 22, Issue 3, 2024, 17 p.

DOI : http://dx.doi.org/10.21511/ppm.22(3).2024.16

Despite the continuous improvement of safety standards in the construction industry, this sphere remains one of the most hazardous sectors, and safety management is becoming a crucial determinant of effective operation at construction sites. The aim of this study is to identify the essential contextual, evolutionary-chronological, and geographical-industrial scientific landscape of the development of safety management in the construction industry through comprehensive bibliometric analysis. More than 15,000 articles indexed by Scopus from around the world from 2000 to 2023 were ana- lyzed using the VOSviewer tool, filtered by keywords such as "construction," "safety," and "management." The research revealed the intensification of publishing activity since 2012 (with peak growth in 2012, 2020, and 2022). The leading scientists are from China, the United States, and the United Kingdom (e.g., Chinese scientists make up 26.1% of all scholars). The majority of papers are in the field of engineering. Priority areas of research include safety climate, safety behavior, and building information modeling. The closest connections of construction safety management are with the study of professional risks, safety techniques, and quality control. The evolution of re- search focuses on "human health and safety-risks-digital security systems." In general, the findings of this study provide a foundation for future research aimed at enhancing safety management in the construction field, potentially increasing worker protection and technical operational efficiency.

A New Paradigm for Construction Safety Management in China: Introducing Knowledge Graph and Accident Database into the Early-stage of BIM

W Li, P Wu, J Huang, Y Xu - Journal of Cleaner Production, Volume 140, 2024

DOI : https://doi.org/10.1016/j.jclepro.2024.143367

Significant progress has been made in managing construction safety risks based on Building Information Modelling (BIM) technology. BIM is active in all stages of construction, including5 planning, design, pre-construction and construction. However, the causes of risks and accidents are complex and can be related to humans, the environment, data and project portraits. The current construction safety risk management process lacks scientific reference and efficiency in conducting comprehensive inspections for specific projects. The uneven and substandard data quality in BIM models significantly undermines their effectiveness. This article introduces a knowledge graph and accident database through data crawling and structuring, with the use and

analysis of an accident causation model, providing key risk elements and management directions for safety managers who require a high level of attention during the early-stage of BIM. The obtained knowledge graph was subjected to data mining analysis to explore the causes of accidents, considering the combined effect of multiple factors, such as “case-date-cause” and “case-address-cause”. The paradigm can be recognized by the BIM, and through the secondary development on the development side, a data interface is constructed to transfer the knowledge graph into the BIM. The approach mentioned in the article can provide standard and structured data for the BIM model, analysing high-risk points of projects, which is valuable for engineering applications.

From Theory to Practice: Challenges and Countermeasures for the Implementation of BIM and Intelligent Construction Technology [PDF]

X Cao, M Lan, Y Li, S Wang, L Zhao, Y Hou, L Li, X Cao… - International Journal of Education and Humanities, Vol. 15, No. 3, 9 p.

The rapid advancement of information technology has introduced Building Information Modeling (BIM) and intelligent construction technology as trans-formative tools in the construction industry. Despite their potential to significantly enhance efficiency, quality, and safety in construction projects, the practical implementation of these technologies is fraught with challenges. This paper explores the theoretical underpinnings of BIM and intelligent construction technologies and investigates the practical challenges encountered during their implementation. It provides an in-depth analysis of these challenges and proposes countermeasures to effectively address them, offering valuable insights for practitioners and stakeholders in the construction sector.Finally, through the study of the application of technology in actual projects, it is found that the combination of BIM and intelligent construction technology will improve the efficiency and quality of the construction process, reduce the waste and consumption of human resources, and improve the competitiveness and sustainable development capabilities of the project. It will promote the transformation and upgrading of the construction industry, promote scientific and technological innovation and industrial upgrading, and promote economic development and social progress. It will improve the safety and sustainability of construction, reduce accidents and environmental pollution during construction, and protect the health and safety of workers and the environment.