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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.

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1. Article scientifique

Enhancing Total Construction Safety Culture in Indonesia's New Capital: A Structural Equation Modeling Approach [PDF]

CR Pashya, RA Machfudiyanto, A Suraji - International Journal of Safety and Security Engineering, Vol. 14, No. 5, October 2024, pp. 1477-1486

DOI : https://doi.org/10.18280/ijsse.140515

The establishment of Indonesia's new capital, Ibu Kota Nusantara, was a massive project that created significant risks during the construction phase, such as construction accidents. In response, total construction safety culture was developed to make a belief and implement strategies for minimizing risks. This research aimed to recommend strategies based on a structural equation model of total construction safety culture to improve safety performance. Using structural equation modeling with a partial least square approach, strategies were categorized into two aspects, covering the macro impact of construction accidents (national scope) and the micro and meso impacts (company and project scope). The macro strategy recommended the creation concept of nomenclature and criteria within government regulations related to construction safety The suggestion for the government regualation would cover construction safety ecosystem in Indonesia. Meanwhile, the micro and meso strategies concept included practical steps such as technology transformation, tacit knowledge, and improved supervision methods. By transformationing technology in construction safety such as using movement sensor and Building Information Modeling, it will be helpfull for the contractors to monitor all of the manpower and create safer working enivronment. Additionally, they can be applied in other cases to minimize the risk of construction accidents.

Risk assessment and ranking methodology for occupational hazards in construction: a case of Indian high-rise projects

P Tripathi, YK Mittal - Smart and Sustainable Built Environment, 2024

DOI : https://doi.org/10.1108/SASBE-06-2024-0219

The unique nature, complicated design, hazardous activities and complex work environment involved in the high-rise construction projects constitute significant risks worldwide. In the Indian context, construction safety management in high-rise construction projects is crucial due to the presence of significant occupational risks and hazards at the workplace. Occupational hazards lead to accidents that severely affect human health and result in substantial financial losses. The study aims to present a hybrid risk assessment method (RAM) and the technique for order of preference by similarity to ideal solution (TOPSIS) method to detect and evaluate occupational risks in different construction activities through a questionnaire survey approach. Around six types of construction activities and corresponding ten risks are identified and evaluated during the study. Based on the calculation of risk scores, the findings imply that "roof work activities," "finishing work," "mechanical, electrical and plumbing work (MEP)" are hazardous construction activities, while, among the corresponding ten risks, "workers falling from height" is the most prominent risk among the majority of activities. Other risks include "risk due to fire and electric accidents" and "struck by falling objects," which are the major risks in high-rise construction projects.

From Reactive to Proactive: The Role of Wearable Technology, AI, and Digital Training in Construction Safety Management

KP Chandu, KH Raja, NN Kumar - Library Progress International, 44(3), 22858-22864

Available online at www.bpasjournals.com

The construction industry remains one of the most hazardous sectors, necessitating constant advancements in safety management technologies to protect workers. This review focuses on key innovations that have transformed construction safety management, including wearable technology, artificial intelligence (AI) for hazard detection, and safety training software. Wearable devices like smart helmets and vests monitor workers' health and alert them to unsafe conditions, while AI-based systems detect potential hazards in real-time, enhancing situational awareness. Additionally, software platforms for safety training have digitized the learning process, ensuring compliance and delivering dynamic, customizable content. The integration of these technologies has shifted safety management from reactive to proactive, significantly reducing the risk of accidents and injuries. This article aims to review the latest research in these areas, identify gaps, and provide recommendations for future developments. By examining the benefits, impacts, and challenges associated with these advancements, we present a comprehensive overview of how construction safety management is evolving. The findings indicate that while these technologies offer significant advantages, challenges such as cost, adoption, and technical limitations remain. Future research must focus on overcoming these barriers to ensure widespread implementation across the industry.

Framework to assess connection of risk factors and management strategies in Building Information Modeling

A Elnokaly, I Dogonyaro - Academia Engineering, 2024, 1(4)

DOI : https://doi.org/10.20935/AcadEng7392

The implementation of Building Information Modeling (BIM) technology is advancing within the construction industry. However, there are several risks and challenges associated with the implementation process. Nowadays, there is a lack of research on management strategies to minimize or eradicate these risk factors. The objective of this work is to assess and select the most appropriate theoretical framework to examine the interrelations between risk factors and management strategies based on the publications available in Scopus and Google Scholar. Information has been processed using NVivo 12 Pro software via thematic and content analysis to extract risk factors and suitable theories/theoretical lens. The analysis reveals that the DeLone and McLean information systems (IS) success model is appropriate to examine risk factors within technical aspects from a single-dimensional perspective, while the Socio-technical system theory is preferred for considering socio-technical aspects from a multidimensional perspective. Thus, the new approach merges two concepts, namely, BIM-based construction networks and Leavitt socio-technical model, to analyze the situation in a more holistic manner. This article explores the theoretical concepts of risks in the BIM implementation and various methodological approaches from previous BIM and other information technology (IT)-related studies. The findings provide evidence from a single-dimensional perspective extending to areas with limited research such as the amalgamated aspects. Therefore, they establish a robust and adaptable theoretical framework with global relevance contributing to the generation of new knowledge. Further research is recommended to assess the financial and contractual theories for verification in BIM studies.

Optimizing construction management and workflow integration through autonomous robotics for enhanced productivity safety and precision on modern construction site [PDF]

VB Ayoola, PI Idoko, EO Danquah, EA Ukpoju, J Obasa… - International Journal of Scientific Research and Modern Technology (IJSRMT), 2024, Vol 3, Issue 10

DOI : 10.38124/ijsrmt.v3i10.56

The construction industry is experiencing a technological transformation with the integration of robotics, fundamentally altering traditional construction management and process design. This review explores the role of construction robots in enhancing productivity, safety, and efficiency on construction sites. It examines the various types of robots used, such as bricklaying and welding robots, and analyzes their functions and real-world applications. The paper also addresses the design of workflows and processes around robots, highlighting the challenges and strategies involved in adapting construction projects to a robot-centric approach. Additionally, the impact of robotics on construction management, including shifts in roles, cost efficiency, and collaboration between humans and robots, is thoroughly explored. The review concludes by identifying future trends, challenges, and opportunities in the field of construction robotics, along with relevant policy and regulatory considerations. This paper aims to provide insights into how construction management must evolve to successfully integrate robots, leading to a more efficient, cost-effective, and safe construction environment.

8D-BIM models in construction: Enhanced occupational safety for construction works

M Szóstak, M Napiórkowski, K Dziekoński, KS Anandh - Construction of Optimized Energy Potential (CoOEP), Vol. 13, 2024, 184-192, DOI: 10.17512/bozpe.2024.13.18

Building Information Modelling (BIM) is a key tool supporting innovative approaches in the area of sustainable and ecological construction. Through the use of digital technologies such as BIM, it is possible to accurately plan and optimize construction processes resulting in efficient resource management, reduced energy consumption and minimized waste. BIM also allows for better collaboration between project teams, which supports the integration of sustainability efforts throughout the building lifecycle, from design, realization to operations and maintenance. In addition, the use of BIM can improve occupational health and safety (OHS) on construction sites. With detailed 3D models and simulations, potential hazards can be identified before work begins, construction site organization can be better planned and dangerous situations can be avoided. This facilitates risk management and also ensures safer working conditions for all participants in the construction process.

Adaptive information retrieval for enhanced building safety management leveraging BIM

S Jiang, J Zhang, J Shi, Y Wu - Engineering, Construction and Architectural Management, 2024

DOI : https://doi.org/10.1108/ECAM-08-2024-1018

This paper introduces a novel method to improve building safety management by leveraging building information modeling (BIM) and adaptive information retrieval techniques. The integration aims to overcome the limitations of traditional safety management methods in connecting construction processes with risk management efficiently. The proposed method involves developing industry foundation classes (IFC) ontologies and integrating them with a safety document ontology to form a comprehensive BIM-based safety context framework. Custom reasoning rules and an inference engine are constructed to enable automatic context-aware safety information retrieval. The methodology is demonstrated through an adaptive information retrieval system using job hazard analysis (JHA) documents. The implementation of the BIM-based adaptive information retrieval system shows significant improvements in identifying and managing construction risks. By mapping job-specific risks to corresponding safety measures, the system enhances risk detection and management tailored to particular construction tasks. The results indicate a marked improvement in the precision and accuracy of safety assessments and recommendations, aligning them closely with planned construction activities and conditions.

2. Conférence / ouvrage / thèse

Exploring the Role of Building Information Modeling in Prevention through Design Practices: The Findings in Malaysia's Construction Industry

AR Zulkifli, CKIC Ibrahim, S Belayutham – In Handbook of Drivers of Continuous Improvement in Construction Health, Safety, and Wellbeing, 2024

eBook ISBN 9781032614069

The construction industry is undergoing a transformative shift with the adoption of building information modeling (BIM), which streamlines the design, construction, and operation processes and fosters collaboration among stakeholders. By integrating BIM with the prevention through design (PtD) concept, safety features can be visualized, allowing designers to identify hazards and minimize risks during early design phases, ultimately improving construction safety in later stages. Despite the recognized potential of BIM to enhance safety, research on the integration of PtD utilizing BIM capabilities remains scarce. In this chapter, the authors explore integrations of BIM and PtD on construction projects in Malaysia on which both were incorporated. The authors conducted a comprehensive focus group discussion and incorporated the group feedback into building a proposed comprehensive BIM–PtD framework to strengthen the integration between BIM and safety considerations. Key outcomes of the BIM–PtD integration included risk identification through BIM visualization, constructability reviews, and enhanced collaboration platforms. This research significantly contributes to stakeholders' understanding of the practical implementation of PtD by leveraging BIM functionalities. The established BIM–PtD framework derived from insights gained within the context of Malaysia's construction industry provides invaluable guidance for professional and stakeholders in developing countries' construction sectors. It equips them to implement safety measures adeptly and efficiently in the design stage and throughout the construction project life cycle.

Employing BIM to Improve Construction Safety

X Chen, S Zhang, RY Sunindijo - In Handbook of Drivers of Continuous Improvement in Construction Health, Safety, and Wellbeing, 2024

eBook ISBN 9781032614069

Building information modeling (BIM) can be employed to improve construction project performance, including health and safety, for instance facilitating design optimization and visualization and construction simulation to identify safety hazards more accurately. Such efforts in turn lead to better measures for improving construction safety. There is a need, therefore, to understand the critical factors of employing BIM to ensure its successful application in improving construction safety. Using China as a case study, the authors of this chapter (1) identify the critical facilitating factors in the use of BIM to improve construction safety and (2) compare the perspectives of different construction professionals on the importance of these facilitating factors. Six potential facilitating factors were initially identified through literature review. A questionnaire survey was then used to collect data from 128 construction professionals in China. Analysis revealed that the professionals, regardless of their backgrounds, considered the six factors important for improving construction safety. Three factors are particularly critical: visualization, construction safety simulation, and design optimization.

Multi-objective optimization model for urban road maintenance planning using BIM, GIS, and DCE [PDF]

S LI, Z REN, Y TIAN, JI KIM, L MA, L HUANG – In The 10th International Conference on Construction Engineering and Project Management, Jul. 29-Aug.1, 2024, Sapporo

DOI : https://dx.doi.org/10.6106/ICCEPM.2024.0807

Urban road maintenance creates potential risks for both road users and workers in addition to traffic congestion and delays. The adverse effects of maintenance work could be minimized through mitigation measures of work zone layout and construction arrangement, such as reducing the dimension of work zone segments and scheduling construction during low-traffic periods. However, these measures inevitably escalate construction costs. Consequently, decision-making in urban road maintenance necessitates a balance among multiple strategic objectives to facilitate optimal development via a comprehensive road maintenance management system. This study aims to propose an integrated framework to accomplish the multiple and conflicting objectives for maximizing safety and mobility while minimizing construction costs by optimizing the work zone layout and construction sequence dynamically. The framework enables the seamless information exchange among building information modeling (BIM), geographic information system (GIS), and domain-specific computational engines (DCE), which perform interdisciplinary assessments and visualization. Subsequently, a genetic algorithm is employed to determine the optimal plan considering multiple objectives due to its versatility in resolving highly complex conflict problems.

Enhancing construction safety: Safety resource-based construction safety planning and 3D BIM integration to prevent falls from height in stadium roof projects

RA Machfudiyanto, NB Laksono, MF Radifan, MZN Aini - AIP Conference Proceedings, 2024

DOI : https://doi.org/10.1063/5.0235594

The construction industry faces significant safety challenges in stadium roof construction, with current methodologies lacking effectiveness in addressing these issues. This research aims to bridge this gap by proposing the utilization of Building Information Modeling (BIM) technology to enhance safety measures. The goal of the study is to identify work activities, potential hazards and risks, develop risk control measures, and utilize BIM-based visualization to allocate safety resource requirements. Applying a comprehensive analysis, this research seeks to improve safety standards and reduce accidents in stadium roof construction projects. The integration of BIM technology allows for proactive risk identification, control, and resource allocation. The study’s contribution lies in advancing construction safety practices, highlighting the importance of BIM integration and comprehensive safety planning for successful and safe stadium roof construction.