# Rapport de veille n° 69

## BIM

**31/03/2025**

**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

Rapport de veille BIM n°69

# 1. Articles scientifiques

## Revolutionizing Construction Safety: Unveiling the Digital Potential of Building Information Modeling (BIM)

The construction industry is facing issues worldwide, particularly worker fatalities and injury rates. Construction safety requires careful attention and preparation across the project's entire lifecycle, from design to demolition activities. In the digital era, Building Information Modeling (BIM) has emerged as a transformative technology in the construction industry, offering new opportunities to enhance safety standards and reduce accidents. This study examines the influence of BIM on construction safety, particularly its capacity to transform safety protocols, enhance danger identification, and minimize accidents during the construction project's duration. The review approach used is based on PRISMA. Scopus and Web of Science were the databases used to search for qualifying publications. From an initial cohort of 502 papers, 125 were chosen as relevant to the scope of this research. A thorough analysis of the existing literature was conducted to examine the processes by which BIM helps to improve safety, such as early hazards identification, conflict detection, virtual safety simulations, and improved communication and collaboration among project stakeholders. This study examined the following knowledge gaps: integration with safety regulations and standards, a comprehensive safety dimension in BIM, BIM for real-time safety monitoring, and a BIM-driven safety culture. The following potential future research directions were highlighted: enhanced BIM applications for safety, longitudinal studies on BIM and safety outcomes, BIM for post-construction safety and maintenance, and BIM for safety training and simulation. In conclusion, the integration of BIM into construction safety protocols presents significant potential for mitigating risks and improving safety management over the asset lifecycle. As the industry increasingly adopts digital technology, BIM will be crucial in establishing safer and more efficient construction environments.

## A systematic review of criteria influencing the integration of BIM and Immersive Technology in building projects [PDF]

Integrating Building Information Modeling (BIM) and Immersive Technologies (ImT) provides several benefits, such as the inclusion of clients in the design process, thereby improving construction management practices. BIM's propensity for digital data management, coupled with ImT's enhanced communication and coordination capabilities, addresses inherent issues like fragmentation and collaboration challenges in construction projects. While prior studies have primarily examined BIM and ImT individually, limited research has explored the synergistic integration of these two technologies and the potential benefits they can offer when combined in the context of architecture, engineering, and construction (AEC) industry. This paper reviewsstrategies and prospects for integrating BIM and ImT in the existing construction management literature, aiming to identify and categorize key socio-technical criteria that support the successful integration of BIM and ImT. A Systematic Literature Review (SLR) was accordingly employed, following PRISMA guidelines, analyzing 56 academic journals from Scopus and the ASCE Library databases on BIM and ImT integration in building projects from 2013 to May 2023. The results reveal various attributes of BIM and ImT integration, including the use of BIM-related software like Autodesk Revit, ImT hardware like Oculus Rift and

HTC Vive, game engines like Unity3D, data standards like FBX, and collaborative platforms like Autodesk BIM 360 and Trimble Connect. Essential technical criteria were identified from these aspects: emphasizing software system integration and hardware optimization for seamless data exchange, alongside non-technical criteria focusing on user engagement, learning, and effective stakeholder collaboration. The study also highlights significant gaps, such as the need for standardized methodologies, more detailed technical discussions, and user-centric strategies, pinpointing areas for further exploration to refine BIM and ImT integration practices while providing valuable insights into the adoption and efficacy of digital transformation strategies in the AEC sector.

## Integrating BIM for health and safety in industrial heritage restoration: a case study on gasometer refurbishment

The restoration of industrial heritage buildings presents unique challenges, particularly in ensuring structural integrity, safety, and sustainability throughout the process. It is evident that activities such as structural modifications, demolition and retention carry significant risks. The field of building engineering plays a pivotal role in the transformation of aged industrial edifices into functional and sustainable spaces, while simultaneously preserving their historical significance. Nevertheless, the design for safety and health approach has yet to be implemented with regard to the protection of workers and the general public, as part of the broader concept of sustainability. This study explores the integration of Building Information Modelling (BIM) in the refurbishment of the Phoenix-West Gasometer, emphasizing risk mitigation and project efficiency. By utilizing a multi-phase approach, the research incorporates 3D modelling, hazard identification, and 4D project scheduling to enhance decision-making. The study leverages Autodesk Revit, Navisworks, and Tekla Structures to develop a comprehensive model that integrates safety attributes, material assessments, and environmental risk management. The project timeline was structured into distinct phases, including structural reinforcement, soil remediation, prefabrication, and final safety checks. Through case study comparisons with the Oberhausen and Augsburg Gasometers, the research highlights best practices in heritage restoration, such as soil contamination management, prefabrication strategies, and climate control solutions. The findings demonstrate that BIM-driven restoration can enhance safety compliance, reduce construction risks, and improve project efficiency. This study contributes to the growing body of knowledge on heritage conservation and digital construction methodologies, offering a structured framework for future industrial restoration projects.

# 2. Conférence / ouvrage / thèse

[Exploring the Integration of Digital Technologies and Lean Principles for Transformative Construction Project Management: A Review [PDF]](#)

BA Adewale, CO Aigbavboa, BFOVO Ene – CIC Global, The Fourteenth International Conference on Construction in the 21st Century (CITC-14), Rio de Janeiro, Brazil | September 2-5, 2024, 13 p.

This study explores the synergies between digital technologies and lean project delivery to address persistent challenges in the construction industry. The primary aim is to examine the integration of digital technologies, such as Building Information Modelling (BIM) and modular construction techniques, with lean principles to transform construction project management. Building on previous research highlighting the potential of these approaches, a narrative literature review examined existing knowledge on leveraging digital tools to enable lean project delivery. The review process involved secondary data from scientific databases, with 150 potentially relevant papers scrutinized and reduced to a final sample of 68. Findings demonstrate that integrating digital technology and lean principles drives substantial improvements in collaboration, visualization, data-driven decision-making, productivity, supply chain management, and overall project performance, as evidenced by global case studies. The study identified key challenges and implementation considerations, including the need for cultural shifts, training investments, and robust data management capabilities. BIM's role in enhancing design coordination and modular construction's contribution to waste reduction and efficiency are highlighted as critical components of this integrated approach. The research builds upon earlier studies emphasizing the importance of digital transformation in construction, while uniquely focusing on its synergies with lean principles. Future research directions include in-depth case studies, empirical investigations, and collaborative initiatives to further validate benefits, develop best practices, and explore emerging technologies' role in enhancing digital-lean synergies, thus unlocking the full potential of this integrated approach.

[Literature Review on Semantic Enrichment of BIM Models to Consider Occupational Health and Safety Requirements](#)

Moalla, F., Feno, M.R., Messaoudi, T., Savescu, A., Halin, G. - In: Francis, A., Miresco, E., Melhado, S. (eds) Advances in Information Technology in Civil and Building Engineering. ICCCBE 2024. Lecture Notes in Civil Engineering, 2025, vol 628. Springer, Cham, pp. 391-407
DOI : https://doi.org/10.1007/978-3-031-84208-5_31

The use of Building Information Modelling (BIM) technology in architectural projects stakeholders to collaborate around a digital mock-up that contains all relevant and shared information throughout a building's lifecycle. One emerging application of BIM technology focuses on occupational health and safety by providing opportunities for safety risks prevention from the building's design phase. In this context, BIM provides a set of standards that enable the modelling of the main building component. Although IFC (Industry Foundation Classes) is considered as a standardized, digital description of the built asset (ISO 16739–1:2018), it does not cover all the elements and properties necessary to represent and describe work activities related to requirements induced by the architectural model. Therefore, this situation makes the comprehensive formalization of safety requirements in buildings incomplete. It is thus necessary to add data information and knowledge from external sources. The objective of the article is to provide an in-depth analysis of the literature from 145 articles extracted over the last 5 years (2019–2023) regarding the representation of safety requirements in an IFC model based on work situations at different project phases. The analysis of the systematic review reveals that there are specific ontological knowledge models dedicated to health and safety, but it is important to consider both the contributions and limitations of these ontologies. This article examines how semantic enrichment of the IFC

Rapport de veille BIM n°69

model tends to use in research projects to address this issue. In addition, these projects provides several use cases that facilitate risks factors identification, verify safety requirements, and propose recommendations occupational risk and safety prevention.