



## ***Rapport de veille n° 78***

### **BIM**

**31/12/2025**

**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.

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## 1. Articles scientifiques

### [Utilization of BIM Technology for Construction Operation Sequencing Training for General Contractors](#)

[\[PDF\]](#)

YC Lin, YT Hsu - *Advances in Civil Engineering*, 2025, Vol. 2025, n°1

DOI : [10.1155/adce/8383065](https://doi.org/10.1155/adce/8383065)

Construction operation sequencing is vital for effectively managing construction job sites. In this regard, it is important that junior engineers learn construction operation sequencing on construction sites. In Taiwan, senior engineers teach construction operation sequencing to junior engineers by using documents or two-dimensional (2D) shop drawings. However, many junior engineers find it difficult to understand construction operation sequencing when their instructors use 2D illustrations. With the COVID-19 public health crisis serving as a catalyst for changes in the nature of training across fields, there is an opportunity to review the traditional approach for training in construction operation sequencing. Therefore, this study develops a construction building information modeling (BIM)-based learning and training (CBLT) system to train junior engineers employed by general contractors. The proposed approach and system are applied to a building project in Taiwan as a case study to verify their effectiveness in practice. The results demonstrate that a CBLT system is an effective visual learning and training platform for junior engineers to learn construction operation sequencing. The CBLT system not only increases learning and training efficiency but also facilitates the transfer and reuse of senior engineers' knowledge and experience for effective construction operation sequencing at job sites, which is particularly valuable for junior engineers.

### [Sustainability in civil construction through industry 4.0 and BIM technologies](#)

J de Oliveira, D Schreiber, VD Jahno - *Automation in Construction*, Volume 182, February 2026

DOI : <https://doi.org/10.1016/j.autcon.2025.106729>

Despite the potential benefits of managing buildings as material banks (BAMB) through circular economy practices, several operational challenges remain. The integration of technologies such as Building Information Modeling (BIM) and Industry 4.0 (I4.0) offers a promising pathway to address these barriers. This paper aims to evaluate the current state of research on the application of BIM and I4.0 technologies to promote sustainability in civil construction, with a particular focus on their alignment with the BAMB concept. A systematic literature review is conducted, analyzing 151 peer-reviewed articles published between 2014 and 2024 from the Scopus and Web of Science databases. The findings indicate that the use of BIM and I4.0 technologies contributes positively to all three pillars of sustainability. Based on the analysis, a conceptual framework is developed to support the implementation of the BAMB model, incorporating BIM and I4.0 technologies across all phases of the building life cycle.

### [Construction Waste Documentation System in Poland: Current State and Prospects for Automation](#)

J Sagan, P Wojtaszek - *Sustainability*, 2025, 18(1), 77

DOI : <https://doi.org/10.3390/su18010077>

Efficient documentation and traceability of construction waste are essential for meeting the objectives of the European Green Deal and the Circular Economy. In Poland, the national Database on Products, Packaging, and Waste Management (BDO) serves as the central platform for recording and reporting waste flows, including those generated by the construction sector. However, its current structure imposes substantial administrative burdens, particularly on large-scale projects involving thousands of waste transports. This study examines the documentation workflow within the BDO system as applied to construction activities. Using process mapping, field studies, and interviews, the research identifies key bottlenecks and opportunities for improvement, especially through automation enabled by the integration of external applications connected to BDO via its

public Application Programming Interface (API). Among nine identified systems, one was selected due to its comprehensive functionalities tailored to construction-sector needs. A study involving thirty users demonstrated that implementation of this system reduced the time required to issue a Waste Transfer Card (KPO) by 77% and fully automated entries in the Waste Records Register (KEO). As a result, the average administrative workload decreased by 87%. For a representative demolition company generating approximately 46,000 KPOs annually, the total time savings correspond to 8.2 months of full-time administrative work. This reduction translates into annual savings exceeding PLN 47,000 and yields a return on investment of over 100% within the first year. Sensitivity analysis indicates that the system's effectiveness decreases with lower documentation volumes. The findings confirm that targeted automation and improved interface design can significantly enhance the efficiency, accuracy, and transparency of construction waste documentation.

### [3D Building documentation using portable LiDAR systems–functionality analysis \[PDF\]](#)

K Wawrzyniak, ME Kowalska, J Zaczek-Peplinska... - Reports on Geodesy and Geoinformatics, 2025, Vol. 120, pp. 109–119

DOI : 10.2478/rgg-2025-0022

Contemporary building documentation increasingly relies on laser scanning technologies that provide rapid and precise spatial data acquisition. Portable LiDAR systems such as the Leica BLK360, as well as mobile devices like the iPad, offer modern tools for efficient documentation of interior spaces, including office rooms. With dedicated applications (e.g., Leica Cyclone Field 360, Leica Cyclone 3DR, MagicPlan, BIMx, AutoCAD Mobile), users can record measurements, create sketches, and generate 3D models and photographic documentation within a single digital environment. The purpose of this study is to assess the dimensional accuracy in the documentation of an office space using portable LiDAR systems. The experiments showed that, for most analysed dimensions, the results agreed within several centimetres, which is sufficient for architectural inventory work. However, the issue of rounded corners was identified, which may significantly influence measurement results depending on the distance-measurement method applied. Reliable accuracy analysis required proper mutual alignment (common georeferencing) of the scans acquired with the selected instruments. To achieve this, point cloud classification was performed to identify surfaces suitable for cloud-to-cloud alignment. A predefined AI-based classification model dedicated to indoor environments was used. The findings confirm that portable LiDAR systems significantly reduce the time required to complete inventory tasks and enable more comprehensive visualisation of interior spaces. This technology serves as an effective tool supporting the design, modernisation, and management of office environments in a digital workflow, although its accuracy-related limitations must be considered.

### [Integration of 4d bim methodology into proactive risk management for falls from heights: planning collective protection measures in the structural phase](#)

MD Martínez-Aires, LM Cabrera, J Durán-Álvarez - Revista Ingeniería de Construcción, Vol. 40 No. Special Issue (2025): Advances in Digital Construction Management, pp.1-15

DOI : <https://doi.org/10.7764/RIC.00169.21>

Falls from height remain one of the leading causes of serious and fatal accidents in the construction sector. In response to this issue, various countries have established specific regulations and work procedures. Within the European context, there is a well-established regulatory framework complemented by different standards, including those that define collective protection systems designed to minimize the risk of falls, particularly during the structural phase of construction. This article analyzes the potential of the Building Information Modeling (BIM) methodology—and, in particular, 4D simulations (3D models linked to the construction schedule)—as a key tool to anticipate and manage fall hazards from the early stages of design and planning. A procedure is described for incorporating standardized collective protections during the structural construction phase. Finally, the study highlights the importance of integrating these standardized collective protections into

the BIM model within the project workflow. This integration, supported by tools such as Navisworks, enables the verification of their implementation through 4D simulations, optimizing coordination, anticipating risks, and ensuring the effective presence of preventive measures before the commencement of critical activities.

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J Sagan, P Wojtaszek - Sustainability, 2026, 18(1), 77

DOI : <https://doi.org/10.3390/su18010077>

Efficient documentation and traceability of construction waste are essential for meeting the objectives of the European Green Deal and the Circular Economy. In Poland, the national Database on Products, Packaging, and Waste Management (BDO) serves as the central platform for recording and reporting waste flows, including those generated by the construction sector. However, its current structure imposes substantial administrative burdens, particularly on large-scale projects involving thousands of waste transports. This study examines the documentation workflow within the BDO system as applied to construction activities. Using process mapping, field studies, and interviews, the research identifies key bottlenecks and opportunities for improvement, especially through automation enabled by the integration of external applications connected to BDO via its public Application Programming Interface (API). Among nine identified systems, one was selected due to its comprehensive functionalities tailored to construction-sector needs. A study involving thirty users demonstrated that implementation of this system reduced the time required to issue a Waste Transfer Card (KPO) by 77% and fully automated entries in the Waste Records Register (KEO). As a result, the average administrative workload decreased by 87%. For a representative demolition company generating approximately 46,000 KPOs annually, the total time savings correspond to 8.2 months of full-time administrative work. This reduction translates into annual savings exceeding PLN 47,000 and yields a return on investment of over 100% within the first year. Sensitivity analysis indicates that the system's effectiveness decreases with lower documentation volumes. The findings confirm that targeted automation and improved interface design can significantly enhance the efficiency, accuracy, and transparency of construction waste documentation.

### [Automated Assessment of Construction Workers' Accident Risk During Walks for Safety Planning Based on Empirical Data](#)

J Cho, HY Lee, J Kim, J Jang, TW Kim - Sustainability, 2026, 18(1), 265

DOI : <https://doi.org/10.3390/su18010265>

Ensuring workers' safety is a critical component of social sustainability in the construction industry. Accidents that occur while workers are walking on construction sites constitute a significant portion of overall accidents, yet they are often overlooked in conventional task-oriented safety risk assessments. This study proposes novel Accident-During-Walk (ADW) risk indices, hierarchical and data-driven metrics designed to quantify workers' accident risk during walks. The indices are built on Association Rule Mining and utilize structured accident data, accounting for both environmental and work-related attributes. By integrating these indices with project-specific work schedules and worker allocation plans, this study establishes an automated method for daily and weekly look-ahead ADW risk monitoring aligned with construction progress. Case studies on two construction projects validate the discriminative power of the proposed method. The results demonstrate that the indices effectively capture risk fluctuations driven by concurrent multi-trade operations and environmental severity. Notably, the analysis reveals counterintuitive patterns where adverse weather conditions paradoxically reduce risk values by constraining worker mobility, a nuance often missed by static assessments. Ultimately, this framework serves as a data-driven decision-support tool, enabling safety managers to transition from uniform inspections to targeted interventions during high-risk periods, thereby fostering a safer and more socially sustainable construction environment.

## [Blockchain for Safety Compliance in Construction: A Comprehensive Literature Review](#)

R Lal, AO Daoud, AG Mohamed, M Nabawy - Buildings, 2026, 16(1), 143

DOI : <https://doi.org/10.3390/buildings16010143>

The construction industry continues to grapple with persistently high accident rates and fragmented workforce management systems, where manual record-keeping and siloed data impede effective safety compliance. While digital interventions exist, they often rely on centralized databases that are vulnerable to manipulation and opaque. This systematic literature review critically examines the application of blockchain technology as a decentralized infrastructure for enhancing safety compliance in construction. Adhering to the PRISMA 2020 guidelines, this study synthesizes findings from 115 peer-reviewed articles (2020–2025) retrieved from Scopus, Web of Science, IEEE Xplore, and Google Scholar. The analysis focuses on three core mechanisms: (1) the creation of immutable, timestamped safety logs to prevent retroactive data tampering; (2) the integration of IoT sensors for real-time, trustless hazard monitoring; and (3) the deployment of smart contracts to automate compliance verification and incentive distribution. The review juxtaposes theoretical frameworks with empirical evidence from global case studies, including pilot projects in North America and the Asia-Pacific, to quantify benefits such as reduced reporting latency and improved data integrity. Despite promising results, the analysis reveals significant barriers to widespread adoption, notably the “oracle problem,” scalability limitations of consensus protocols, and the lack of legal recognition for blockchain records. This paper concludes that while blockchain is not a panacea, it offers a necessary layer of trust and accountability absent in traditional Common Data Environments (CDEs). Future research directions are proposed to address interoperability with BIM standards (ISO 19650) and to develop energy-efficient consensus mechanisms suitable for resource-constrained construction sites.

## 2. Conférence / ouvrage / thèse

### [Digitalisation Of Occupational Safety And Health In Construction: A Cross-National Perspective \[PDF\]](#)

J Jeong, CM Cheung, D Kim, SR Mohandes, D Lee... - , In: Thomson, C and Neilson, C J (Eds) Proceedings of the 41st Annual ARCOM Conference, 1-3 September 2025, Abertay University, Dundee, UK, Association of Researchers in Construction Management, 409-418

Construction remains one of the most hazardous sectors worldwide, driving interest in digital technologies to enhance Occupational Safety and Health (OSH) management. This study explores the current state, benefits, challenges, and future directions of OSH Digitalisation in the construction industries of the UK, Canada, and South Korea. A structured cross-national questionnaire survey yielded 74 valid responses from professionals across the three countries. Results show that while technologies like Building Information Modelling (BIM), Artificial Intelligence (AI), and drones are widely used, the overall level of OSH Digitalisation is moderate. Significant differences emerged based on job roles, company size, and national context. Common challenges included resistance to change, lack of technical skills, and regulatory issues. Strategic priorities differed: Korean respondents favoured “Offering Financial Incentives from the Government,” while UK professionals emphasized “Providing Training and Support for Staff.” Nevertheless, there was broad consensus on the future importance of technologies such as AI and Machine Learning (ML). This study addresses a critical gap by providing a comparative, datadriven view of digital OSH transformation and offers insights for policymakers, industry leaders, and researchers.

### [A Review of Building Information Modelling and Digital Twin Applications in Prevention Through Design](#)

MRA Salleh, S Mohd, TJ Wen, MS Senin, NC Teng - IOP Conference Series: Earth and Environmental Science, 2025, 1577 012015

DOI : 10.1088/1755-1315/1577/1/012015

The integration of advanced digital technologies such as Building Information Modelling (BIM) and Digital Twin (DT) in construction safety has the potential to support the implementation of Prevention through Design (PtD) practices. By integrating BIM and DT applications into PtD practices, it could enhance hazard identification, design risk analysis and decision-making processes at the early stages of construction projects. However, the implementation of BIM and DT technologies into PtD practices is still slow. This paper conducts a comprehensive review that examines the current state of BIM and DT adoption within PtD contexts by analysing twenty-three (23) existing papers gathered from journal articles, conference papers, books, and materials available on Scopus, Web of Science, and ScienceDirect databases related to the study. The study identifies current applications, categorises the key benefits such as real-time monitoring, predictive analytics, and improved stakeholder collaboration and evaluates the major implementation challenges, including interoperability issues, high costs, and skill shortages. Findings from this review aim to provide a foundational understanding for researchers and raise awareness among industry stakeholders seeking to enhance construction safety through integrated digital solutions. These findings suggest a need for clearer implementation frameworks, standardised data protocols, and targeted workforce upskilling initiatives to fully realise the potential of BIM and DT in PtD practices. Thus, these technologies have the capacity to transform PtD from a reactive, checklist-based process into a dynamic, data-driven strategy for accident prevention.