

# HBIM for Heritage Preservation

## A Comparative Study of Standards and Applications

The preservation and documentation of cultural heritage face significant challenges in the digital era, particularly due to climate change, conflicts, and other threats. Building Information Modeling (BIM), specifically Historic/Heritage Building Information Modeling (HBIM) under the ISO 19650 standard, provides a robust tool for the digital 3D representation and management of heritage sites. This research investigates HBIM's application in heritage preservation, focusing on its potential, challenges, and the evaluation of approaches in United Kingdom, Germany, and Poland.

This study reviews guidelines and standards from relevant authority institutions, both existing and under development. Data were collected from case studies and best practices involving Heritage England, Historic Environment Scotland, the Association of Heritage State Authorities in Germany, and the National Institute of Cultural Heritage in Poland. These datasets offer a comprehensive view of HBIM implementation and its effectiveness across different regulatory and cultural environments.

Our methodology involves analyzing documentation, guidelines, and standards employed by these institutions to identify best practices and challenges in HBIM implementation. We evaluate the interoperability of various HBIM tools and their compliance with international standards like ISO 19650, ISO 7817-1:2024 and open international standard for information ISO 16739-1:2024. Additionally, we explore practical applications through case studies, including the preservation of a UNESCO World Heritage Site, a conversion project, and ongoing building research. These case studies focus on collaborative efforts with German and Polish stakeholders to develop and standardize building research, digital planning and operational processes. For example, the HBIM project for a UNESCO World Heritage Site involved creating a comprehensive digital model that integrates historical data, architectural details, and conservation requirements, demonstrating the practical benefits and challenges of HBIM implementation to preserve endangered cultural heritage.

In Germany, the Association of Heritage State Authorities is actively incorporating HBIM into their strategies, focusing on developing standardized approaches that facilitate its integration into daily operations. German authorities emphasize high-quality data acquisition and interoperable software solutions compliant with international standards. They also explore HBIM's potential to enhance collaborative efforts among stakeholders involved in heritage preservation.

In Poland, the National Institute of Cultural Heritage has conducted extensive research on modern technologies in heritage documentation as well as HBIM applications proposal for managing and preserving historical sites. The Polish approach highlights an idea of a coherent system of data collection, processing and presentation of data as a basis for conservation activities as well as HBIM's opportunities in improving restoration accuracy and efficiency. The Institute also identifies the importance of training and capacity building among heritage professionals to ensure successful HBIM implementation.

The analysis reveals significant benefits of HBIM in heritage preservation, facilitating the creation of detailed and accurate digital models for research activities, conservation planning, risk assessment,

restoration, and preservation projects. In United Kingdom, HBIM enhanced heritage asset management and documentation. In Germany and Poland, first attempts of HBIM highlighted the importance of training and capacity building. Despite benefits, challenges such as high technology costs, the need for specialized skills, and data interoperability issues remain. Ongoing collaboration with responsible associations and institutions addresses these challenges through the development of use cases, requirements, and guidelines. The UNESCO World Heritage Site case study demonstrates HBIM's potential in managing complex preservation tasks. The digital model under development serves as a central repository for all information related to the building, allowing for efficient planning and execution of restoration and preservation projects.

HBIM represents a transformative approach to cultural heritage preservation, combining digital precision with the need to protect historical assets. As digital technology evolves, integrating HBIM and other advanced technologies will be crucial for safeguarding cultural heritage for future generations. This study's findings offer a comprehensive overview of HBIM's application and best practices, serving as a valuable resource for cultural heritage institutions worldwide.

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