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OPTIMIZATION OF ENERGY AND CARBON FOOTPRINT THROUGH THE IMPLEMENTATION OF BUILDING INFORMATION MODELING (BIM) DIGITAL TWINS

Problem Statement. Modern construction is one of the largest consumers of energy and a significant source of greenhouse gas emissions, which significantly impacts climate change and poses a threat to sustainable development. The issue of energy efficiency and carbon footprint has become urgent, demanding the implementation of new technologies and methods to address it. The use of building information modeling (BIM) with the application of digital twins is an important approach to tackling this challenge.

Objective. The objective of this study is to conduct a comprehensive analysis and assessment of the impact of implementing building information modeling (BIM) digital twins on optimizing the energy and carbon footprint of construction projects characteristic of our country.

MainSection. The implementation of BIM technology in construction allows for a detailed analysis of building energy consumption even at the design stage [1]. BIM enables the modeling of various building solutions and determines their impact on the energy efficiency of the building before its realization. Visualization and simulation of different scenarios allow engineers and architects to find optimal solutions to reduce energy consumption during the building's operation [2].

Building information models allow for identifying potential issues with energy efficiency and carbon footprint at the design stage. Through BIM, it is possible to analyze the energy efficiency of different constructions, heating, ventilation, and air conditioning systems, as well as building insulation and the use of natural light [3]. This enables adjustments to be made to the project in its early stages, avoiding additional costs during construction and operation [4].

The analysis of materials during the design and creation of the building information model provides the optimization of the energy and carbon footprint. The results of creating such a model are reflected in the author's (master's) thesis. To build the investigated model of the residential complex in Bucha city, Autodesk Revit 2022 software was used (Fig. 1), and further analysis was conducted on the One Click LCA platform (Fig. 2). The use of this platform has permitted the assessment of the characteristics of the materials used in construction and their impact on the environment, which facilitated the selection of safer materials without compromising the mechanical properties of the object.
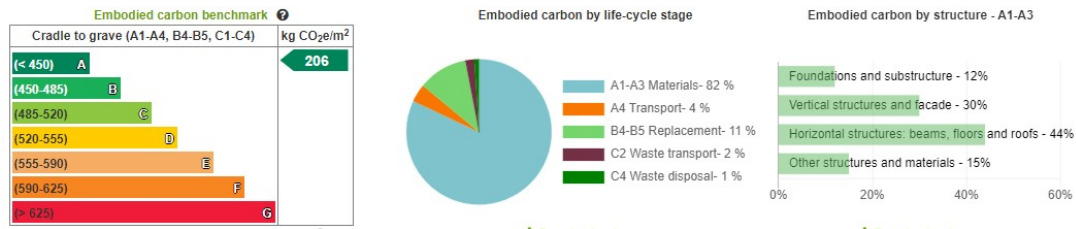

Figure 1. BIM model (building information model)

Figure 2. Results of the analysis of characteristics of materials used in construction

Conclusion. The implementation of building in formation models using BIM technology is an important step towards optimizing the energy and carbon footprint of construction projects. These technologies enable efficient resource utilization, emissions reduction, and the creation of more environmentally friendly buildings and infrastructure.

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