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ASSESSMENT OF THE CARBON FOOTPRINT OF MULTI-STOREY HYBRID TIMBER-CONCRETE BUILDING

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Problem statement. Environmental problems are related not only to the reduction of the use of non-renewable resources, but also the reduction of emissions, waste and pollutants. The important indicator for the environmental impact assessment is the carbon footprint, which is expressed as the carbon dioxide equivalent. The carbon footprint evaluation for a specific construction project must take into account all emissions that occur not only during the service life. The possibilities of reuse and/or recycling of components and materials in the future after demolition of the building should also be considered, as well as, where possible, impacts outside the system of the construction site.

To reduce the environmental impact of the construction industry, in particular the carbon footprint of the building, innovative design solutions for multi-storey hybrid buildings, which allow application of timber in combination with traditional reinforced concrete or steel structures, are being developed today.

Purpose of the study. The aim of this work is to evaluate the effectiveness of multi-storey hybrid buildings with wooden structures in terms of reducing the carbon footprint.

Main results. Two variants of a 15-storey building with a reinforced concrete frame and a hybrid frame (columns and beams are made of glued laminated timber and a reinforced concrete rigidity core provides spatial stability) were considered. The assessment of the carbon footprint (carbon dioxide equivalent) was performed taking into account the requirements of the standard EN 15978, which considers all stages of the life cycle and the possibility of recycling the components and materials after the demolition of the building.

The results of the assessment of the carbon footprint of multi-storey buildings with reinforced concrete (option 1) and hybrid frame (option 2) are shown on Figure 1.

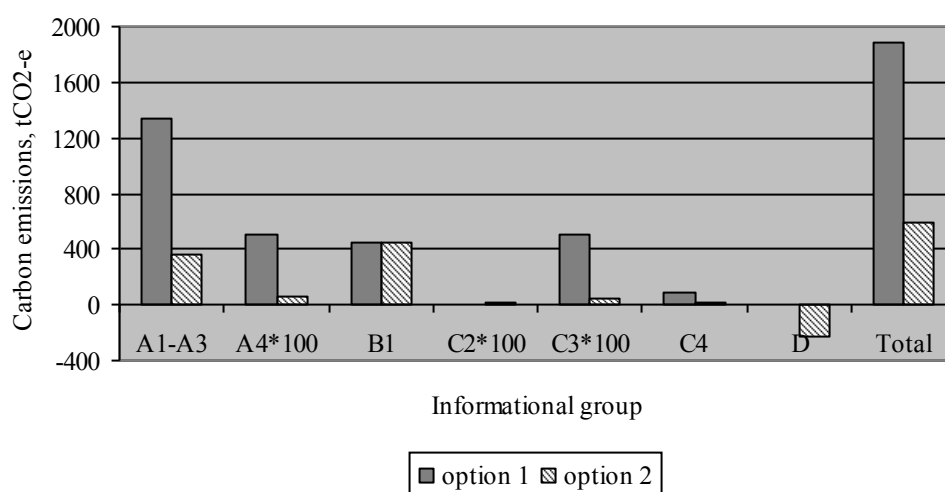


Fig. 1. Carbon emission diagram for considered life cycle modules and total carbon footprint

For the considered variants of the buildings and the stages of the life cycle, the application of a hybrid structural system with the predominant use of load-bearing elements made of timber and timber-based products reduces the carbon footprint by more than three times compared to a

traditional building with a reinforced concrete frame and floors. The use of timber structures due to the possibility of recycling for reuse allows further reducing the emissions by 232 tCO₂eq.

Such significant differences in the carbon footprint of the considered buildings with load-bearing structures of reinforced concrete and timber emphasize the importance of the choice of structural material in the design according to the criteria of life cycle sustainability and prove the feasibility of hybrid systems in multi-storey construction aimed at decreasing the environmental impact.

References

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