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USING ENVIRONMENTALLY FRIENDLY CONCRETE IN REINFORCED CONCRETE STRUCTURES

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Problem statement. In accordance with the concept of sustainable development, construction must adhere to environmental standards and use materials that have a lesser impact on the environment. To meet these requirements, environmentally friendly concretes are finding increasing use in construction, as an alternative to traditional concrete which is made using non-renewable resources and can have a significant carbon footprint.

Environmentally friendly concrete, also known as green concrete or sustainable concrete, is a type of concrete that is made from environmentally friendly materials, and its use reduces the impact on the environment [1].

The use of eco-friendly concrete in reinforced concrete elements has many advantages for sustainable construction (Fig.). Some of the key advantages of eco-friendly concrete in building structures include:

- reduced carbon emissions: eco-friendly concrete can be made from materials such as fly ash, slag, and silica fume, which are by-products of other industrial processes. By using such materials instead of traditional cement, carbon emissions associated with concrete production can be reduced;

- improved energy efficiency: the process of producing eco-friendly concrete can be optimized to use less energy, reducing the impact of production on the environment;

- longer service life: eco-friendly concrete can be selected to have better durability than traditional concrete, reducing the need for repair and maintenance over time;

- improved thermal insulation properties: some types of eco-friendly concrete (such as polystyrene-based concrete, lightweight aggregate concrete, aerated concrete, green concrete made from household waste materials such as glass, ceramics, rubber, and other materials) can be selected to have better thermal insulation properties, which can help reduce heating and cooling costs in buildings;

- reduced waste: by using by-products from other industries, eco-friendly concrete can help reduce the amount of construction and household waste that ends up in landfills [2].

However, it is important to note that ecological concrete is not a universal solution for building construction. The properties and characteristics of ecological concrete may vary depending on the specific materials and processes used, and it may not be suitable for all types of building structures. It is also necessary to consider the compliance of ecological concrete with construction standards and regulations [3].

Therefore, the research of physical-mechanical and operational characteristics of reinforced concrete structures based on ecological concretes is an important scientific and technical task on the way to sustainable development of the construction industry in Ukraine.

Purpose of the study is to investigate the impact of technical, economic, and environmental indicators of different types of eco-friendly concrete for their use in flexural reinforced concrete elements.

To achieve the set goal, the following tasks need to be solved:

- Study the processability of different types of eco-friendly concrete (for example, ease of placement, shrinkage, cracking).
- Evaluate the effectiveness of using eco-friendly concrete in reinforced concrete elements that work under bending in terms of their economic feasibility, environmental benefits, and operational reliability.
- Develop a composition of the mixture for eco-friendly concrete, taking into account the criteria of sustainable development in construction.
- Study the impact of using eco-friendly concrete on the environment and assess the comfort of premises in buildings made of such materials.
- Develop recommendations for using eco-friendly concrete (of a certain type) for bending reinforced concrete structures of buildings and structures.



Fig. Examples of buildings with structures made of ecological concrete

The ability to place ecological concrete may differ from traditional concrete due to differences in materials and production processes used. To ensure that ecological concrete has the appropriate workability for use in flexural reinforced concrete elements, it is necessary to select the appropriate mixture composition and conduct appropriate laboratory tests to determine its physical-mechanical characteristics. In addition, ecological concrete may be susceptible to shrinkage and cracking, which could jeopardize the structural integrity of the reinforced concrete elements working in flexure. Proper curing and moisture control can help prevent shrinkage and cracking.

The composition of the concrete mix should be optimized to achieve desired mechanical properties when using environmentally friendly materials. This involves selecting the right combination of materials, proportions, and water-cement ratio to achieve the necessary strength and durability.

The use of eco-friendly concretes in reinforced concrete elements has many advantages for sustainable construction, such as reducing the use of natural resources, lowering emissions of carbon dioxide and other harmful substances during production, and reducing waste. However, the use of eco-friendly concretes can have its drawbacks. Some eco-friendly concretes may have a higher production cost, quality control complexity, and instability of properties under different usage conditions.

The impact assessment of concrete structures on the environment should be carried out throughout the entire life cycle, from production to demolition. The main indicators for impact assessment are the consideration of embodied energy, greenhouse gas emissions, and other environmental impacts related to production, use, and disposal of the structure.

Conclusion. The use of eco-friendly concrete in reinforced concrete structures is one of the key directions in modern construction industry. Over the last decade, there has been a growing awareness of environmental responsibility and the need to reduce the impact of construction activities on the environment. The use of eco-friendly concrete is one way to achieve this goal.

Overall, eco-friendly concrete can be an alternative to traditional concrete and help reduce harmful emissions into the atmosphere, increase environmental sustainability, and reduce the use of natural resources in construction. However, when using eco-friendly concrete for reinforced concrete structures, it is important to be cautious and consider their peculiarities and drawbacks to use them effectively and safely. Moreover, the properties and characteristics of eco-friendly concrete may differ depending on the specific materials and processes used in their production, and it may not be suitable for all types of building structures.

References

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