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THE USE OF PREFABRICATED BASALT-PLASTIC REINFORCEMENT IN CONSTRUCTION

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ABSTRACT

There probably aren't many domed concrete structures where you live, because they're difficult to build. To build them usually requires the construction of a supporting wooden structure that holds the concrete in place while it is hardens. However, nowadays, a team at the Vienna University of Technology has devised a system that allows concrete shell structures to simply be "inflated" and cinched together with a steel cable.

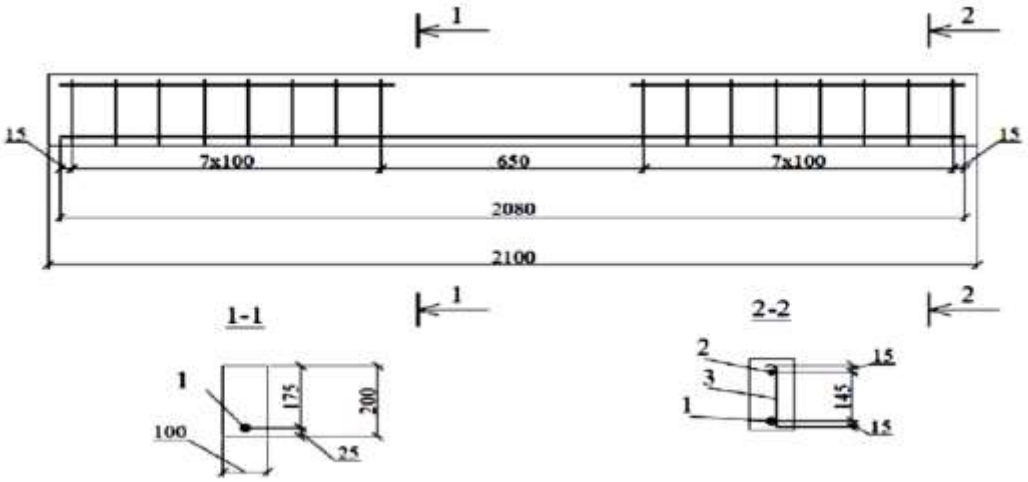
Keywords: domed concrete structures, supporting wooden structure, shell, steel cable, concreting, sub-zero temperature.

INTRODUCTION

Reinforcement is a mandatory attribute of modern construction. It is used in the construction of foundations for private houses, baths and factories, the construction of bridges and roads. Today, basalt-plastic reinforcement (ABP) is very popular. The material has characteristics that have allowed it to partially replace the classic metal fittings - a proven and reliable material. Therefore, before choosing the right building material, it is useful to learn more about ABP.

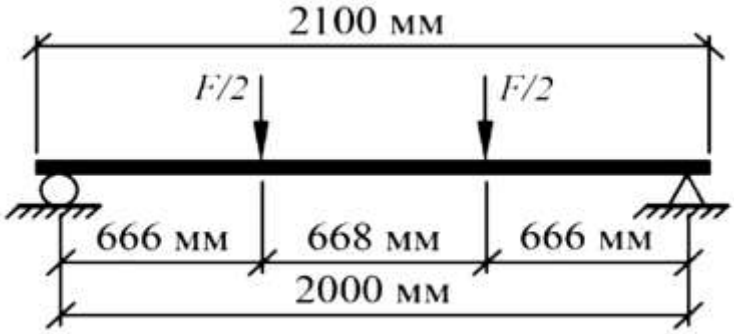
Basalt-plastic reinforcement

This type of composite reinforcement is made from basalt fibers, which are impregnated with thermosetting or thermoplastic binder polymers. Due to its composition, ABP rods are highly resistant to aggressive environments (rice.1).



Rice. 1. Construction of a basalt concrete beam.
1 - a rod of basalt-plastic reinforcement; 2 - 2Ø6 A-I; 3 - 16Ø6 A-l.

Today, there are several methods for manufacturing basalt-reinforced plastic rods. The properties of the finished product depend on this. We list the most common options:
Pulltrusion - the fibers of the rod are impregnated with a special polymer, after which they are passed through spinnerets, the diameter of which gradually decreases. This makes it possible to mold and increase the strength of the finished material (rice.2).



Rice. 2. Static scheme for testing basalt concrete beams.

Planetrusion - a spinless broach is used to reduce the cost of rods.
Needletrusion - fibrous threads bound into one rod, impregnated with a polymer binder, passed through separate channels. And then they are connected, subjected to stretching and twisting. Finished fittings are distinguished by high cost, but they have excellent performance characteristics [1].
A large selection of production technologies allows you to get finished products that meet the requirements of the consumer. It is possible to choose a material that has a suitable diameter and length, as well as other important characteristics.
Depending on the requirements of the user, the rods can have both a smooth and embossed surface. Are issued nominal diameters from 4 to 32 millimeters. If desired, you can order a different diameter - the production of basalt rebar is highly flexible. However, 32 millimeters are already very thick rods that can withstand loads of tens of tons. The method of storage also depends on the thickness. Thin fittings, from 4 to 8 mm., are stored and transported in bays 50 or 100 meters long. Thick - in rods with a length of 0.5 meters or more.

Table of physical and mechanical characteristics of basalt-plastic reinforcement[2]

№	Characteristic	Indicator
1.	Tensile strength, MPa, not less than	800
2.	Tensile modulus, GPa, not less than	50
3.	Ultimate compressive strength, MPa, not less than	300
4.	Ultimate strength at cross section, MPa, not less than	150
5.	Strength limit of adhesion to concrete, MPa, not less than	12
6.	Reduction of tensile strength after soaking in an alkaline environment, %, no more	25
7.	Strength limit of adhesion to concrete after soaking in an alkaline environment, MPa, not less than	10
8.	Limiting operating temperature, °C, not less than	60

SCOPE OF APPLICATION

As practice shows, the use of this material is justified in the construction of any objects. It is used in the construction of industrial, public and residential buildings, in cottage and low-rise construction. Often rods are used when pouring concrete forms in winter. In order for the solution to gain hardness, special antifreeze additives are added to it. Thanks to them, you can do construction in the cold season. But at the same time, the corrosion of steel reinforcement is significantly accelerated. But composite basalt reinforcement is not afraid of corrosion, so it can be used in construction.

The use of basalt-plastic reinforcement in construction.

Corrosion resistance further increases the scope of application. Basalt rebar is used in the construction of embankments and pavements, on which special anti-icing agents will be used, which can also cause corrosion. Metal fittings are afraid of moisture, especially salt water. Therefore, it should be used with caution in the construction of bank protection structures. But corrosion does not threaten basalt plastics, so construction becomes simple and safe [3].

At present, the percentage of use of basalt-plastic rods in construction work is growing at a rapid pace. This is not surprising if you know what advantages are characteristic of the material. Let's briefly talk about the main advantages that professionals highly appreciate:
High, in comparison with the metal counterpart, strength. As tests have shown, it withstands tensile loads 3 times greater than the usual metal rods.
Lightness - weight gain is about 4-5 times.
Not afraid of corrosion (as already mentioned above).
It is characterized by low thermal conductivity, due to which the thermal conductivity of the walls of buildings is significantly reduced, and hence their heat loss during operation.
Works in a wide temperature range - from -70 to +100 degrees Celsius.
Transportation - small diameter rebar can be transported in coils, even by car.
The temperature coefficient of expansion is the same as that of concrete. That does not allow the appearance of cracks in the concrete structure, with changes in ambient temperature.
Provides good grip when working in concrete.
Therefore, questions about why basalt-reinforced plastic reinforcement quickly gained popularity usually do not arise.
Unfortunately, any building material has not only pluses, but also minuses. It is especially important to know about the latter. Therefore, we will briefly talk about them.

DISADVANTAGES

One of the main disadvantages that basalt plastic rods have is low ductility. The platform of fluidity is almost completely absent. Therefore, it is simply impossible to bend them - you have to use special equipment to heat them to the desired temperature. This makes building (especially private) more difficult.
Low rigidity, 4 times less than that of metal fittings. Also low heat resistance - loses its load-bearing properties at temperatures above 300 ° C, and metal at 500 ° C. In this regard, its use in construction is sharply limited [4].
When working with it, it is advisable to use protective equipment. And in no case should you cut basalt rebar without gloves, goggles and a respirator. In this case, the smallest dust is formed. Its light weight allows it to stay in the air for a long time. Each speck of dust is a thin and sharp fiberglass needle. Contact with open skin, respiratory organs and eyes will cause dangerous injuries.
When choosing a building material, in no case should you forget about these shortcomings. Otherwise, you can build a structure that will not meet the requirements, as well as damage your own health.

GENERAL CONCLUSIONS

A new solution of the scientific and technical task for experimental and theoretical research has been obtained.
Strength, stiffness and crack resistance of concrete and fiber-reinforced concrete beam structures
Bridges reinforced with non-metallic basalt-plastic reinforcement and the following conclusions were made:

- All the difference between fiberglass reinforcement and basalt plastic reinforcement lies in the difference in changeable raw materials. If in the first case the polymer fastens fiberglass, then in the second - basalt fibers. The production cycle for both materials is exactly the same, therefore, both fiberglass and basalt-plastic reinforcement are manufactured at the same power news. Basalt fiber provides a different color to the final building material, and it is saturated black, which is the main distinguishing feature.
- The similarity of production, as well as the same connecting component, make these two mamaterials are almost exactly the same. However, a slight advantage in practice all parameters remain with the basalt-plastic reinforcement. This increased time cotensile strength (if for 8 diameter fiberglass reinforcement this value equal to 1200 MPa, then for basalt plastic it is 1300 MPa), this is a larger modulus of elasticity (45,000 MPa for ASP, and 60,000 MPa (33% more) for ABP), in addition, basalt plastic reinforcement has a higher resistance in aggressive environments. Still fiberglass reinforcement is the undisputed leader in demand among all types of composite reinforcement, and this is due to its lower cost compared to basalt-plastic, because raw materials in this case are cheaper [5].
- Obtained experimental data on the possible types of destruction of basalt concrete bends forged elements reinforced with basalt-plastic reinforcement as a result of rupture of the positive reinforcement and as a result of concrete fragmentation of the compressed zone. Installed dependency type of destruction on the coefficient of longitudinal reinforcement.
- Experimentally established the possibility of applying the methodology for calculating reinforced concrete bending elements according to bridge design standards, calculations of concrete and fiber-reinforced concrete bending elements with basalt-plastic reinforcement, provided that they are optimally reinforced ing (simultaneous destruction of the compressed and stretched zones).

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