CONSTRUCTION OF EARTHQUAKE-RESISTANT BUILDINGS AND STRUCTURES USING INNOVATIVE FIBER-REINFORCED CONCRETE STRUCTURES

Professor Khodjaeva Zulfiya Shukhratovna, Bachelor Sabitova Iroda Ibrokhim qizi
Tashkent University of Architecture and Civil Engineering,
khiro3905@gmail.com

Annotation: This article discusses the scope of fiber-reinforced concrete and determines the advantages of fiber-reinforced concrete over conventional concrete. The effectiveness of the use of fiber-reinforced concrete is also analyzed.

Key words: Seismic resistance, fiber-reinforced concrete, concrete, reinforced concrete, structures, technology, construction, glass fiber-reinforced concrete, reinforced concrete structures.

First, let's define what seismic resistance is. Seismic resistance is the property of a building or structure not to collapse during an earthquake. When designing and constructing buildings and structures, taking into account the possible seismic activity of the area, many factors are taken into account, such as soil conditions, building exposure, building materials, and many others.

One of the materials that are widely used today in the construction of earthquake-resistant buildings and structures is fiber-reinforced concrete. Fiber-reinforced concrete is a composite building material consisting of a binder (cement, lime, gypsum) and special fibers (glass, basalt, carbon fiber, polyethylene or others).

Fibre-reinforced concrete has unique properties that make it very attractive for use in construction (Pic. 1). It has high strength and toughness, which allows it to withstand heavy loads and deformations. In addition, fiber-reinforced concrete has excellent anti-corrosion properties and retains its properties well at extreme temperatures.

Pic.1

With the help of fiber-reinforced concrete, you can create innovative structures that are guaranteed to withstand earthquakes. For example, fiber-reinforced concrete walls are thin but strong, allowing for more spacious housing with less stress on the building's foundation. Also, fiber-reinforced concrete can be used to create lightweight panels that can be used in the construction of large buildings, reducing transportation and installation costs.

Innovative structures based on fiber-reinforced concrete make it possible to create more reliable and durable buildings and structures that can withstand even the strongest earthquakes. This is important not only for those countries that are in a zone of high seismic activity, but also for any country, including Uzbekistan, where such phenomena are also not rare.

There are a lot of examples of buildings and structures, the construction of which was carried out using fiber-reinforced concrete. Here are some examples from different countries:

1. Tower "Thirty-two", Taiwan. This tower is 101 meters high and was built using fiber reinforced concrete as the main building material. It is one of the tallest buildings built using fiber reinforced concrete.

2. Skyscraper "New York Times", USA. This 228-meter high skyscraper was built using fiber reinforced concrete to improve seismic resistance. In total, about 6 thousand tons of fiber-reinforced concrete were used.

3. The building of the company "Mercedes-Benz", Russia. This large building is located in St. Petersburg and was built using fiber reinforced concrete to improve seismic resistance.

4. Towers "Twin Towers" (The Twin Towers), UAE. These two high-rise towers, 800 and 600 meters high, were built to create a new lifestyle and working environment in the Dubai metropolitan area. These towers were built using fiber-reinforced concrete, which provided earthquake resistance and minimized the risk of natural disasters.

These are just some examples of the many buildings and structures that have been built using fiber reinforced concrete. Every year this technology becomes more and more popular and promising.

Fibre-reinforced concrete is a material obtained by adding steel fibers to a concrete mix. Fiber-reinforced concrete has high strength and deformation characteristics, as well as resistance to aggressive environments. It can be used in many designs including the following.

1. Facade panels: fiber concrete panels are used in architecture to create the exterior decoration of buildings. They have high strength and wear resistance, and can also imitate various types of surfaces, including wood, brick or stone.

2. Bridges and Tunnels: Fiber concrete structures can be used to create the structural elements of bridges and tunnels, such as concrete slabs, columns, beams and abutments. They are stronger and more durable than regular concrete and can withstand high loads without warping or breaking.

3. Floors: Fibre-reinforced concrete can be used to create floor structures such as industrial floor panels. These structures are highly durable and wear resistant, making them ideal for industrial buildings and warehouses.

4. Tunnels and drainage pipes: Fiber concrete pipes and tunnels are used to transport liquids and gases, as well as sewer systems in various industrial and civil facilities.

5. Floor Slabs: Fiber concrete slabs can be used to form floors in buildings. They have high strength and resistance to deformation, making them ideal for use in buildings with a large number of floors.

Depending on the type of fibers used, fiber reinforced concrete can be micro fiber concrete, macro fiber concrete and composite fiber concrete. Each of these types has specific properties that can be tailored to specific design requirements.

The scope of fiber-reinforced concrete is determined by its technical and economic efficiency. This is due to the fact that the positive properties of fiber-reinforced concrete can be used to the fullest in comparison with ordinary concrete or concrete reinforced with steel reinforcement. When choosing a constructive solution, the method of manufacturing the structure, the method of its installation and operating conditions are taken into account. The shape and dimensions of the elements should be determined based on the most complete use of the characteristic features of fiber-reinforced concrete, the possibility of mechanized and automated factory production and the convenience of transporting the installation of the structure [1]. The specific properties of distributed reinforced concrete should also be taken into account. For example, glass fiber reinforced concrete is radio-permeable and there is no risk of algae blooms on it in water bodies. The accumulated national and international experience made it possible to determine the initial range of cost-effective structures made of glass fiber reinforced concrete. Thin-walled structures are most effective. Non-coated rolled panels, ribbed panels with coating and overlapping, elements of fixed formwork, elements of underground utilities, wall panels and partitions, floor panels, monolithic shells, elements of loggia fencing, architectural decoration of balconies and facades, elements of hydraulic structures. Today, saving energy in the production of various building materials is a topical issue. The amount of energy needed to produce concrete is negligible compared to the amount of energy needed to produce steel, aluminum, glass, bricks and plastic. In addition, concrete production requires less water than steel production, which has a lower environmental impact. Reinforcement of concrete increases the energy strength of the material. The widespread use of reinforced concrete means that it is necessary to minimize the use of steel and use it as efficiently as possible in the concrete mixture. For example, reinforcing steel is often included in concrete structures solely because of the forces acting on the structure during transport and installation. In this case, the thickness of the structure is usually 60-80 mm or more (since the protective layer of concrete must be thick enough to protect the reinforcement from corrosion). At the same time, however, the specified thickness of the elements may not be justified in terms of strength. This leads to excessive structural consumption of concrete and reinforcement, which does not fulfill its intended purpose during the operation of the structure. In addition, in reinforced concrete structures, a significant amount of steel is spent on mounting rods, transverse rods and reinforcement. Thus, there is potential to reduce the consumption of steel reinforcement in structures. Therefore, further improvement of concrete materials includes not only the improvement of mechanical properties, but also the search for the most rational use of metal reinforcement and the creation of new effective reinforcing materials. When choosing a rational type of distributed reinforcement in lightweight expanded clay concrete, it should be taken into account that the properties and geometric characteristics of the reinforcing elements are such that they do not cause the appearance of defects that weaken the concrete structure, provided that their content is sufficient for concrete hardening. If coarse aggregate is the weak point of the concrete, then the length of the fibers must be commensurate with it, so that the coarse aggregate can be located in the center of the cells formed by the fibers. In this case, the propagation of cracks between the components of the weak point will be prevented by dispersed reinforcement, and the irregularities will have a local character. If the weak point of the concrete is the mortar part, then in this case, the dispersed reinforcement will prevent the propagation of cracks in the mortar part, and the main load during the development of stresses will fall on the fiber-reinforced concrete. In the production of fiber-reinforced concrete, not only the right choice and rational combination of raw materials is important, but also the production technology. The principles of engineering and technology of dispersion reinforcement largely depend on the type of concrete base material used. The type of concrete determines the type of particulate reinforcement suitable for it and the optimal geometric value of particulate reinforcement. The choice of particulate reinforcement should be influenced by the fact that, for example, ordinary glass fibers are subject to severe corrosion during the hardening of Portland cement concrete and do not react with the hydration products of the gypsum binder. Fiberglass undergoes noticeable corrosion in gypsum-based compositions, but is reliably protected from the corrosion process in the hydration environment of the cement binder. This means that the matrix must be chemically inert to the fibers used. In addition, the fibers must retain significant strength during production and adhere well to concrete. The main difficulty in the preparation of fiber-reinforced concrete is the problem of uniform distribution of fibers throughout the volume of the matrix, while the fibers should not be in direct contact with each other. Currently, the technology for the production of basalt fiber-reinforced concrete is developing in two directions. Namely: vibratory extrusion method and forced shear method. At the same time, further research is needed to determine the most rational use of concrete using fibers from various materials in the construction of buildings and structures [2-4] .

References

1. Бердичевский Г.И., Светов А.А., Курбатов Л.Г., Шикунов Г.А. Сталефибробетонные ребристые плиты размером 6 x 3 м для покрытий. Бетон и железобетон. 1984, № 4. с. 33-34.

2. Гайна А.Л., Кривошеев П.И., Катруца Д.А., Турчин П.М. Состояние и перспективы развития преднапряженных железоетонных конструкций в УССР. М., Бетон и железобетон. № 4, 1990, с.4.

3. Долголаптев В.М. Напряженно-деформированное состояние изгибаемых бетонных элементов, армированных стеклянными стержнями. Автореф.дисс. канд.техн.наук, Киев, 1991, с.36

4. Di-Hua Tong, Xue-Ren Wu, Analysis of crack opening stresses for center and edge crack tension specimens, Chinese Journal of Aeronautics, 2014, № 27, pp.291-298.

5. GAZOBETON BLOKLARINING UZOQQA CHIDAMLILIGI, MUSTAHKAMLIGI, O ‘RTACHA ZICHLIGI VA SOVUQQA CHIDAMLILIGI,BB Hasanov, SS Saydaliyev,RESEARCH AND EDUCATION 1 (8), 4-9

6. GAZOBETONDAN TAYYORLANGAN MAYDA BLOKLARNING ISSIQLIK O’TKAZUVCHANLIK XOSSALARINI O'RGANISH,SS Saiddavronovich,Scientific Impulse 1 (6), 1052-1054

7. O ‘ZBEKISTON SHAROITIDA KO ‘PIKBETON BLOKLARNING UZOQQA CHIDAMLILIK XOSSALARINI OSHIRISH,BB Hasanov SS Saydaliyev,RESEARCH AND EDUCATION 1 (8), 26-31