

Luftkonditionierung. Die letzten Untersuchungen der Gelehrten aus der Max Plank-Universität bestätigen, dass die Moose das CO₂ der Luft absorbieren.

Die Vervollkommnung des Betons durch seine Zusammenwirkung mit biologischen Organismen konnte schon die Lösung für viele technische Aufgaben geben.

THE LATEST ACHIEVEMENTS IN THE CONSTRUCTION OF BOMB-PROOF SHELTERS IN KHARKIV

SERHII CHEKHOV, PhD student

KATERINA YU. SEHIDA, Professor, Doctor of Science in Geography, Scientific Adviser

IULIIA I. SHAMAIEVA, Associate Professor, PhD in Philology, Language Adviser
V. N. Karazin Kharkiv National University, Kharkiv

A month before the Russian invasion in Ukraine took place, an audit of protective constructions and civil defense facilities was conducted in Kharkiv region. As of January 25, 2022 year, 1118 protective structures were registered in the Kharkiv region, 80% of which were ready for use. There are three types of protective structures in Kharkiv: *the shelters on the territory of enterprises; the dual-purpose structures* (metro stations, parking lots, underpasses); and *the basic shelters* (basements, ground floors of buildings, medical and educational institutions). In total, Kharkiv has more than 300 protective structures in enterprises, 30 metro stations, 53 underground passages, 24 parking lots and more than 4,2 thousand basic shelters. The shelters of all types can accommodate more than 1.5 million of the city's residents.

As time has shown, in the context of this full-scale war and continuous bombardments, a large number of defects have been identified in the complex of protective structures and civil defense facilities of the city. They include: most of the shelters are located in the city center and residential areas of the high-rise buildings; lack of citizen knowledge about nearby civil protection facilities; existence of these facilities only on paper; lack of access to these facilities; their unsatisfactory condition, etc. All problems with the existing civil defense facilities must be urgently fixed. At the same time, it is necessary to build new types of protective constructions for the city's residents. Currently, two new types of civil protection facilities are being developed in Kharkiv: the stop-shelters and the metal underground bunkers.

According to the Kharkiv City Council, the city is going to build 25 stop-shelters (at the busiest trolleybus, bus and tram stops). In the case of a threat of artillery fire, people will be able to hide there and wait out the air raid. Israel has a similar experience. In the cities located in the areas of special danger (for example, along the border with the Gaza Strip), there are bomb shelters near every bus stop.

The Kharkiv's stop-shelters will be equipped with seats, wi-fi, and a TV screen where you can see the public transport arriving. It will be possible to contact with the dispatcher. There will be a box with sand to extinguish a fire. These stop-shelters will be designed for 30 people, but they will have a modular design, so they can be expanded if necessary. All the processes for the production of the concrete stop-shelters are performed at one of the Kharkiv's specialized enterprise. According to the manufacturers, their construction can withstand thermobaric shock, high-explosive impact, and shell hits of up to 152 mm. Compared to other shelters, even Israeli ones, the Kharkiv's stop-shelters will have two exits and indirect angles, which provides additional security. The stops-shelters of Kharkiv have a public funding source (they are free to use) and are designed for short-term stays.

The other new type of civil defense facilities in Kharkiv are the metal underground bunkers, or so-called «SKHOVy». In comparison to the stop-shelters, this is a private project (about 2.5 million UAH per unit) and designed for long stay (up to 2 weeks). These metal underground bunkers look like a cargo containers. All structural elements are made of steel and hermetically welded. The rigidity of the structure is ensured by a heavy-duty steel frame made of thick-walled shaped tubes. The outer surface of the bunker is treated with a special anti-corrosion coating. The bunker is insulated with mineral wool. The area inside is about 17 square meters. It is designed to withstand a heavy artillery strike. It is separated from the ground by three meters of ground and a strong monolithic reinforced concrete slab. In case of damage of the main exit, there is a backup evacuation trapdoor. In the event of a complete blackout and disconnection of communications, the bunker is equipped with an inverter generator and a fuel reserve. It provides power for the ventilation, drying and heating of air, water supply and sewage pump. For long-term stays, the bunker has a refrigerator, a large reserve of drinking water and an additional water filtration system, a storage space in the floor, and a technical room. The kitchen is equipped with an electric stove, an extractor hood, a microwave, a sink and a dining table. The bathroom is equipped with a shower, a boiler and a sewage treatment system.

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80% zakhysnykh sporud Kharkivshchyny perebuvaiut u prydatnomu stani – ODA [80% of protective structures in Kharkiv region are in good condition – RSA] / «Suspilne Novyny» – zahalnoukrainskyi suspilnyi telekanal ta internet-ZMI [«Social News» is an all-Ukrainian public TV channel and online media]. – Available at: <https://suspilne.media/200771-80-zahisnih-sporud-harkivsini-perebuvaut-u-pridatnomu-stani-oda/> (in Ukrainian, access date: 31/03/2023).

NEUE IDEEN IN DER ARCHITEKTUR

JELISAWETA DANKO, Student

OLEXANDER W. RACHKOVSKYI, Doz. Dr.-Ing., Sprachwissenschaftlicher
Betreuer

Charkiwer nationale O.M. Beketow Universität für Stadtwirtschaft

Die Arbeit ist der Bionik gewidmet. Die Bionik hat sich erst in den letzten Jahrzehnten insbesondere aufgrund neuer und verbesserter Methoden (Rechenleistung, Produktionsprozesse, interdisziplinäre Betrachtungen) zu einer etablierten Wissenschaftsdisziplin entwickelt. Bei der Entwicklung technischer Funktionselemente waren den Ingenieuren parallele Entwicklungen in der Natur nicht immer bekannt. So wurde das Fachwerk ohne Kenntnis der Feinstruktur der Knochenbälkchen entwickelt. Da keinerlei Übertragung stattfand, spricht man bei solchen formellen oder funktionellen Übereinstimmungen von Entsprechungen und nicht von Bionik.

Auch in der Architektur und dem Bauwesen spielt Neugier und die stete Suche nach neuen Möglichkeiten eine große Rolle. Ein Beispiel hierfür ist etwa der technisch bestimmte Architekturstil der High-Tech Architektur, der in den 1970er Jahren aufkam. Bis heute verwenden die Gebäude der High-Tech Architektur neuartige Werkstoffe der High-Tech-Industrie und Hochtechnologie-Materialien der Luft- und Raumfahrt.

Die Baukunst nimmt die Natur als Vorbild an. Dadurch ist die Bionik ein anderer spannender Forschungszweig. Dieser Begriff ist eine Wortkreation aus Biologie und Technik. Als interdisziplinäre Wissenschaft versucht die Bionik Prinzipien der belebten Natur für die Technik nutzbar zu machen. Dahinter steht die Überlegung, dass sich Konstrukte der Natur- und Pflanzenwelt im Zuge der Evolution über tausende von Jahren stetig optimiert haben. Je nach Ansatz unterscheidet man zwischen Funktionaler Bionik (Adaption natürlich optimierter Prozesse: z. B. klimagerechtes Bauen und natürliche Gebäudelüftung) und Konstruktive Bionik (Bauen mit natürlichen Werkstoffen, oder in Analogie zu natürlichen Vorbildern).