

THE LATEST TECHNOLOGIES IN THE CONSTRUCTION OF MULTI-STORY BUILDINGS

Vinnitsia National Technical University

***Abstract.** The construction of multi-storey buildings is a complex, time-consuming and responsible process. Construction companies try to build buildings in such a way that they are warm, reliable, and soundproof and at the same time constructed at the lowest possible cost. Developers are increasingly using new technologies in the construction of multi-storey buildings.*

Keywords: modern technologies, high-rise buildings, project, monolith, brick construction, modular elements, visualization

Some thirty years ago, we did not even think that we would be able to use mobile phones every day or talk to people on the other side of the planet and see them at the same time. The incredible speed of development of science and technology gives us technologies that we could only dream of before. Amazing developments of modern scientists fascinate and impress with their novelty and significance. It is very gratifying that technological development also applies to our construction industry, in particular, in the construction of multi-story buildings [1, 159-161].

When using modern technologies, developers set several main goals:

- Make the house as high-quality as possible.
- Reduce construction time.
- Reduce the costs of building a house.

Over the past 10-20 years, a huge number of technologies and solutions have appeared in construction, which developers often resort to. Let's consider several innovative changes that are now actively used by Ukrainian developers, and almost nothing was known about them in Ukraine ten years ago:

1. BIM (Building Information Modeling). This is informational modeling that makes it possible to estimate the profitability of the project. Thanks to the program, the developer can quickly prepare the necessary documents, as well as calculate the profit he will receive from construction [2, 8-13].
2. Use of 3D printers for construction. Only advanced construction companies use printers to manufacture some elements of the house. But there are already several houses in the world built exclusively with the help of a 3D printer. The difficulty of using this technology lies in its high cost.
3. Solar panels on the roof. More and more companies are using "green" energy to power homes. In most cases, it is impossible to completely meet the needs of residents in electricity with the help of solar panels, but it can be partially done. Such a project gives residents the opportunity to be somewhat independent of the city's central energy supply. In addition, the panels have a huge service life.
4. Use of drones. With the help of drones, you can take pictures from a height, assess the scale of construction, and find problem areas. Also, the drone helps to evaluate nearby infrastructure and take some nice promotional photos for investors. These devices are also used for security. If we are talking about a large object, then it is quite difficult for guards to bypass it, so round-the-clock drone patrolling is an excellent solution.

There are other new technologies in the construction of multi-story buildings. We considered only the most interesting and those that are actively used by Ukrainian construction companies.

New technologies in construction are used by many developers, including the RIEL Real Estate Corporation. But the current building regulations remain unchanged. Three main technologies are used in the construction of buildings:

- Monolithic technology. Its feature is the use of removable formwork made of wooden panels, plastic, foam. The formwork is filled with a ready-made concrete mixture, which is trampled with a special construction vibrator. As soon as the mixture becomes completely dry and hardened, the formwork is removed. Thanks to this technology, the residential building turns out to be a reliable monolithic object in which the water supply, ventilation, heating, sewage and power supply systems are connected.
- Panel construction of the building. Panel high-rise buildings are structures made of solid reinforced concrete slabs, which have recently been increasingly replaced by so-called sandwich panels (a three-layer product

consisting of two layers of reinforced concrete and a layer of insulation between them). A huge number of high-rise buildings of the last century were built in Ukraine using panel technology. Now it is used by many developers. The main advantage of this technology is the high speed of construction, because the house is assembled as a constructor.

- Technology of brick construction. Brick houses have long been considered the most comfortable and reliable. In the summer, they heat up little, and in the winter they provide good sound insulation. Today, the technology of brick construction is mainly used in the construction of buildings up to 4-12 floors. This is due to the high cost of such buildings and not the highest construction rates. In addition, if low-quality bricks are used and masonry requirements are not met, the tightness of the walls may be violated.

The latest technologies in construction have helped construction companies simplify many processes, as well as achieve higher quality. Many technologies are aimed at reducing construction time and, as a result, reducing costs [3, 3-8].

- Permeable waterproofing. The essence of this technology is to impregnate concrete with a special solution that penetrates into the pores and crystallizes. Thanks to this, the penetration of moisture is blocked, and the service life of the building is significantly increased.

- Fixed formwork. Now this technology is very popular in the construction of houses. Its advantages are the low cost of housing and the high speed of construction. This technology provides monolithic walls, but the formwork itself does not need to be removed.

- Absorption of smog. Such houses absorb all harmful impurities that settle on the surface of the building. Currently, this technology is actively used in Japan, but it is relevant for any large cities, including Kyiv.

- Tensioned armature. This is a method of hardening steel, thanks to which the armature turns out to be extremely powerful and able to withstand huge loads. This technology is increasingly used in the construction of buildings with a heavy load on the walls and ceiling.

The following technologies are also interesting:

- Prefabrication

The assembly of ready-made elements-modules is becoming more and more popular due to its speed and economy. Building blocks and structures are prepared in the workshop, and simply assembled at the site. This helps to reduce costs and speed up the construction process. In timber residential construction, pre-fab residential units for high-rise buildings consist of Cross Laminated Timber (X-LAM) panels. They are characterized by high strength, which is why they are used in the construction of high-rise buildings. The highest modern wooden house was built using this technology. Technologies for the manufacture of more complex MEP (Mechanical, electrical, and plumbing) elements are already being implemented.

- Internet of Things (Internet of Things, IoT)

Internet of Things, IoT applications are created to facilitate and simplify the work of engineers and designers. In the process of designing the object, the specialist can receive information about all new materials and can introduce them into construction. All necessary materials and components are delivered directly to the construction site.

- Virtual and augmented reality

With the help of special glasses, the client can view the presentation model in the office. And the function of augmented reality enables the client and the engineer in glasses connected to a computer to evaluate a full-scale model on the landscape. And immediately assess the need for all changes made in the development process and their effectiveness at the facility. Of course, such a development is a bit shocking and possibly frightening. But examples of incredible projects that have already been built in different cities around the world, whether it is flying houses in Japan, created to protect against earthquakes, or 3D-printed housing in China clearly give an awareness that we are in a new era of construction technology. And this cannot but please and inspire.

Almost every day, new ideas and proposals for ensuring maximum comfort and safety of modern housing appear on the world market. Scientists from different parts of the planet are working on creating new super strong and safe building materials, developing incredible, sometimes cosmic architectural ideas. And all this is implemented and used in construction [5, 141-148].

REFERENCES

1. Arutiunian, I. and Saikov, D. (2019). The place of building term reserve in concept of organizational processes optimization for building production of contracting companies. *Eastern European Conference of Management and Economics*. 159-161.

2. Banakh, A. and Poltavets, M. (2019). Analysis of mutual influence of parameters of natural and anthropogenic urban planning systems. Urban planning and territorial planning. *Urban and territorial Planning*. 69, 8-13.
3. Berkuta, A., Osynska, V., Halinskyi, O. and Vakhovych, I. (2010). Organizational and economic aspects of foreign experience of self-regulation in construction. *Building Production*. 52. 3-8.
4. Konventsiya pro bezpeku ta hihiyenu pratsi u budivnytstvi №167. Construction Safety and Health Convention. URL: https://zakon.rada.gov.ua/laws/show/993_021.
5. Petrenko Yu. (2017). Features of architectural planning and urban planning decisions of the design of buildings in a dense development. *Architectural Structures and Architectural Physics*, 141-148.
6. Sayt Derzhavnoyi Sluzhby Statystyky Ukrainy. Website of the State Statistics Service of Ukraine. URL: https://ukrstat.org/uk/operativ/menu/menu_u/mp.htm.

Bilous Dmytro A. – a student of BM-21b group, Faculty of Civil Engineering, Civil and Ecological Engineering, Vinnytsia National Technical University, Vinnytsia, e-mail: bilousd1524@gmail.com

Stoliarenko Oksana Vasylivna – Candidate of Pedagogical Sciences, Associate Professor of the Department of Foreign Languages, Vinnytsia National Technical University, e-mail: stoliarenko@vntu.edu.ua