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RESTORATION AND STRENGTHENING OF BEARING BRICK COLUMNS USING TM MAPEI MATERIALS

Today, many industrial and civil objects of Ukraine have damaged load-bearing structures, which make their safe and project operation impossible. The main reasons for this can be conditionally as follows:

-the life span of a lot of buildings, built in times of the Soviet Union, have already completed;

-buildings did not operate for a long time and receive any proper maintenance and repair, which caused their destruction;

-buildings were damaged as a result of hostilities or being hit by missiles.

-a combination of all the above-mentioned factors.

All this leads to the emergency stop of the technological process, long-term repair and restoration works and repeated, rather expensive, production start-up.

The purpose of the study is to provide the technology for performing repair and restoration works of brick structures using modern technological solutions and materials, in order to achieve the optimal result in terms of quality, speed of work, cost and warranty period of operation of the restored structure.

Restoration of load-bearing structures should be carried out only after identifying the cause of destruction and determining the current state of the structures by conducting an examination of their current state, bearing capacity, and, if necessary, diagnostic laboratory analysis. Only this approach makes it possible to ensure the correct selection of materials and technology for the repair, restoration and strengthening of structures, which allows ensuring durability and their integrity after carrying out repair and restoration works.

Restoration of brick structures is carried out in several stages:

- surface preparation [5];
- base consolidation;
- repair of cracks, peeling areas and missing elements of the masonry;
- strengthening of structures using Mapei FRG System composite materials;
- equipment of the restored structure.

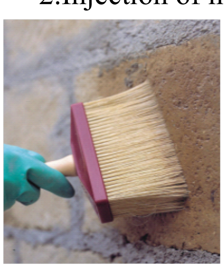
According to the CNR DT 200/2004 norm, before starting the restoration process, brick structures must be cleaned of dirt, mold, salts and other contaminants that impair the adhesion of repair solutions to the base.

In the second stage, it is necessary to consolidate the base by saturating it with a deep penetration primer that strengthens the base, reduces its absorption capacity and improves the adhesion of subsequent repair layers.

After that, cracks in the masonry are repaired, includeing the following stages:

1.Filling the opening of the crack with solution from one or both sides of the structure to prevent the injection solution from leaking out of the crack.

2.Injection of high-flow cement-based mortar (or pozzolana-based for historic buildings).



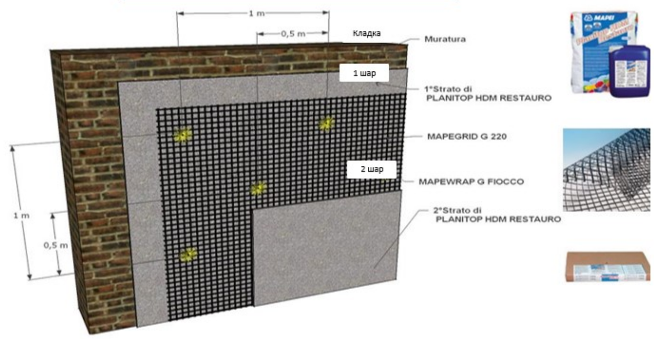
Pic 1. Consolidation of the base

Pic 2.Technology of crack repair and injection.

3. If necessary, perform the technology of "stitching" the crack using the "dry" or "wet" method.
4. Filling and repair of process holes after performing the above-mentioned types of work.

Reinforcement of the brick structure is carried out after restoring its integrity, meeting the requirements for roughness, shape, rounding of corners and other requirements for the base. Amplification is performed by MAPEI FRG System [1, 6] technology which is made of a two-component cement mortar - Planitop HDM Maxiand Mapegrid G120 alkali-resistant glass fiber mesh that is immersed in the mass of the mortar. This system has shown its effectiveness during laboratory tests on strengthening brick columns (conducted in Lviv Polytechnic University in 2018) and in practice.

Reinforcement of wall cladding outside or inside:



Pic 3. Scheme of MAPEI FRG amplification system [3,4, 6]

The installation of this reinforcement system does not require any special equipment and mechanisms, the additional weight of the reinforcement system is 21 kg per 1 sq.m. surface, while "cold bridges" are not formed, which has a positive effect on the energy efficiency of the building as a whole.

Conclusion.The use of modern technical solutions using Mapei FRP System and Mapei FRG System composite materials allows to performing repair and restoration works:

-in the shortest time;

-minimum additional load of structures (the weight of the system is approximately 21 kg/sq.m.)

-without any large-sized equipment and lifting mechanisms;

-without additional "bridges" of cold, without disturbing the thermal insulation of the building;

-the linear expansion of the materials of the reinforcement system is similar to the linear expansion of the structure itself, due to which the system works simultaneously with the base and does not require additional anchoring;

-unlike repair work during sheathing with steel plates, there is no corrosion problem when applying the reinforcement system;

-the system meets the requirements of CNR DT 200/2004: 'Instructions for the design, implementation and control of stationary reinforcement systems using fiber-reinforced composites'.

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ANALYSIS OF 3D PRINTING TECHNOLOGIES IN THE CONSTRUCTION OF COMMERCIAL FACILITIES

3D printing technologies have gained significant attention in the construction industry due to their potential to revolutionize the way buildings are designed and constructed. By using additive manufacturing techniques, 3D printing can offer advantages such as reduced costs, decreased construction time, and minimized environmental impact. Here is an analysis of the available information on 3D printing technologies in the construction of commercial facilities:

According to a systematic literature review conducted by Ali et al., 3D printing technologies have been extensively studied in architectural design and construction. The review identified various research topics, including printing techniques analysis, material analysis, control system, data analysis, architectural design, literature review, concept analysis, and cost-benefit analysis [1].

One promising 3D printing technique mentioned in the literature is Contour Crafting. It has the potential to revolutionize the construction industry by offering almost unlimited possibilities for geometric complexity realizations. Contour Crafting has been associated with numerous advantages, such as cost reduction, time savings, environmental pollution reduction, and improved safety on construction sites [2].

The application of 3D printing in construction has also been investigated in terms of its efficiency and feasibility. Researchers have studied different types of 3D printers, materials, and construction procedures to advance this technique. For example, Bos et al. described the development of additive manufacturing of concrete and presented the 3D concrete printing facility at the Eindhoven University of Technology [1].

However, despite the potential benefits and advancements in 3D printing technology, its adoption in commercial construction has been limited. Building codes and regulations have been identified as a significant barrier to the widespread implementation of 3D printing in nonresidential construction. Incorporating new technologies and building innovations into existing building codes takes time, which slows down the adoption process [3].

In conclusion, 3D printing technologies have shown great potential in the construction industry, particularly in the design and construction of commercial facilities. The use of additive manufacturing techniques, such as Contour Crafting, can offer advantages such as cost reduction, time savings, and improved safety. However, the adoption of 3D printing in commercial construction is hindered by existing building codes and regulations. Further research and collaboration between industry stakeholders and regulatory bodies are needed to overcome these barriers and fully realize the benefits of 3D printing in the construction sector.

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