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NEW URBANISM OF RECONSTRUCTION IN A POST-CONFLICT ENVIRONMENT: PARADIGMS AND PRINCIPLES OF RESTORING THE ARCHITECTURAL FUND DESTROYED AS A RESULT OF THE RUSSIAN-UKRAINIAN WAR

Abstract. *Conflict-affected cities, particularly those in Ukraine, face long-term challenges associated not only with the consequences of war but also with the need for sustainable and integrated reconstruction. The complexity of recovery processes has expanded beyond traditional issues of post-war restoration, preservation of urban heritage, and rebuilding of iconic elements of the built environment to include challenges related to decision-making efficiency, resource management, technological implementation, and financing mechanisms. These factors often lead to prolonged reconstruction cycles lacking coherent long-term planning and management. The full-scale Russian-Ukrainian war has resulted in extensive destruction of residential, public, and industrial facilities, making the prompt, high-quality, and resource-efficient restoration of infrastructure and architectural heritage a national priority. Modern reconstruction strategies increasingly rely on digital and innovative technologies, including BIM, GIS, artificial intelligence, digital twins, and additive manufacturing. However, reconstruction planning focused exclusively on urgent functional needs often leads to the neglect of New Urbanism principles, resulting in fragmented urban environments and the formation of disconnected spatial structures. This article aims to systematize global and Ukrainian paradigms, practices, and case studies of post-conflict reconstruction of destroyed architectural assets within the framework of New Urbanism principles. The methodological basis of the research includes comparative analysis o international reconstruction cases, synthesis of technological and urban planning approaches, and generalization of decision-making models applied in post-war recovery. Particular attention is given to the integration of digital technologies into sustainable urban redevelopment strategies and the preservation of urban identity. The results highlight the importance of aligning technological reconstruction processes with holistic urban development concepts, emphasizing walkability, mixed-use planning, community participation, and environmental sustainability. The proposed conceptual approach contributes to the formation of a resilient and adaptive reconstruction paradigm suitable for the restoration of Ukrainian cities affected by military aggression.*

Key words: Reconstruction, operation, technology, housing destroyed due to Russian aggression, BIM, 3D printing

Introduction. One of the most significant human hazards and calamities is war, which puts social, economic, and cultural institutions including the architecture and urban design of the nations they affect at risk. In turn, the building industry has historically faced a significant challenge: post-conflict reconstruction. Divergent opinions have been voiced by architects, urban planners and designers, and other experts in the built environment regarding the potential, difficulties, and problems that come with rebuilding cities, especially in the housing sector [1]. The key to delivering reconstruction successfully is seen to be post-conflict construction planning.

The military aggression against Ukraine caused large-scale destruction of cities and settlements, especially in the eastern regions of the country. As a result of the fighting, a significant number of residential buildings, critical infrastructure facilities, historical and cultural monuments, and industrial enterprises were damaged or destroyed (as of the beginning of 2024, more than 150 thousand buildings required restoration or complete reconstruction) [2]. The scale of the destruction prompts a rethinking of traditional approaches to reconstruction the process should include not just the physical restoration of buildings and infrastructure, but a comprehensive revitalization of the urban environment based on the principles of new urbanism. Meanwhile, the urgency of the problem is also enhanced by the limited resources for reconstruction and the need to ensure sustainable development of restored territories in the long term..

Modern technologies for postwar building reconstruction prioritize speed, sustainability, and resilience, utilizing digital advancements, industrialized construction methods, and improved materials to restore infrastructure. Key options include employing BIM (Building Information Modeling) for planning, precast concrete and modular steel for quick assembly, and 3D printing to reduce material waste. Studying and systematizing world experience in this domain is of crucial importance for rebuilding architectural fund destroyed during Russian aggression.

Literature review. Rawat et al. [3] investigated the present applications of advanced digital/Industry 4.0 technologies in post-disaster reconstruction (PDR) with the goal of increasing its efficacy and efficiency, as well as the built environment's sustainability and resilience. The analysis uncovers a constantly changing environment of technological innovation with revolutionary potential for improving the efficiency, efficacy, and sustainability of rebuilding operations, with dominating technologies such as GIS, remote sensing, AI, and BIM.

The impact of wars on the urban environment, post-war architectural trends and reconstruction strategies, the principles of rebuilding the physical structure of buildings, and urban sustainability in post-war reconstruction operations are just a few of the theoretical concepts Zin Eddin [4] discusses.

The use of sustainable building materials and methods is emphasized in a number of studies. Moreno-Sierra et al. [5] investigated the possibilities of using recycled plastics to make emergency shelters that are thermally resilient, showcasing its benefits in terms of price, water resistance, and thermal performance. The viability of constructing shelters with a thermal reflecting multi-layer system was examined by Pusceddu et al. [6], who emphasized the system's energy efficiency and versatility for a range of uses. A requirement-based design approach for sustainable temporary housing units was put forth by Montalbano and Santi [7], who gave low-embodied energy materials, ease of assembly and disassembly, and reuse potential top priority.

BIM is frequently used to expedite the reconstruction process, especially when it comes to assessing building performance and improving construction management. Its application in automating construction permitting procedures is highlighted by Messaoudi and Nawari [8], allowing for quicker code compliance checks and permit issuance. Saeed et al. [9] provide evidence of how BIM can enhance teamwork, resource allocation, and efficiency during the building phase. Additionally, as demonstrated by Chashyn et al. [10], BIM has been used to assess energy use, choose suitable retrofitting techniques, and encourage sustainable building practices.

GIS is essential for community involvement, spatial planning, and damage assessment. Its application in determining damaged areas, evaluating infrastructure requirements, and displaying the level of destruction was demonstrated by Alsous et al. [11]. Additionally, GIS makes it easier to make well-informed decisions on the distribution of resources, the choice of locations, and the inclusion of hazard risk assessments in reconstruction plans. Furthermore, as Dionisio [12] highlights, GIS facilitates the incorporation of local knowledge and participatory planning procedures.

For the management, preservation, and restoration of historic structures especially those damaged by extreme events digital twin models, or DTMs, are essential. By mimicking the effects of disasters, assisting in damage assessment, and promoting effective restoration planning, Cinquepalmi and Cumo [13] investigated the potential of DTMs in protecting cultural assets. DTMs' importance in structural analysis, risk detection, and resource management is demonstrated by their use in the restoration of Notre Dame Cathedral and the Basilica of Saint Francis in Assisi. The use of DTMs for real-time data processing and simulation to assist decision-making in post-disaster reconstruction was covered in the study by Rotilio et al. [14], which helped to create rebuilding methods that are more robust and sustainable.

The problem of reviving Ukrainian cities ravaged by Russian assault, especially in the eastern regions, is discussed in the paper by Ukrainian researchers Cherkes et al. [2]. In addition to physical rebuilding techniques, the study looks at holistic approaches to urban environment renewal that take social, cultural, and ecological factors into account. In order to find effective tactics that might be modified for the Ukrainian setting, the study examines post-conflict urban reconstruction experiences from across the world, with particular reference to Sarajevo, Berlin, Warsaw, and Beirut.

Volozhinska and Tochenyuk [15] examine digital and innovative technologies used in the design of reconstruction of damaged buildings in the post-war period. The emphasis is made on BIM, 3D scanning, parametric design, and digital management platforms. The advantages of their use for accelerating and optimizing the process of restoring infrastructure facilities are shown.

Lavrukhina et al. [16] investigate the use of innovative materials, such as environmentally friendly concrete and 3D printing of building structures, which reduce time and resource consumption. The article analyzes the role of digital technologies, such as BIM, in optimizing the planning, management and monitoring processes of reconstruction projects.

The usual destruction of high-rise residential buildings made of prefabricated reinforced concrete is examined by Fedorenko and Sopov [17]. Damaged and partially destroyed multi-story buildings can be restored using the Speedstac modular construction solution technology developed by the Canadian architectural company WZMH Architects and its research laboratory Sparkbird. An illustration of how this approach was used to restore one of the Pivdenniy Saltivka districts in Kharkiv is provided.

In December 2025, representatives of GIZ Ukraine, together with partners, presented a fundamental study on the restoration of apartment buildings in Kryvyi Rih the book "Architecture of Restoration. Rehabilitation of War-Damaged Housing in Kryvyi Rih", which offers practical solutions for the restoration of housing destroyed as a result of the war in Ukraine [18]. The publication provides cases from a pilot project on the restoration of a typical multi-storey residential building of the 94 series, common in Ukraine in the 1960s–1990s. The authors outline a consistent, step-by-step approach to restoration from ensuring basic safety to further modernization [18].

However, while really innovative solutions and concepts are suggested for reconstruction domain, alignment with integrative urbanism framework is rarely considered, and this constitutes significant gap, which can eventually lead to unsustainable decisions for reconstruction projects.

Aim of the study. The study aims at outlining the principles of aligning architectural fund reconstruction with the urban landscape within the framework of new urbanism, based on systematizing appropriate world experience and suggesting its adoption for Ukraine.

Results and Discussion. Rebuilding residential neighborhoods and entire cities is one of the key tasks of recovery in Ukraine. According to experts, among the main technologies that will have an impact on the country's recovery, there may be Digital Twins, IoT, and other modern solutions for construction [19]. Lavrukhina

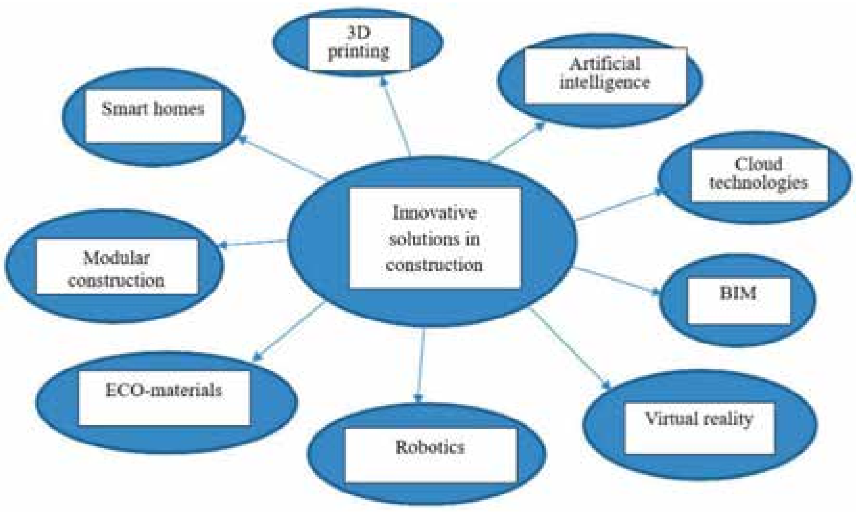

Fig. 1. Overview of innovative approaches and solutions in construction
Source: [16]

et al. [16] provide an overview of innovative approaches and solutions in construction, in a schematic representation (see Fig. 1).

Meanwhile, Ukraine often follows the path of quick solutions and opaque schemes, which ultimately leads to corruption during construction and additional costs for the operation of the house. In particular, in Ukraine there are no such requirements as, for example, in Poland, for insulation of walls, floors, windows, the presence of a heat pump, solar panels, effective ventilation with recuperation. Therefore, new houses require more resources for operation. Reconstruction according to outdated, although relevant, building codes leads to inefficient use of resources or violation of standards.

According to the Confederation of Builders of Ukraine, the reconstruction of the housing stock destroyed by the war alone will require at least 3.9 million square meters of glass, 5.7 million cubic meters (11.9 million tons) of concrete, 39.3 million cubic meters (or 14 billion pieces) of bricks, and 45 million square meters of roof tiles. All of this is in addition to the usual average annual consumption of such products [20]. Even this list of building materials itself clearly demonstrates the "old" approaches to construction and reconstruction. This picture becomes even more disappointing if to consider the fact that in Ukraine there are no safeguards against the overuse of building materials where it is inappropriate, for example, pouring hundreds of tons of concrete into the ground just for the foundation of a one-story house for one family. For example, in a project currently under reconstruction in the Kherson region, an incredible amount of concrete and other building materials is laid in a one-story house with an area of 70 m^2. There is no shelter or cellar in the house, but the total weight of the concrete in the foundation (which will be hidden under the floor) is over 150 tons. This is actually three railway cars. From this amount of concrete, a solid bunker (walls, floor, and roof) with an area of over 100 m^2 can be cast, but the walls of this house are made of light aerated concrete, while the heavy concrete is buried in the ground. Meanwhile, this amount of concrete could be enough for the foundations of half of the houses in the village [21].

The construction and reconstruction are not aligned with the new urbanism paradigm. The SvitloPark residential complex in the industrial zone of Kyiv is one of the vivid examples of violation of the principles of modern urban planning. The complex is located between the CHP plant and the cement plant, in the immediate vicinity of the railway. The road from the metro passes under the railway and road bridges, and to drive into the complex by car, one either has to go to the intersection a few kilometers away, where it is possible to cross the highway under the bridge, or turn back, in front of the "Vydubychy" metro, and drive through narrow congested roads near concrete mixers and factories to the complex's parking lot. Although the construction of this residential complex began in the pre-war period, there are also many similar projects within the framework of today's reconstruction.

It should also be noted that the restoration of the architectural fund and the urban environment is not limited to the reconstruction of buildings and infrastructure. An equally important component is social and landscape revitalization, which is aimed at restoring social ties, creating comfortable public spaces, and shaping sustainable urban ecosystems. According to New Urbanism, post-conflict space restoration aims to restore devastated cities by giving community-driven growth, sustainability, and human-scaled design precedence over quick, top-down rehabilitation. Instead of only rebuilding damaged infrastructure, this strategy aims to create durable, walkable, mixed-use urban landscapes that improve public life and social cohesion.

Selecting the best reconstruction option is a complex process that requires a systematic approach and informed decisions, which can be achieved through the application of the analytic hierarchy process. The application of the analytic hierarchy process provides effective problem solving in a variety of fields. It provides a systematic and logical approach to the analysis of hierarchical systems, which contributes to obtaining more informed results [22]. The algorithm for applying the analytic hierarchy process includes several stages (Fig. 2).

To justify the selection of the optimal reconstruction option, it is necessary to establish criteria that will be used in the hierarchy analysis. Examples of such criteria may include capital investments allocated for the reconstruction, completion timeframes, availability of utility infrastructure, compliance with safety requirements, physical deterioration of the reconstructed facility, sustainability, and many others. A general view of the three-level hierarchy is shown in Figure 3.

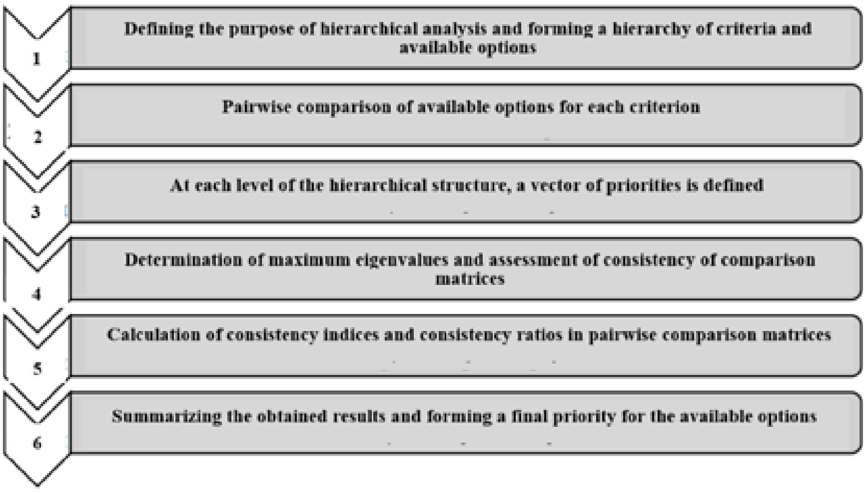

Fig. 2. Algorithm for applying the analytic hierarchy process method
Source: [22]

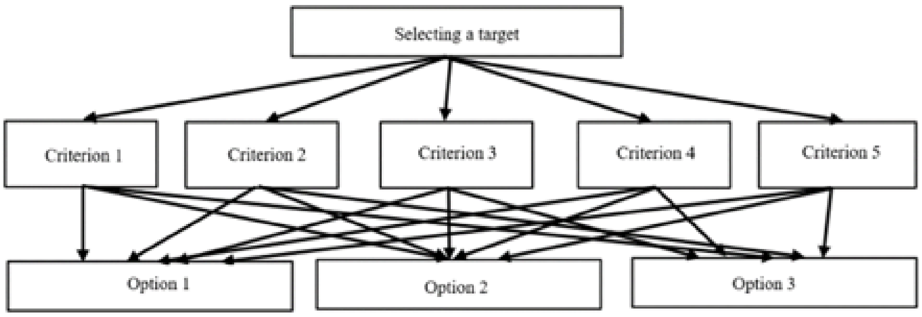

Fig. 3. Hierarchical structure of the choice problem in generalized form
Source: [22]

The structure combines the goal P, criteria $K = \{Kj\}$ and options $AP = \{APi\}$, i.e., those objects of the hierarchy that essentially influence the choice of the best solution option A^* according to the set goal P. It should be noted that the authors propose three main options for the reconstruction of buildings: partial, complete, and building transformation (Fig. 4).

The study by Tabbakh et al. [23] suggests an Algorithmic Retrofitting Workflow (ARW) to handle the problem of maintaining a city's identity during post-war reconstruction (PWR). Retrofitting cratered walls a common problem seen in damaged residential buildings in post-war Syria is the study's main focus. This algorithmic, adaptive reconstruction was created in a controlled

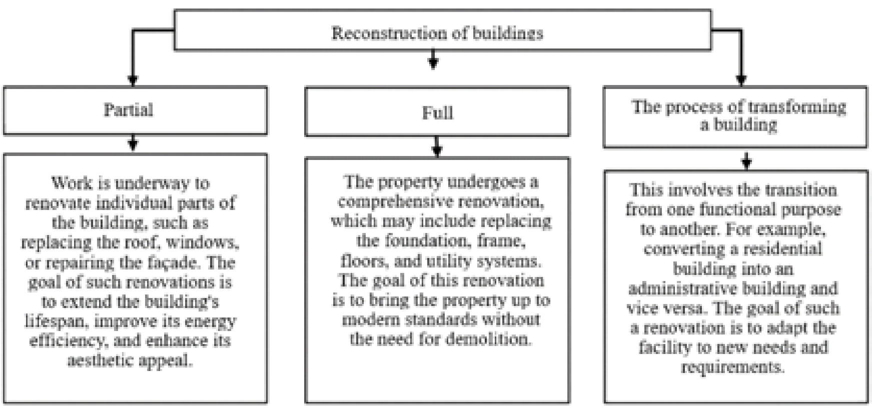

Fig. 4. Options for building reconstruction
Source: [22]

setting, evaluated using publicly available data, and used in scanned environments from the real world. By adjusting to the intricate crater shape, the retrofitting solutions produce solutions that use both standard and specialized bricks to address the damage. The outcomes of ARW provide an alternative to tearing down broken structures, which is a popular fix but destroys a city's identity. Seven recurrent damage typologies were found in the 61 structures examined in post-war Syria using a remote visual survey using Google Street View (GSV). Three main groups were established for these damage typologies [23]:

1. Moderately Damaged (little non-structural damage, 5–30 % collapse):

– Openings in non-load-bearing walls are known as a "cratered wall".

– Broken window with slight wall damage is called a "blown-out window".

– Bullet Pitting: Surface impact marks that are not very deep.

– Charring: Burn markings from explosions or fire.

2. Severe Damage (large structural damage, 30–75 % collapse)

– Partial Damage: A sizable portion of the building's framework gave way.

– Top Floor Damage: Roof and slab damage to the upper floor.

3. Complete Damage (severe or complete structural loss, 75–100 % collapse). One representative building for each damage typology is depicted in Figure 5. With 58 % of the 38 moderately damaged buildings in the GVS dataset having a cratered wall, this damage typology was the most prevalent among all of the structures with moderate damage.

To model retrofitting cratered walls in a post-war Syrian residential building, a single algorithmic parametric approach was created. Reusing buildings that were physically sound but damaged rather than tearing them down was the goal. To depict the damaged curve and the region where the retrofitting procedure (ARW) is used, the crater-affected area was manually traced as a closed polyline (Figure 6).

Fig. 5. Damage catalog in post-war Syria

Source: [23]

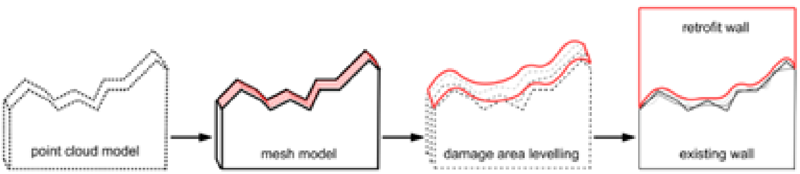

Fig. 6. Retrofit area extraction process

Source: [23]

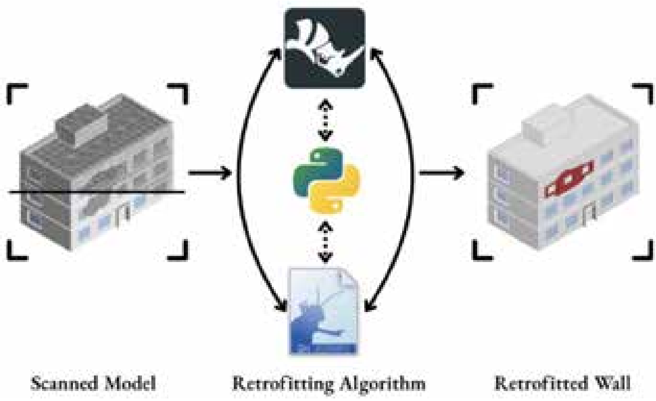

Fig. 7. Digital tools used for ARW's digital workflow

Source: [23]

The base model was built using Rhinoceros 3D. The ARW scripting was then done using Grasshopper, and the following crucial steps were carried out using GhPython components: (1) Brick pattern generation, (2) Lintel formation, (3) Non-standard brick generation, and (4) Clustering non-standard bricks. A versatile digital approach that adjusts to different crater damage curves for retrofitting is made possible by these technologies working together (Figure 7).

According to scientists, BIM is the instrument that will transform the building sector in underdeveloped nations [24]. However, BIM is not widely used in these nations for construction project planning and management, especially in post-conflict settings [25]. Conventional methods are used in the planning, design, implementation, and building of construction in emerging nations like Iraq. It has been demonstrated that these approaches are ineffective and perform poorly [26]. Conventional construction is still common in developing nations, despite the pressing need for efficient construction techniques in post-conflict environments. Implementing BIM for post-conflict city rehabilitation in Iraq has received little to no attention [27]. As a result, the issue is becoming more complicated because traditional construction is no longer considered a viable option for rebuilding Iraqi cities after the war. A few studies [9] have demonstrated the necessity and need for Iraq to embrace BIM. Iraq's building industry is seeing a surge in demand for both new construction and post-conflict reconstruction. With an annual budget for the building industry determined by the government, private sector, and non-governmental organizations, there is especially strong backing for reconstruction in Iraq. Therefore, it is imperative that a workable and efficient plan for rebuilding post-conflict cities be adopted in order to comply with reconstruction procedures in Iraq. Since housing development is still one of the biggest obstacles to post-conflict city restoration, this is particularly significant.

Experts' qualitative interviews in the Saeed et al. study [9] offered a strategy for rehabilitating the city's prefabricated housing industry. This mostly relies on the idea of recycling and repurposing post-conflict waste as building materials. For example, the respondents recommended recycling cement rubble and using it to make cement slab constructions and wall panels. The interviews also recommended reusing the stone material for the new housing units' facade covering and recycling it on-site. On-site recycling of steel, plastic, and other durable materials was one of the recommendations. These recommendations will be taken into account while testing BIM applications and were incorporated into the development of the housing paradigm. A dwelling paradigm was developed as a result of this phase's qualitative interviews and expert input on the previous phase's schematic suggestions. The prefabrication approach was used to model the created paradigm as a BIM asset using Autodesk Revit 2020. The developed dwelling paradigm is shown in Figure 8.

Overall, using the city of Mosul as a case study, the research by Saeed et al. [9] demonstrates the potential of BIM applications in post-conflict environments. For Ukraine, such findings are especially important, bearing in mind critical damages of energy infrastructure and, thus, significant importance of buildings' energy efficiency.

Additive manufacturing, or 3D printing, is another useful method for rebuilding damaged

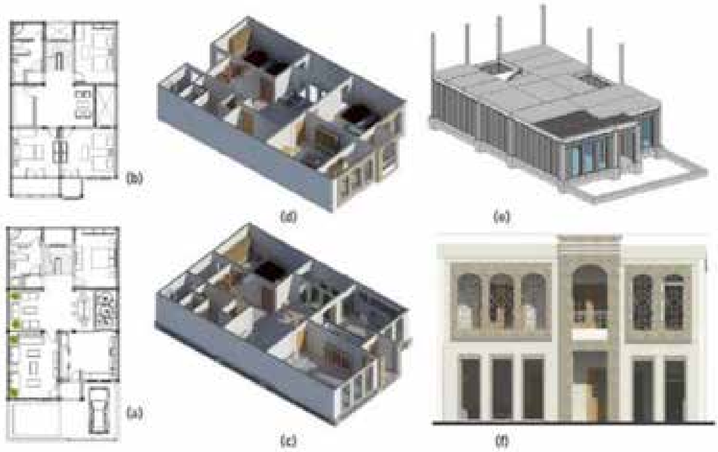

Fig. 8. Prefabrication prototype; (a) Ground floor plan, (b) First floor plan, (c) Ground floor model, (d) First floor Model, (e) Unit structure (prefabrication elements), (f) House unit model

Source: [9]

architectural funds. A smaller model of the Monumental Arch of Palmyra was created in 2015 by the business D-shape and the Institute of Digital Archaeology using a CNC machine on marble blocks. Conflictual events caused significant damage to the arch, and Palmyra's location was unreachable for a considerable amount of time. The scientific community at the time supported a drive to compile a collection of local photographs in order to use photogrammetry to generate a digital model. In order to continue promoting documentation and increase awareness of the arch's cultural significance, a symbolic recreation was then shown. In this situation, robotics can respond quickly to a loss of culture and provide resources for successful rehabilitation when local socio-political unrest has passed [28].

Additive fabrication is taken into consideration for rehabilitation projects by Turk and Weheba [29]. This research proof that Polyblend Calcium Carbonate (Grout) powder may be utilized as a construction material on the ZPrinter 450 Binder Jetting 3D printer. Applications for this kind of material in the restoration of historic buildings appear promising. The 3D printing of ornamental tiles and mosaics is one use for this study (PEI 0). These 3D-printed tile items can be utilized to decorate the walls of hotels, churches, mosques, and historic buildings. An ideal use for this research would be the restoration or recreation of a historic façade. The technique enables the smooth integration of precise duplicates of sensitive components into pre-existing structures by using digital 3D scanners and computer-aided designs.

For the repair of antique buildings, Kaya [30] offers 3D printed concrete columns (concrete choreography) in his thesis. At ETH Zurich, these columns were designed and constructed. The primary goal of the study was to examine a novel concrete typology, showcasing the exceptional architectural attributes made possible by 3DCP. Mesh subdivision and trigonometric function-based procedural computational design engines were created and used (Fig. 9). A double shell and internal bracing have been incorporated into the design of each column (Fig. 10). The inner shell was intended to serve as a cavity for conventional reinforced concrete, while the outer shell, which ranges in size from 0.25 to 0.6 meters, has an ornamental façade. These shells were joined by internal bracing in each layer. In addition to providing a closed core and supporting the neighboring layers, the internal bracing also enhances the overhang for column geometry.

Linking digital design and digital building processes is made possible by the digitization of construction sites undergoing repair. Even with the most cutting-edge technologies, however, a lack of reconstruction that is in line with the overall urban concept in its post-conflict development can result in an unsustainable landscape, particularly car-dependent, polluted, and disconnected cities due to urban sprawl, excessive highway construction, and a lack of green spaces, which exacerbates pollution, social isolation, and poor public health.

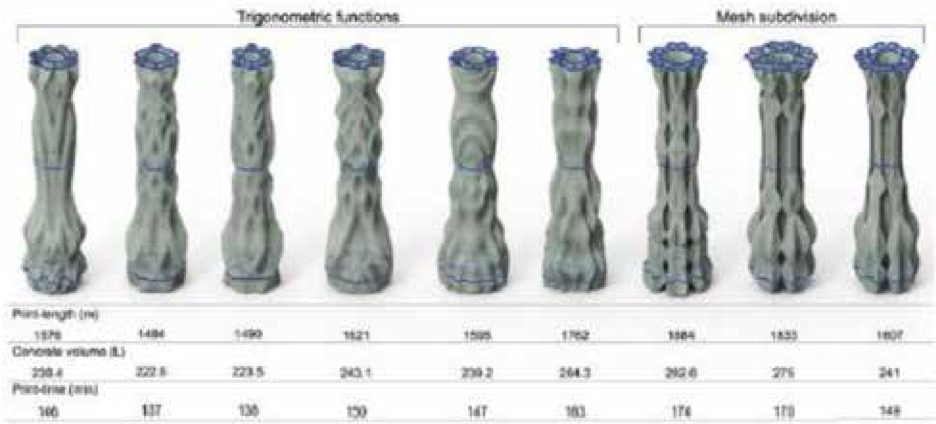

Fig. 11. Trigonometric functions and mesh subdivision

Source: [30]

Fig. 12. Double shell composition and internal bracing

Source: [30]

The work by Rezk et al. [31], which presents a novel assessment methodology designed for the initial management of blast-damaged reinforced concrete buildings without structural collapse risk, is particularly pertinent in this context. The authors stress that in the context of post-war recovery, evaluating and reconstructing blast-damaged buildings without a risk of structural collapse pose significant problems. The model, which was developed using the Integrated Value Model for Sustainable Assessment and improved via the Delphi method, gives stakeholders a useful tool to assess various reconstruction scenarios, such as demolition, restoration with preservation for future work, refurbishment, and reconstruction with retained identity. A case study of a tourist hotel in Damascus' historic district is used for validation; the building's structural collapse risk was found to be zero. According to the findings, "refurbishment" is the most environmentally and socially sustainable choice, while "preservation for future work" is the most environmentally friendly. In order to develop resilient and sustainable post-war reconstruction plans that honor heritage contexts, this study emphasizes the significance of thorough damage assessments and sustainability-focused techniques.

The MIVES–Delphi model does, in fact, provide a methodical and adaptable framework for evaluating and ranking reconstruction options. It allows stakeholders to prioritize economic, environmental, and social factors based on project-specific criteria, which makes it especially useful in situations with limited resources, as is now the case in Ukraine, particularly in small-city communities.

One promising way to improve the accuracy and effectiveness of sustainability evaluations is through the incorporation of cutting-edge technology like BIM and GIS. While GIS supplies information about the building's surrounds, BIM includes detailed information about the building itself, resulting in a comprehensive view that is crucial for complicated projects.

However, despite its strength, BIM still depends on human creativity and labor. AI can help in this situation, to create a more sustainable built environment by optimizing building design for resource and energy reduction. Furthermore, AI can create sustainable and livable urban environments by evaluating data on demographics, transportation trends, and environmental factors a crucial aspect of modern urbanism. These technologies could greatly improve decision-making and offer more thorough assessments of reconstruction options when incorporated into the MIVES–Delphi framework.

Ukrainian architects began to recreate destroyed buildings using AI. For example, the architectural company Balbek bureau visualizes the reconstruction of urban structures destroyed during hostilities. The company's architects use the Stable Diffusion generative neural network, which, at the architect's request, first blurs the image of a destroyed building and then gradually restores its structures and color schemes. AI allows models to be recreated from a few simple images, and the conversion of text information to 3D is already becoming a reality [32]. Text-to-BIM applications are being actively implemented, allowing users to create detailed models of buildings using text prompts and specialized BIM CAD tools.

Meanwhile, within the framework of new urbanism, socio-psychological dimensions are no less important than purely 'physical' amenities. A case presented by Badescu [33] clearly demonstrates it. According to the authors, resolving the past through architectural reconstruction entails both (re)creating a sense of belonging for both newcomers and locals, in addition to resolving the conflict from the past. Badescu [33] demonstrates how, throughout restoration, Sarajevo transformed into a hub of global capital that was altering the city to suit different agendas without any local participation. For example, locals in Marijin Dvor asked why trees that were part of the original plan were not included while the Sarajevo City Center was being built. Their desire to restore the trees was denied after they were informed that they would obstruct the building's view. Like with the construction of new structures, including places of worship, reconstruction projects were top-down, and locals were only allowed to see and not participate in the process of creating their city. This case should be carefully examined by the participants and stakeholders of Ukrainian urban reconstruction projects, to avoid negative potential of not following new urbanism principles.

New approaches and progressive methods are required in progressive crisis situations. A comprehensive approach to the "big picture" is a prerequisite for any sustainable development endeavor when the main goal is to restore livelihoods and a community in a traumatized environment. This calls for the cooperation of many professional actors and multidisciplinary approaches.

Conclusions. Rebuilding a post-conflict urban space is by no means an easy endeavor, especially as each situation has its own set of complexity, obstacles, and nuances. Reconstruction has typically been viewed as a functional process that prioritizes immediate demands, particularly those of emergency housing for bombing victims and displaced people, as well as infrastructure rehabilitation. However, in the modern world, the integration of New Urbanism concepts with advanced technology such as BIM, GIS, and AI implies rethinking urban rebuilding and post-conflict urban planning. Traditional architecture is transformed into data-driven, resilient, and sustainable urban development via this synergy. At the same time, the domain of reconstruction of destroyed architectural fund in Ukraine is still characterized with somewhat chaotic nature and lags behind this contemporary paradigm. This necessitates conducting thorough research of world best practices and designing a national paradigm, adopted to all specific conditions.

Bibliography

1. Tortorici G., Fiorito F. Building in post-war environments. Procedia Engineering. 2017. Vol. 180. P. 1093–1102. https://doi.org/10.1016/j.proeng.2017.04.269
2. Cherkes B., Pohranychna I., Rosliakov M. Revitalization of cities damaged by Russian aggression in Eastern Ukraine. Series Architecture. 2025. Vol. 7. No. 2. P. 139-148. https://doi.org/10.23939/sa2025.02.139
3. Rawat A. et al. Advanced Digital Technologies in the Post-Disaster Reconstruction Process A Review Leveraging Small Language Models. Buildings. 2024. Vol. 14, No. 11. Article 3367. https://doi.org/10.3390/buildings14113367
4. Zin Eddin M. Post-War Reconstruction of Cities (Reconstruction of Baba Amr Neighbourhood in the City of Homs, Syria). Builder. 2024. Vol. 72. P. 1–7.
5. Moreno-Sierra A., Pieschacón M., Khan A. The use of recycled plastics for the design of a thermal resilient emergency shelter prototype. International Journal of Disaster Risk Reduction. 2020. Vol. 50. Article 101885. https://doi.org/10.1016/j.ijdrr.2020.101885
6. Pusceddu C. et al. The use of building technology to support disaster resilience: the case study of air shelter house. International Journal of Disaster Resilience in the Built Environment. 2017. Vol. 8. No. 02. P. 139–157. https://doi.org/10.1108/IJDRBE-11-2015-0057
7. Montalbano G., Santi G. Sustainability of temporary housing in post-disaster scenarios: A Requirement-Based Design Strategy. Buildings. 2023. Vol. 13. No. 12. Article 2952. https://doi.org/10.3390/buildings13122952

8. Messaoudi M., Nawari N. O. (2020). BIM-based Virtual Permitting Framework (VPF) for post-disaster recovery and rebuilding in the state of Florida. International Journal of Disaster Risk Reduction. 2020. Vol. 42. Article 101349. https://doi.org/10.1016/j.ijdrr.2019.101349
9. Saeed Z. O. et al. (2021). BIM applications in post-conflict contexts: the reconstruction of Mosul city. Buildings. 2021. Vol. 11. No. 8. P. 351. https://doi.org/10.3390/buildings11080351
10. Chashyn D., Khurudzhi Y., Daukšys M. Integration of Building Information Modeling and Artificial Intelligence of Things in the Post-War Reconstruction and Renovation of Buildings. Journal of Sustainable Architecture and Civil Engineering. 2024. Vol. 35. No. 2. P. 117-132. https://doi.org/10.5755/j01.sace.35.2.35160
11. Alsous M. M., Scherbina E., Ghada R. Advanced analysis technology in reshaping post war cities (Palmyra-Syria). IFAC-PapersOnLine. 2019. Vol. 52. Iss. 25. P. 240-245. https://doi.org/10.1016/j.ifacol.2019.12.480
12. Dionisio M. R. et al. Geospatial tools for community engagement in the Christchurch rebuild, New Zealand. Sustainable Cities and Society. 2016. Vol. 27. P. 233-243. https://doi.org/10.1016/j.scs.2016.04.007
13. Cinquepalmi F., Cumo F. Using Digital Twin Models (DTM) for Managing, Protecting and Restoring Historical Buildings. Conservation Science in Cultural Heritage. 2022. Vol. 22. https://doi.org/10.6092/issn.1973-9494/17364
14. Rotilio M., Villa V., Corneli A. Digital Twin for a resilient management of the built environment. In Proceedings of the 2023 IEEE International Workshop on Metrology for Living Environment, 2023, May. MetroLivEnv. P. 113–117.
15. Воложинська О. О., Точенюк О. В. Інноваційні технології проєктування повоєнного відновлення пошкоджених будівель. Інформаційні технології в сучасному світі: матеріали Міжнародної науково-практичної конференції здобувачів вищої освіти і молодих учених, 29 квітня 2025 р. Харків: ДБТУ, 2025. С. 387–388.
16. Лаврухіна К., Титок В., Кравчук О. Інноваційні підходи та рішення вітчизняних будівельних підприємств для відновлення повоєнної України. Будівельне Виробництво. 2024. № 77. С. 85–91.
17. Федоренко Ю, Сопов В. Технологія модульного будівельного рішення Speedstac для відновлення зруйнованого житла в Україні. Науковий Вісник Будівництва. 2022. № 108. Вип. 2. URL: https://svc.kname.edu.ua/index.php/svc/uk/article/view/16
18. Meuser Ph., Markov O. Architecture of recovery rehabilitation of war-damaged housing in Kryvyi Rih. Berlin: DOM Publishers. 2025. 75 p.
19. Братчук Д. IT напоготові: які технології стануть у пригоді у відбудові України. Mind. 27 березня 2023 р. URL: https://mind.ua/openmind/20255115-it-napogotovi-yaki-tehnologiyi-stanut-u-prigodi-u-vidbudovi-ukrayini
20. Повоєнне відновлення: шанс для розвитку будіндустрії. Ukrinform. 1 квітня 2023 р. https://www.ukrinform.ua/rubric-vidbudova/3690313-povoenne-vidnovlenna-sans-dla-rozvitku-budindustrii.html
21. Гречух О. Марні витрати енергії та ресурсів. Що не так із відбудовою України й що запозичити в Польщі. *Texty*. 21 листопада 2023 р. URL: https://texty.org.ua/articles/111150/ukrayina-chy-znovu-sovok-jak-varto-zminyty-pidkhody-do-vidbudovy-i-shcho-zapozychyty-v-polshchi/?src=main
22. Andras S. Building Design and Construction: An Architect's Perspective. Hoboken: Wiley. 2025. 224 p.
23. Tabbakh Y., Rogeau N., Ileda Y. Architectural Informatics as a Tool for Adaptive Reconstruction: Retrofitting Post-war Syria. In; Proceedings of the Conference ASCAAD 2025, Riyad, Saudi Arabia. P. 356–373.
24. Olawumi T. O., Chan D. W. Development of a benchmarking model for BIM implementation in developing countries. Benchmarking: An International Journal. 2019. Vol. 26. No. 4. P. 1210-1232. https://doi.org/10.1108/BIJ-05-2018-0138
25. Assem A., Abdelmohsen S., Ezzeldin M. Smart management of the reconstruction process of post-conflict cities. Archnet-IJAR: International Journal of Architectural Research. 2020. Vol. 14. No. 2. P. 325–343. https://doi.org/10.1108/ARCH-04-2019-0099
26. Hadi Z. S. A Review paper on Benefits of BIM Adoption to Improve project performance in Iraqi Construction Industry. International Journal of Contemporary Applied Researches, 7. 2020. Vol. 10. P. 81-108. https://ijcar.net/assets/pdf/Vol7-No10-October2020/6.-A-Review-paper-on-Benefits-of-BIM-Adoption-to-Improve-project-performance-in-Iraqi-Construction-Industry.pdf
27. Hatem W. A., Abd A. M., Abbas N. N. (2018). Barriers of adoption building information modeling (BIM) in construction projects of Iraq. Engineering Journal. 2018. Vol. 22. No. 2. P. 59-81. https://doi.org/10.4186/ej.2018.22.2.59
28. Codarin S. Additive Manufacturing Technologies in Restoration: An Innovative Workflow for Interventions on Cultural Heritage. Cubic Journal. 2020. P. 32-55. https://doi.org/10.31182/cubic.2020.3.023
29. Turk A., Weheba G. (2024). Restoring historical buildings using additive manufacturing. The Journal of Management and Engineering Integration. 2024. Vol. 17. No. 1. P. 10-20. https://doi.org/10.62704/10057/28081
30. Kaya P. Applications of Additive Manufacturing in Construction and Historic Building Restoration / Rehabilitation. [Master's thesis]. University of Bologna. 2021. 91 p.
31. Rezk J., Pons-Valladares O., Muñoz-Blanc C. Evaluating Sustainability in Post-Conflict Reconstruction: A Case Study of Blast-Damaged Buildings Without Structural Collapse Risk in Syria. Buildings. 2025. Vol. 15. No. 3. Article 369. https://doi.org/10.3390/buildings15030369
32. Krasniy E. Prospects for using AI in architectural design for the restoration of Ukraine. Theory and Practice of Design. 2024. Vol. 37. P. 133–141. https://doi.org/10.32782/2415-8151.2025.37.12
33. Badescu G. Dwelling in the Post-War City Urban Reconstruction and Home-Making in Sarajevo. Revue d'études comparatives Est-Ouest. 2015. Vol. 4. No. 46. P. 35-60. https://doi.org/10.3390/books978-3-03897-871-8-19

References

1. Tortorici, G., & Fiorito, F. (2017). Building in post-war environments. Procedia Engineering, 180, 1093–1102. https://doi.org/10.1016/j.proeng.2017.04.269
2. Cherkes, B., Pohranychna, I., & Rosliakov, M. (2025). Revitalization of cities damaged by Russian aggression in Eastern Ukraine. *Series Architecture, 7*(2), 139-148. https://doi.org/10.23939/sa2025.02.139
3. Rawat, A., Witt, E., Roumyeh, M., & Lill, I. (2024). Advanced Digital Technologies in the Post-Disaster Reconstruction Process A Review Leveraging Small Language Models. *Buildings, 14*(11), 3367. https://doi.org/10.3390/buildings14113367
4. Zin Eddin, M. (2024). Post-War Reconstruction of Cities (Reconstruction of Baba Amr Neighbourhood in the City of Homs, Syria). *Builder, 72*, 1–7.
5. Moreno-Sierra, A., Pieschacón, M., & Khan, A. (2020). The use of recycled plastics for the design of a thermal resilient emergency shelter prototype. *International Journal of Disaster Risk Reduction, 50*, 101885. https://doi.org/10.1016/j.ijdrr.2020.101885
6. Pusceddu, C., Blumberg, G., Salvalai, G., & Imperadori, M. (2017). The use of building technology to support disaster resilience: the case study of air shelter house. *International Journal of Disaster Resilience in the Built Environment, 8*(02), 139–157. https://doi.org/10.1108/IJDRBE-11-2015-0057
7. Montalbano, G., & Santi, G. (2023). Sustainability of temporary housing in post-disaster scenarios: A Requirement-Based Design Strategy. *Buildings, 13*(12), 2952. https://doi.org/10.3390/buildings13122952
8. Messaoudi, M., & Nawari, N. O. (2020). BIM-based Virtual Permitting Framework (VPF) for post-disaster recovery and rebuilding in the state of Florida. *International Journal of Disaster Risk Reduction, 42*, 101349. https://doi.org/10.1016/j.ijdrr.2019.101349
9. Saeed, Z. O., Almukhtar, A., Abanda, H., & Tah, J. (2021). BIM applications in post-conflict contexts: the reconstruction of Mosul city. *Buildings, 11*(8), 351. https://doi.org/10.3390/buildings11080351
10. Chashyn, D., Khurudzhi, Y., & Daukšys, M. (2024). Integration of Building Information Modeling and Artificial Intelligence of Things in the Post-War Reconstruction and Renovation of Buildings. *Journal of Sustainable Architecture and Civil Engineering, 35*(2), 117–132. https://doi.org/10.5755/j01.sace.35.2.35160
11. Alsous, M. M., Scherbina, E., & Ghada, R. (2019). Advanced analysis technology in reshaping post war cities (Palmyra-Syria). *IFAC-PapersOnLine, 52*(25), 240–245. https://doi.org/10.1016/j.ifacol.2019.12.480
12. Dionisio, M. R., Kingham, S., Banwell, K., & Neville, J. (2016). Geospatial tools for community engagement in the Christchurch rebuild, New Zealand. *Sustainable Cities and Society, 27*, 233-243. https://doi.org/10.1016/j.scs.2016.04.007
13. Cinquepalmi, F., & Cumo, F. (2022). Using Digital Twin Models (DTM) for Managing, Protecting and Restoring Historical Buildings. *Conservation Science in Cultural Heritage, 22*. https://doi.org/10.6092/issn.1973-9494/17364
14. Rotilio, M., Villa, V., & Corneli, A. (2023, May). Digital Twin for a resilient management of the built environment. In Proceedings of the 2023 IEEE International Workshop on Metrology for Living Environment, MetroLivEnv (pp. 113–117).
15. Volozhinska, O. O., & Tochenyuk, O. V. (2025). Innovative technologies for designing post-war restoration of damaged buildings. In: Proceedings of Information technologies in the modern world: materials of the International Scientific and Practical Conference of Higher Education Applicants and Young Scientists, April 29, 2025. Kharkiv : DBTU, 2025 (pp. 387–388).
16. Lavrukhina, K., Tytok, V., & Kravchuk, O. (2024). Innovative approaches and solutions of domestic construction enterprises for the restoration of post-war Ukraine. *Construction Production, 77*, 85–91.
17. Fedorenko, Yu., & Sopov, V. (2022). Technology of the modular construction solution Speedstac for the restoration of destroyed housing in Ukraine. *Scientific Bulletin of Construction, 108*(2), https://svc.kname.edu.ua/index.php/svc/uk/article/view/16
18. Meuser, Ph., & Markov, O. (2025). *Architecture of recovery rehabilitation of war-damaged housing in Kryvyi Rih*. DOM Publishers.
19. Bratchuk, D. (2023, March 27). IT ready: what technologies will be useful in the reconstruction of Ukraine. *Mind*. https://mind.ua/openmind/20255115-it-napogotovi-yaki-tehnologiyi-stanut-u-prigodi-u-vidbudovi-ukrayini
20. Post-war recovery: a chance for the development of the construction industry (2023, April 1). *Ukrinform*. https://www.ukrinform.ua/rubric-vidbudova/3690313-povoenne-vidnovlenna-sans-dla-rozvitku-budindustrii.html
21. Grechukh, O. (2023, November 21). Wasteful expenditure of energy and resources. What is wrong with the reconstruction of Ukraine and what to borrow from Poland. *Texty*. https://texty.org.ua/articles/111150/ukrayina-chy-znovu-sovok-jak-varto-zminyty-pidkhody-do-vidbudovy-i-shcho-zapozychyty-v-polshchi/?src=main
22. Andras, S. (2025). *Building Design and Construction: An Architect's Perspective*. Wiley.
23. Tabbakh, Y., Rogeau, N., & Ileda, Y. (2025). Architectural Informatics as a Tool for Adaptive Reconstruction: Retrofitting Post-war Syria. In; Proceedings of the Conference ASCAAD 2025, Riyad, Saudi Arabia (pp. 356–373).
24. Olawumi, T. O., & Chan, D. W. (2019). Development of a benchmarking model for BIM implementation in developing countries. *Benchmarking: An International Journal, 26*(4), 1210-1232. https://doi.org/10.1108/BIJ-05-2018-0138
25. Assem, A., Abdelmohsen, S., & Ezzeldin, M. (2020). Smart management of the reconstruction process of post-conflict cities. *Archnet-IJAR: International Journal of Architectural Research, 14*(2), 325–343. https://doi.org/10.1108/ARCH-04-2019-0099
26. Hadi, Z. S. (2020). A Review paper on Benefits of BIM Adoption to Improve project performance in Iraqi Construction Industry. *International Journal of Contemporary Applied Researches, 7*(10), 81–108. https://ijcar.net/assets/pdf/Vol7-No10-October2020/6.-A-Review-paper-on-Benefits-of-BIM-Adoption-to-Improve-project-performance-in-Iraqi-Construction-Industry.pdf
27. Hatem, W. A., Abd, A. M., & Abbas, N. N. (2018). Barriers of adoption building information modeling (BIM) in construction projects of Iraq. *Engineering Journal, 22*(2), 59–81. https://doi.org/10.4186/ej.2018.22.2.59

28. Codarin, S. (2020). Additive Manufacturing Technologies in Restoration: An Innovative Workflow for Interventions on Cultural Heritage. *Cubic Journal*, 32–55. https://doi.org/10.31182/cubic.2020.3.023
29. Turk, A., & Weheba, G. (2024). Restoring historical buildings using additive manufacturing. *The Journal of Management and Engineering Integration, 17*(1), 10–20. https://doi.org/10.62704/10057/28081
30. Kaya, P. (2021). Applications of Additive Manufacturing in Construction and Historic Building Restoration / Rehabilitation. [Master's thesis]. University of Bologna.
31. Rezk, J., Pons-Valladares, O., & Muñoz-Blanc, C. (2025). Evaluating Sustainability in Post-Conflict Reconstruction: A Case Study of Blast-Damaged Buildings Without Structural Collapse Risk in Syria. *Buildings, 15*(3), 369. https://doi.org/10.3390/buildings15030369
32. Krasniy, E. (2024). Prospects for using AI in architectural design for the restoration of Ukraine. *Theory and Practice of Design, 37*, 133–141. https://doi.org/10.32782/2415-8151.2025.37.12
33. Badescu, G. (2015). Dwelling in the Post-War City Urban Reconstruction and Home-Making in Sarajevo. *Revue d'études comparatives Est-Ouest, 4*(46), 35–60. https://doi.org/10.3390/books978-3-03897-871-8-19

НОВА УРБАНІСТИКА РЕКОНСТРУКЦІЇ У ПОСТ-КОНФЛІКТНОМУ СЕРЕДОВИЩІ: ПАРАДИГМИ ТА ПРИНЦИПИ ВІДНОВЛЕННЯ АРХІТЕКТУРНОГО ФОНДУ ЗРУЙНОВАНОГО ВНАСЛІДОК РОСІЙСЬКО-УКРАЇНСЬКОЇ ВІЙНИ

Анотація. *Міста, розташовані в зонах конфліктів, зокрема в Україні, постійно стикаються з труднощами як наслідків війни, так і необхідності довгострокової сталої реконструкції. Виклики вийшли за рамки типового питання відновлення після війни, збереження міської спадщини та знакових елементів забудованого середовища, і почали охоплювати питання прийняття критично важливих рішень, ефективності відновлення та механізмів фінансування, що призводить до трудомістких процесів, яким бракує належного послідовного довгострокового управління. Повномасштабна війна в Україні завдала значних руйнувань житловим, громадським і промисловим об'єктам. Одним із головних викликів сьогодення є оперативне, якісне та ресурсоефективне відновлення зруйнованої інфраструктури та архітектурного фонду. У цьому процесі ключову роль відіграють сучасні підходи до проєктування, які спираються на використання цифрових і інноваційних технологій. Однак, планування та реалізація реконструкції виключно з точки зору термінової функціональності призводить до відходу від принципів нового урбанізму, створюючи таким чином «ландшафт роз'єднаності». Стаття є спробою систематизації світових та вітчизняних парадигм, практик та кейсів постконфліктної реконструкції зруйнованого архітектурного фонду на основі принципів нового урбанізму.*

Ключові слова: реконструкція, експлуатація, технологія, зруйноване житло через агресію Росії, BIM, 3D друк.

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