

Future of the European Housing environment in Ukraine: Challenges, Directions and Reconstruction Scenarios (Part 2)

Abstract

The multifaceted and long-term consequences of the war in Ukraine present a significant challenge to the reconstruction of the housing environment. This is due to the fact that the process involves a variety of aspects and areas, including social, economic, political and environmental factors. In light of the mounting challenges, the overarching objective of the research was to develop a proposal for a novel, optimal and stable model of the housing environment by leveraging the potential of collaboration between international academic institutions, namely Lviv Polytechnic University (Ukraine) and Kielce University of Technology, in collaboration with an expert from the Cracow University of Technology, undertook an in-depth examination of the challenges associated with the reconstruction of lost architectural heritage, the creation of new living conditions, and the role of architecture in shaping identity and security. The study presented a series of optimised model solutions for the housing environment, taking into account the specific needs and interests of different user groups. In addition, it delineated a framework for the sustainable design of post-conflict cities. The study yielded several key findings, including the formulation of assumptions and postulates that collectively constitute a coherent vision of sustainable architecture and urbanisation. This vision is posited as a means of ensuring the stability of community life and functioning. Priorities for rational action were identified, and when integrated into a multi-pronged strategy, they have the potential to produce synergistic effects in the aftermath of conflict. The article concludes with a recommendation to adopt an interdisciplinary approach to reconstruction, integrating modern technologies and innovative architectural practices. This approach could inform potential projects in Ukraine, indicating further directions and strategies for action. Furthermore, additional phases of analysis were announced, which will serve to complement the results of the research to date.

Keywords: residential environment in Ukraine, housing environment, quality of life, research by design, city

INTRODUCTION

In the ongoing discourse surrounding the future of Ukraine, the issue of post-war reconstruction has assumed a prominent position. It forms the basis of both political discussions (Gould-Davies, 2022; Jonsson, Norberg, 2022) and academic analyses (Materials and Theses, 2023; Gil-Mastalerczyk, Proskuryakov, Bosyy, 2024). The discourse undertaken by leading international organisations such as the North Atlantic Treaty Organisation (NATO), the International Organisation for Migration (IOM),¹ *sui generis* entities such as the European Union (EU), and *foresight* institutions such as: World Bank,² Kyiv School of Economics (KSE),³ Central Europe Institute, The UN Refugee Agency (UNHCR); it focuses on a coherent list of priorities and processes, which include the need for reforms with political, institutional and legal, economic and social dimensions and a multi-year (long-term) process of global reconstruction. It is evident that the multifaceted ramifications of the conflict present a significant obstacle to the advancement of reconstruction processes within the built environment (Zaulichyna, Yasinsky, 2023, Proskuryakov, Bogdanova, Kopylyak, 2023). These challenges are closely linked to the complex and interdependent processes shaping social (Bazhenova, 2023; Rogozha, 2023; Demographic Change, 2023), spatial, urban (Jasinski, 2023; Graham 2010), political and legal (Ditrych, Laryš, 2024), economic and environmental (Аналіз наслідків, 2023; Яких екологічних, 2023), thus affecting different spheres of life of societies living in different areas of the country. Furthermore,

technologies that facilitate these processes through automation or robotisation must also be identified. The influence of these factors is evident not only in the context of transport and production, but also in the realms of construction, housing and social processes (Zhang, Chan, Darko, et al., 2022).

In light of the aforementioned considerations, the reconstruction of Ukraine must not be constrained to the mere restoration of the pre-war state. Instead, it must encompass a broader development perspective. In addition, the identification of fundamental actions that can produce synergistic effects immediately following the conflict, as well as the undertaking of research initiatives such as those described in the submitted article, are of particular importance.

It is evident that there is still a considerable distance to traverse between the plans for rebuilding Ukraine and their actual implementation. Nevertheless, the outcome of this project will have significant implications at the national and European, and global levels. It is thus imperative to establish a hierarchy of priorities for the reconstruction of urban areas, encompassing the domains of architecture, urban planning, and civil engineering. It is of the utmost importance to establish tangible projects as the cornerstones of a novel reality, which can be fully operationalised in due course.

OBJECT AND PURPOSE OF RESEARCH

Given the intricate nature of the issues under consideration, the authors concentrate their research efforts on the task of

*Joanna GIL-MASTALERCZYK, Ph.D. Eng. Arch., Assoc. Professor, Faculty of Civil Engineering and Architecture, Kielce University of Technology, <https://orcid.org/0000-0002-6904-7304>, e-mail: jmastalerczyk@tu.kielce.pl

**Viktor PROSKURYAKOV, Professor D.Sc. Eng. Arch., Institute of Architecture and Design, Lviv Polytechnic National University, <https://orcid.org/0000-0003-1022-8984>, e-mail: viktor.i.proskuriakov@lpnu.ua

***Krzysztof Zima, Ph.D. Eng, Assoc. Professor, Department of Civil Engineering, Cracow University of Technology, <https://orcid.org/0000-0001-5563-5482>, e-mail: krzysztof.zima@pk.edu.pl

reconstructing a new living and functioning environment for human beings, with due consideration of its social microstructure. This subject constitutes a significant field of investigation within the disciplines of architecture and urban planning. The objective is to conceptualise the city as an open and accessible space for all members of society, offering a secure, stable and contemporary housing environment that adheres to the standards set forth by European ecological and technological norms.

This article builds on previous joint research (Part 1) (Gil-Mastalerczyk, Proskuryakov, Bosy, 2025) to analyse the current challenges of reconstructing the residential environment. It presents a framework for sustainable urban design in the context of post-war reconstruction. This represents part two of the research conducted as part of an international project. The project was carried out by the academic communities of Lviv Polytechnic National University (Lviv, Ukraine) and Kielce University of Technology, with the participation of experts from Cracow University of Technology and Toronto Metropolitan University (Canada). The primary objective of the collaboration was to facilitate the post-war reconstruction of the housing environment through the provision of expertise and practical solutions.

The objective of this publication is to enhance the discourse on contemporary Ukrainian architectural issues and the challenges they present, while emphasising the pivotal role of international academic collaboration in influencing the future urban landscape of Ukraine.

The objective of the research was to:

- to carry out a sound needs analysis and develop project concepts through an educational design and research experiment using the *Research by Design* methodology, and to develop a database of potential projects responding to Ukrainian needs to the greatest extent possible, ready to be implemented as soon as the offensive is over;
- The advisory support is particularly focused on providing guidance on the implementation of the principles of Universal Design for architecture and public spaces that are accessible to all on an equal basis. Additionally, the advisory support aims to popularise the concepts and principles of Universal Design, as well as global standards and regulations for universal accessibility and participation. In order to address the needs of disabled individuals and the growing demographic of the ageing population, it is essential to eliminate potential barriers at the design stage. This approach ensures inclusiveness and empathy (Ill. 1) (Gil-Mastalerczyk, 2023, 2022).

Notwithstanding the challenges and adverse circumstances associated with the armed conflict, notable collaborative endeavours were undertaken. A significant occurrence was the joint organisation of the International Scientific Conference, entitled "The Development of Architecture in Europe during the War in Ukraine and after the Victory over the RF" (Lviv, Ukraine, 28–29 November 2023). In 2024, two noteworthy events took place. The first was an exhibition of projects, showcasing the most intriguing architectural designs in Ukraine, created by students of Lviv Polytechnic University (Kielce University of Technology, March 2024). The second was an accessibility workshop, organised by the Laboratory of Universal Design and Transformation of the Built Environment (LPUiPŚZ, Kielce University of Technology, 25–30 March 2024).



Ill. 1. In March 2024, the Laboratory of Universal Design and Transformation of the Built Environment of the Kielce University of Technology conducted an accessibility workshop and presentation on the possibilities of implementing the idea of universal design, March 2024, own archive: J. Gil-Mastalerczyk, 2024

DATA AND METHODS

The study employs four principal data sources, which are drawn from a variety of methodological approaches, thus facilitating the attainment of comprehensive results.

- Firstly, we build on the potential of international research co-operation, providing an excellent opportunity for joint discussions and direct exchange of experiences. The combination of disparate scholarly viewpoints facilitated the acquisition of novel empirical data through interviews, eyewitness accounts, and observations of the conflict in Kyiv, Kherson, Irpin, and Lviv. The testimonies, primarily from academic sources, furnished information on previously unreported phenomena and the consequences of the armed conflict. The study underscores the significance of expert knowledge and personal interactions, which can exert a profound and enduring influence on the future configuration of urban structures and the quality of life in these environments (Gil-Mastalerczyk, Proskuryakov, Bosy, 2025).
- Secondly, as part of the research process, participant observation will be conducted with a particular focus on young people who have been directly affected by the war and who are currently engaged in their studies at the Lviv Polytechnic University. In recent years, the number of students enrolled in the first years of architecture has increased to over 400, primarily due to internal migration resulting from the conflict. Participatory observation was employed as a complementary method to facilitate the researchers' data collection and monitoring of key events and activities, as part of a strategy to enhance the reflective discussions.
- Thirdly, we draw upon existing research and utilise publicly accessible documents and other sources of information, including expert reports, press reports, surveys, forecasts and photographic material provided by journalists. Additionally, we conduct our own observations as a foundation for mapping the repercussions of the attacks on the daily lives of Ukrainians and the socioeconomic context within Ukraine. The situation is monitored in terms of the restrictions that have been introduced, as well as the bans and orders that affect the reality and practice of architecture and urbanism. We endeavour to identify, as accurately as possible,

a representation of the actual damage sustained since the commencement of the war. However, it should be noted that not all available information is entirely dependable and accurate. It is imperative to highlight that there is an absolute prohibition on entering and photographing collapsed apartment blocks and ruins. Consequently, comprehensive analyses of the accumulated data are conducted with a view to identifying needs and contextualising them within the design processes. This encompasses an examination of material losses of housing stock and a diagnosis of the prevailing socio-demographic situation.

- Fourthly, we integrate architectural and urban design into the research process through an educational experiment using the *Research by Design* method. This approach enabled the acquisition of new knowledge through the practical application of design solutions.

Methodologically, we employ a form of theoretical and empirical analysis with an interpretive approach. The identification of pivotal issues is followed by the utilisation of a workshop comprising empirical experience, which is then employed to formulate predictions and recommendations pertaining to the aforementioned issues.

We also provide factors and recommendations that can address the issues discussed.

The article is concluded with a summary of the results and an indication of prospective avenues for future research.

STRATEGIC CHALLENGES AND PRIORITIES FOR THE RESTORATION AND DEVELOPMENT OF THE HOUSING ENVIRONMENT

Expressis verbis, Ukraine and its society are confronted with protracted and financially demanding processes of national reconstruction. This signifies a series of intricate challenges for the collective urban entity, encompassing the surrounding environment in which human life and development occur. Those involved will have to consider the implications of a multitude of factors, including competitive, economic, legal, social, technological, natural, executive and political considerations. This is due to the numerous diplomatic implications and the fact that Russia's invasion of Ukraine has already resulted in significant shifts in geopolitics and international relations⁴.

Furthermore, questions are raised concerning the implementation of extensive processes, including reconstruction, restoration, conservation, modernisation, construction, and the shaping of buildings and cities from the ground up. In these activities and processes, it is of particular importance to consider the input of national specialists and creative circles, as well as international expert circles.

The National Union of Architects of Ukraine (NSAU) played a pivotal role in the discourse by urging the global community of architects, urban planners, engineers, and artists to contribute their own proposals for the reconstruction of devastated cities. The most significant general guidelines were established in accordance with the principles set forth in the aforementioned manifesto. 'Ukrainian architecture should embody a number of new meanings, including respect for people, the value of common spaces, energy independence, accessibility, defence and the strength of society'. Notable designers such as Norman Foster and Hiroki Matsuura of MADMA⁵ also offered their perspectives. In the view of the country's architects and designers, the renovation process must extend beyond the mere restoration of the

pre-war state. This is the rationale behind the decision to design in two directions, with the dual objective of mitigating the impact of destruction and pioneering innovative architectural solutions that anticipate future needs. It is their contention that the reconstruction of the country must be approached in a holistic manner, encompassing ecological considerations, the formulation of a novel economic paradigm and technological advancement, while concurrently ensuring compliance with the prevailing standards of the rule of law as set forth by the European Union. In summary, the country's recovery from the devastation is contingent upon a significant modernisation of the built and natural environments, in addition to the necessity for decommunisation.

FUTURE EUROPEAN ARCHITECTURE.

Scenarios and results from international studies

In this section, the findings of the previous research conducted by Gil-Mastalerczyk, Proskuryakov, and Bosyy (2025) are considered alongside the expert and participatory information, as well as the research and design experience, systematically carried out by the Department of Architectural Environment Design at Lviv Polytechnic National University (Lviv Polytechnic National University, Institute of Architecture and Design, Department of Architectural Environment Design, Professor Viktor Proskuryakov, Head of Department of Architectural Environment Design (AED), a set of the most important assumptions, postulates and factors that we consider to be crucial in architectural-urban design and for the shape of the future residential environment and the development of urban structures of new habitats is presented and discussed. It should be noted that this list is not intended to be exhaustive; rather, it is a generalisation of the results of a broader set of analyses and identified factors that we believe to be of the highest probability and highly relevant to the processes shaping the new habitat environment and future European architecture in a safe environment. The aforementioned priorities for rational action will facilitate the achievement of the anticipated results in the immediate aftermath of the offensive.

Orientations, concepts, prospects for development

In our assessment that the initial phase of any plan to reinstate the residential environment should be as follows:

I. Regeneration and modernisation of the most urgent basic dilapidations of the housing environment and the development of blueprints for a completely new most optimal housing environment – with strategic foresight

1.1. In the short term – through rapid remedial projects – the starting point for the current reconstruction of the housing environment is the regeneration and modernisation of existing housing and the conversion of other facilities to housing, in order to ensure safety and the necessary living conditions. The implementation of temporary modular, container, prefabricated, portable housing and settlements for displaced people is of significant importance. The design of collective (service) housing is becoming an increasingly significant topic of discussion (III. 2–3).

1.2. In the long term, with a view to protecting cities and the population against military threats, it is crucial to create a completely new, most optimal and stable housing environment. In light of the necessity for anticipated future alterations and adaptations to the comprehensive spatial development planning system, it becomes imperative to establish a prospective sustainable housing environment:

- The objective is to develop a new typology of cities for social and urban policy, according to criteria of function-spatial

and demographic deformation. This will entail developing a principle for the distribution of service areas and facilities, creating areas and specialised service/residential facilities, and increasing the need for pro-health/care facilities, due to the increasing proportion of elderly people and people with various disabilities requiring specialised care.

- Developing principles of architectural typology and re-examining the relationship between population densities, building types, spatial patterns and infrastructure – in terms of their resilience, robustness and sustainability against military threats.
- It is imperative to develop innovative design methodologies and strategies to facilitate the creation of secure housing and other forms of refuge for the civilian population. This can be achieved through the utilisation of housing developments, public edifices and the modification of existing structures that possess inherent characteristics conducive to their use as shelters. Examples of such structures include basements, subterranean garage floors with reinforced concrete frameworks, underground metro stations and other edifices whose structural integrity can withstand the impact of above-ground collapse.
- It is imperative that these elements be included in architectural and urban design processes:
 - the comprehensive and multi-functional plans for multi-family residential complexes include the provision of associated infrastructure, as well as facilities and services for a range of uses, including retail, catering, education, health, worship, green and recreational areas.
 - the selection of architectural and urban design concepts allows for flexibility, variation, optimisation, and other such possibilities.
 - considering all the criteria that distinguish residential architecture in terms of the following factors: social, organisational, political, economic (innovation), and architectural and urban design.
 - In light of the growing significance of architectural and urban design, it is imperative to give due consideration to these elements:
 - appropriate spatial **forms that** are innovative and forward-looking, but also respectful of the cultural code, of local traditions,
 - and **function** to foster the restoration of social relations, providing a security complex with a place of refuge, resilient in the face of critical insecurities and war threats, guaranteeing in the long-term context access to water, energy sources, food resources and limited farmland resources - now largely contaminated and degraded,
 - **the use of modern construction technologies and materials** whose production contributes to a reduced carbon footprint, which do not have an adverse effect on climate change and that do not pollute the environment, with a view to leaving behind a world that is as intact and habitable as possible for future generations.
 - **ensuring effective protection of the most valuable strata and areas and rational management of retained water**; it is particularly important to implement the concept of certified *Green Building*, covering all stages from the selection of suitable construction sites to specially selected materials, increased energy efficiency and certified interiors,

- **meeting the challenges of demographic transition and its consequences**; these challenges include increasing **demographic and age polarisation** in the national space, increased **depopulation of war zones, migration, deformation of the age and gender structure of the whole population**, including:
 - an increasing number of military and civilian invalids estimated at 500,000 and 2.7 million respectively (Rogoza, 2023), an ageing population, a shrinking working-age population and increasing regional disparities, including growing divisions between invasion areas; and in 2030 projections that the country's population could be one of the oldest in Europe and additionally burdened with high rates of sickness, disability, post-traumatic stress disorder (PTSD) and depression (Rogoza, 2023),
 - the deterioration of the natural environment and the phenomenon of global warming are both likely to have an adverse effect on human health and increase mortality rates in the long term. This will in turn give rise to migratory movements (Demographic Change, 2023).

Continuous research and design activity, such as the research initiative Research by Design: *Design studies of functional-spatial and architectural-aesthetic solutions for buildings and their architectural forms, based on the application of new technical and technological developments, taking into account the design and construction site environment* (Lviv Polytechnic National University, Institute of Architecture and Design, Department of Architectural Environment Design (AED)).

Systematic design research, carried out as part of the educational process, competitions and commissions, under the guidance of Professor Viktor Proskuryakov (head of the Department of Architectural Environment Design), with the participation of lecturers (J. Bohdanova, I. Kopylak, J. Dzhil, M. Yaiv, R. Kubaj, I. Humennyk, B. Hoj, S.Ivanov-Kostecki and others), experts and students, covered functional-spatial and architectural-urban solutions of objects and spatial forms in a completely new environment of human functioning, which is now degraded by the ongoing war.

2.1. Design as a research process – generating knowledge and ideas that transform the war landscape

The integration of the design process with scientific research has facilitated the exploration of novel approaches to interpreting architectural solutions, thereby contributing to the generation of new knowledge. This knowledge can be further developed, made more tangible, and implemented to the greatest extent possible in the future, particularly in the context of rebuilding Ukraine. The design results set out new directions for the transformation of the housing environment, which in turn can determine not only future urban development but also incorporate a large number of partial solutions into the overall design and spatial assumptions, thus addressing Ukrainian needs.

The research was carried out using the *Research by Design* methodology, and analysis with an interpretive approach. The overarching objective was to develop a vision and concept of facilities and spaces dedicated to the whole of Ukrainian society, which would fully guarantee the needs of all groups of inhabitants and enable social integration. This was done with consideration of the country's dynamic demographic changes and increasing depopulation. In each case, the research commenced with an examination of the overarching context of the conditions, (including the centuries-old

history, local traditions, and the most important needs), in order to develop the most suitable functional-utility programme for the requirements of future user groups, taking into account the surrounding environment and the location in question.

The traditions of local architecture in Ukrainian cities are diverse and reflect the country's rich history as well as influences from various cultures and eras. The architecture of Ukrainian cities across different regions has distinctive features resulting from local building traditions and historical European influences – such as Kievan Rus', the Polish Kingdom, the Ottoman Empire, Austria-Hungary, and the Soviet Union. Lviv, a UNESCO World Heritage Site, is notable for its sacred Gothic architecture, Renaissance townhouses, Baroque churches, and Art Nouveau residential and public buildings. Kyiv is a city where historic architecture featuring elements of Neoclassicism blends with Soviet-era monumental structures – such as blocks from the 1960s to 1980s—and modern developments, including skyscrapers in the city centre. The city of Kharkiv is distinguished by its modernist and constructivist architecture, along with Cossack settlements that are characteristic of the region. Chornomorsk has preserved examples of East Slavic architecture, including Baroque churches. Meanwhile, southern Ukraine is characterised by steppe-style buildings, Cossack traditional houses, and Soviet industrial urban planning, such as the socialist realist buildings in Zaporizhzhia. The extent of war damages in Ukrainian cities varies and depends on their location and the intensity of military actions. Despite being located in western Ukraine, Lviv also experienced serious drone attacks, which damaged nearly 70 historic buildings in the city's historic district, including townhouses on Konovaltsa and Melnyka streets, as well as the villas of Ludwik Heller and Józef Franz.⁶ Many cities, like Drohobych, did not suffer significant destruction due to their location and lesser strategic importance. However, in eastern and southern regions of Ukraine, cities such as Mariupol, Kharkiv, and Bakhmut have suffered substantial damages, especially to civilian infrastructure, as a result of intense fighting.

Research by Design became an appropriate approach to this type of problem, as it brought together complex research into aesthetic, social and economic issues and enabled creative thinking and unprecedented design solutions using technical and technological innovations. The students' designs are distinguished by original solutions that justify the original profile of the designed objects and spaces in terms of sustainable universal design and

contemporary criteria for eco-friendly architectural design.

A significant finding of the research is the expansion of the perception of danger, accompanied by a robust commitment, a sense of shared responsibility, and a willingness to take action in order to lift the country from its current state of ruin.

In addition to a comprehensive array of conceptual designs encompassing futuristic concepts, the team also developed tangible architectural solutions for actual buildings. These are currently being employed in the reconstruction of settlements and the restoration of the country's devastated built environment. In particular, projects were commissioned by the chief architect of the Chernihiv region (Artem Hłuszczenko) and are currently being implemented in the destroyed towns and villages of the Chernihiv region. The portfolio comprises twenty-five projects of varying complexity and scale. These include designs for single-family houses, mobile folding modular housing for displaced persons, recreational complexes, landscape theatres, various landscape and spatial solutions, and elements of the park environment. Additionally, the portfolio features water park designs, urban landscape improvement projects, and wood product and furniture manufacturing plants.

2.2. Individual creative ideas, discussion of the results

The following section presents a series of proposals for research projects that are designed to advance the frontiers of knowledge in a number of key areas, including wellbeing, safety and functionality. These products are distinguished by their practicality, implementability, and tangible characteristics, including health and safety, environmental stewardship, innovation, and a distinctive array of multifaceted functions. They are designed with a particular focus on user-friendliness for older adults and individuals with disabilities.

This approach has enabled the realisation of innovative solutions that offer new possibilities for the functioning of residential environments, including the interaction between different age groups.

A) Mobile, collapsible and modular construction – one of the priorities of crisis urban planning. Lviv is one of the main cities accepting internally displaced people and faces the challenge of providing temporary, but at the same time functional and relatively comfortable housing for internally displaced people in Lviv. Effective modular and assembled solutions offer quick implementation, adaptability and cost and resource optimisation. They create the possibility of relocation depending on the needs. Prefabricated elements (modules), in addition to the possibility of

III. 2. Design of residential complex – folding buildings for displaced persons in Lviv. Author: stud. T. Bekeszta



III. 3. Design of a residential complex – modular, folding – for temporarily displaced persons in Lviv. Author: stud. A. Stefaniw



assembly within a few days or even hours, can be adapted to different numbers of residents and combined into larger units. Flexibility and modular design allows for expansion and adaptation to the changing needs of residents. The high quality of the modules manufactured in controlled factory conditions minimises the risk of construction errors. Thanks to these advantages, future permanent housing complexes can be created and expanded. However, the advantages of these solutions are not only mobility or scalability, but also sustainability and energy efficiency, including: the use of prefabrication that minimises construction waste; recycling or reusing some elements; the possibility of using modern thermal insulation technologies adapted to different climatic conditions and user needs; and even the possibility of increasing the energy independence of new housing estates by integrating renewable energy sources, such as solar panels or heat pumps.

The implementation of this type of construction in Lviv is a key solution for the city. It can help to quickly and effectively provide shelter, while at the same time fitting into the long-term strategy of rebuilding cities after the war. The initiated research activity, cooperation with international environments will enable the creation of innovative and humanitarian projects – in the context of Lviv conditions, such as the solutions recommended below (III. 2, 3). The knowledge and experience of local environments is particularly important in their implementation, in the field of designating appropriate areas and applying solutions adapted to the existing urban tissue, with dense historical buildings.

B) Sustainable processes of social transformation in living spaces, meeting and service centres – these solutions align with the Ukrainian requirements for the planning of accommodating and functional spaces and facilities, while avoiding congestion and ensuring the flexibility and diversity of new spatial solutions. The concept of a harmonious space is one that ensures a positive feeling of the surroundings and enhances the quality of life. This, in turn, influences the quality of the housing environment (see III. 2–3). The geographical area in which a population resides also determines the extent of access that the population has to a variety of services. In the projects presented below, it is notable that the location has been chosen in the degraded environment of the historic city centre, specifically the town square. The new facilities meet the criteria of universal design, and the internal space is filled with modern technological facilities for commerce, service provision and recreation (III. 4–5).

C) Experimental architectural design – large-scale commercial buildings

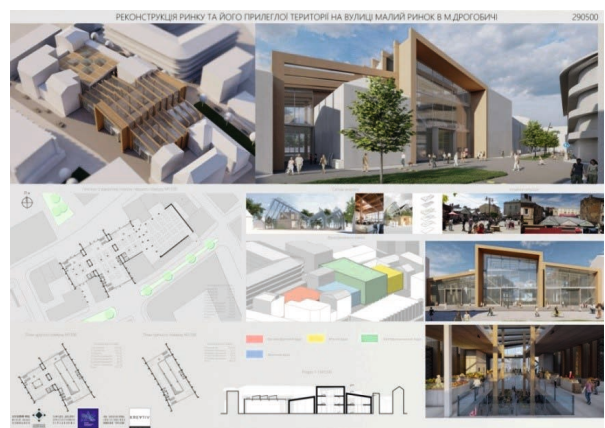
In light of the extensive damage sustained by the shopping centres, variants of their multifunctional types were subjected to testing as part of the research design, with a view to facilitating rapid post-war reconstruction (III. 6).

D) Contemporary monumental architecture as a spatial manifesto and a way of remembering events

The development of designs for **monumental forms**, allows through architecture to pay tribute to war casualties. These objects, in their original form and scale, function as a kind of spatial manifesto in the context of human living and functioning. They serve as a significant formal marker within the memorial space, enhancing the overall aesthetic appeal of the architectural work and its surrounding environment (III. 7). The surrounding context also plays an important role.

E) Reclamation and revitalisation of natural and artificial landscapes.

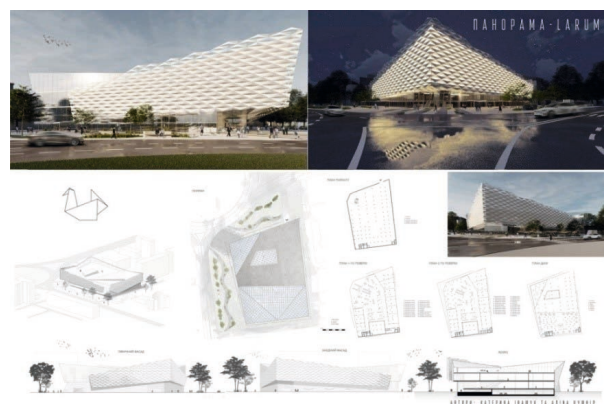
The conflict resulted in the destruction of vast tracts of natural and man-made landscapes, including public squares, gardens,



III. 4. Competition project for the redevelopment of the Market Square and the adjacent area on small market square on Dohobycz. The project was bestowed with the esteemed accolade of the Mayor of Drohobych. Author: stud. I.-B. Wolińska



III. 5. Competition design for the redevelopment of the Market Square and the area adjacent to small market square on Dohobycz. Author: stud. A. Pastuszczyk



III. 6. The experimental competition design of the 'Panorama' shopping centre in Odesa is presented herewith. The project was bestowed with the esteemed accolade of the Mayor of Drohobych. Authors: stud. K. Ivashchuk, stud. A. Kuszniir

parks, and urban forests. These areas are currently undergoing a process of rehabilitation and revitalisation. They are fundamental to meeting the needs of people and improving their quality of life, particularly in terms of recreation, relaxation and social interaction. In addition to the natural environment, the material



III.7. The design of monumental forms serves as a means of conveying respect to those who have fallen in war. Authors: students N. Khyzhniuk, I.-B. Wolianska, Y. Cholavyn



III. 8. Restoration project of the I. Frank park in Sambor. Author: stud. D. Poroznij

components of landscapes, such as theatres and entertainment venues, cultural and educational institutions, sports facilities and medical buildings, as well as smaller architectural forms, technical and technological installations, have been significantly impacted. These structures have been fixed in human memory and represent an important value for local communities and often for larger regional societies, serving as testimonies to significant events and socio-economic phenomena. For these reasons, education at the academic level continues to manifest as a syncretic and systemic architectural-environmental endeavour (III. 8).

DISCUSSION OF RESEARCH RESULTS. SYNTHESIS AND PROPOSED WAY FORWARD

The forthcoming challenges of rebuilding the housing environment in Ukraine will be addressed most effectively through international cooperation and wide-ranging constructive action. The extent to which the assumptions developed will materialise and the capacity of society to realise human rights will be contingent upon the actions of the design community and the people of Ukraine.

In light of the aforementioned assumptions, which can be effectively integrated into a multi-track strategy, it is possible to attain synergistic outcomes through the simultaneous fulfilment of the proposed leading solutions and recommendations.

- Above all, the processes described and any efforts to rebuild Ukraine's built environment require **a holistic and systemic approach** that takes into account all mechanisms,

modalities, factors and networks – carried out with a sense of shared responsibility with the Ukrainian authorities.

- The implementation of appropriate national policies, including a skilful innovation policy, with support in various forms, is the key to radical changes in the way the housing environment is shaped, used, developed and perceived. It follows that a state policy for innovation and technology transfer should seek to establish a general environment conducive to the free flow of scientific knowledge and research and development (R&D) activities.
- It is necessary to link the sphere of legal regulations with economic instruments, and therefore to **undertake legislative work** normalizing regulations in the matter in question, including:
 - It is recommended that regulations be established along the lines of the Construction Law and the Urban Planning Code, which should include comprehensive and effective legal regulations. These regulations should be co-authored by the architectural community of Ukraine (National Union of Ukrainian Architects).
 - regulations for the protection of cities and their populations from war risks, with war risks and civil defence requirements being linked to the spatial shape and infrastructure of cities (synthesis: spatial planning-urban planning-architecture) (Jasinski, 2023)
 - the use of residential developments, public buildings, for civilian shelter functions (in addition to the preparation of special protective structures), with the provision of decentralised water supply systems (Krueger, Rao, Borchardt, 2019), decentralised electricity supply systems (Giliani, Kazemi, Ghasemi, 2020), and nuclear micro-reactors (Gilbert, Bazilian, 2020).
- It is important to **set obligatory directions and perspectives for further research** in architectural, urban and spatial planning design, taking into account all aspects analysed, including sustainable development and civil defence requirements.
 - The findings of previous research, based on the Ukrainian experience, indicate that less intensive, dispersed and polycentric models are of greater importance than compact, densely populated and intensively built-up cities. The model of a small '15-minute' pedestrian-cantered city, better meets the postulates of both living comfort, sustainability, as well as population safety and resilience of urban organisms (resilience of urban structure) (Jasinski, 2023).
 - Furthermore, this study highlights the importance of continued research in the field of design, both in terms of establishing the validity of existing approaches and in addressing the necessity for further developments. The initiative has facilitated an inclusive discourse and contributed to a more nuanced understanding of insecurity. It is recommended that future research include a more expansive range of analytical techniques and a more critical and detailed expert opinion. Furthermore, it would be prudent to conduct a survey of the general public and to undertake an assessment of potential projects at the macro-regional level.
 - It is also significant to **incorporate modern technologies and inventory methodologies** for damaged buildings and surviving buildings and structures with high historical,

aesthetic, social values still at risk of damage. The implementation of a digital preservation strategy utilising digital information technologies, such as 3D scanning, will facilitate not only the digital archiving of cultural heritage, but also restoration work, the reconstruction of original damage and the planning of new developments (Zima, Plebankiewicz, Wiczorek, 2020; Xiong, 2023).

CONCLUSIONS

Moscow's global ambitions are not bringing the intended results. In response, Ukraine, in a war economy, has already initiated some corrective measures, albeit in the sphere of civilian infrastructure. Nevertheless, it is premature to expect the restoration of stability, the re-establishment of order and the provision of security guarantees. It is evident that sporadic offensives and counter-offensives continue to present a tangible threat to the country and its society. Nevertheless, it is our contention that a joint undertaking at this time will facilitate the implementation of the arrangements that have been made and allow them to be put into practice with immediate effect at the conclusion of the war.

It is important to note that the proposals outlined above are inadequate to achieve the optimal stable housing environment model, which represents the best that can be reasonably hoped

for in the foreseeable future. In order to facilitate the rebuilding of Ukraine's housing environment, it is essential that any proposed initiatives are aligned with global policies in the following areas: humanitarian assistance, macro-financial assistance and the implementation of reforms. Furthermore, it is essential to combine this approach with robust backing from the EU, NATO, and their respective member states.

In conclusion, this joint project constitutes a significant contribution to the advancement of scientific knowledge and the future development of Ukraine. It facilitates the undertaking of more detailed research on the built environment, drawing on available models, proven mechanisms and experiences. Furthermore, the project initiates a discourse on the potential for interdisciplinary collaboration in prospective restoration projects that will integrate contemporary technologies and pioneering architectural methodologies. In light of the aforementioned considerations, it becomes evident that there is a necessity to extend the scope of research, with a view to elucidating further concepts and strategies for action in Ukraine. This endeavour should be undertaken with the active involvement of representatives of international expert communities, as well as representatives of central and regional public institutions in Ukraine, and potential partners who are willing to engage in these processes.

ENDNOTES

- ¹ IOM Registered IDP Area Baseline Assessment Dashboard (ABA), IOM's Displacement Tracking Matrix (DTM), <https://dtm.iom.int/responses/ukraine-response> (accessed 10.05.2024).
- ² <https://www.worldbank.org/en/country/ukraine/overview> (accessed 29.05.2024).
- ³ <https://kse.ua/ua/russia-will-pay/> (accessed 02.09.2024).
- ⁴ https://www.lemonde.fr/international/article/2024/02/23/guerre-en-ukraine-les-reponses-du-monde-a-vos-questions-les-plus-frequentes_6117346_3212.html (accessed 10.07.2024).

REFERENCES

- [1] Analiza skutków wysadzenia tamy Kachowska HPP, 2023. Dostępny: <https://kse.ua/wp-content/uploads/2023/11/Report-Ukr-1.pdf> (dostęp 20.02.2024).
- [2] Bazhenova, H., Demograficzne wyzwania Ukrainy. Nr 973 (221/2023), 12.10.2023, Instytut Europy Środkowej, Komentarze IEŚ, red. B. Surmacz, T. Stępniewski, A. Zajdel, A. Kuczyńska-Zonik, J. Olchowski, K. Pawłowski, A. Tatarenko. Dostępny: <https://ies.lublin.pl/komentarze/demograficzne-wyzwania-ukrainy/> (dostęp 19.04.2024).
- [3] Demographic Change. The Impact of Demographic Change in a changing environment, 2023. Dostępny: https://commission.europa.eu/system/files/2023-01/Demography_report_2022_0.pdf (dostęp 10.07.2024).
- [4] Ditych, O., Laryś, M., 2024. What can European security architecture look like in the wake of Russia's war on Ukraine? *European Security*, 1–21. Dostępny: <https://doi.org/10.1080/09662839.2024.2347221> (dostęp 19.05.2024).
- [5] Gil-Mastalerczyk, J., Proskuryakov, V., Zima, K., 2024. Urbicide in Ukraine: Analysis of Environmental Destruction – Challenges, Strategies, and International Cooperation (Part 1).
- [6] Gil-Mastalerczyk, J., Proskuryakov, V., Bosny, P., 2024. Urbicide in Ukraine: Analysis of Environmental Destruction – Challenges, Strategies, and International Cooperation (Part 1).
- [7] Gil-Mastalerczyk, J., 2022. Developing engineering competence and engagement in the sustainable development idea through a flexible and creative approach. *World Transactions on Engineering and Technology Education*, v. 20, 2, 124-130.
- [8] Gil-Mastalerczyk, J., 2023. Discovering others and transforming the world together - the effect of an innovative attitude in sustainable design. *Global Journal of Engineering Education*, v. 25, 1, 21-28.
- [9] Gil-Mastalerczyk, J., 2023. An Accessible City – A Look from the Perspective of the '60+' Generation. *Structure and Environment*, v. 15, 1, pp. 25-37, DOI: 10.30540/sae-2023-004.
- [10] Gilbert A.Q., Brazilian M.D., 2020. Can Distributed Nuclear Power Address Energy Resilience and Energy Poverty? *Joule*, Sep 16;4(9):1839-1844. DOI: 10.1016/j.joule.2020.08.005.
- [11] Giliani M.A., Kazemi A., Ghasemi M., (2020). Distribution system resilience enhancement by microgrid formation considering distributed energy resources, *Energy*, v191, 116442, doi.org/10.1016/j.energy.2019.116442.
- [12] Graham S., 2010. Cities under Siege: the New Military Urbanism, London-New York.
- [13] Gould-Davies, N., 2022. Belarus, Russia, Ukraine: three lessons for a post-war order. *Survival*, 64 (5), 39–46.
- [14] IOM's Displacement Tracking Matrix (DTM). Dostępny: <https://dtm.iom.int/responses/ukraine-response> (dostęp 10.05.2024).

html (accessed 10.07.2024).

⁵ https://www.propertydesign.pl/architektura/104/norman_foster_ujawnia_masterplan_odbudowy_charkowa,41861.html (accessed 24.02.2024).

⁶ Destroyed historical buildings of Lviv after the Russian attack on the city, https://dzieje.pl/dziedzictwo-kulturowe/perfekcyjnona-historyczna-zabudowa-lwowa-po-rosyjskim-ataku-na-miasto?utm_source=chatgpt.com (accessed 25.09.2024).

- [15] Jakie konsekwencje dla środowiska poniosła Ukraina podczas wojny, oprócz zniszczeń spowodowanych eksplozją elektrowni Kachowska, 2023. Dostępny: <https://kse.ua/ua/about-the-school/news/yakih-ekologichnih-naslidkiv-zaznala-ukrayina-zachas-vyni-okrim-zbitkiv-vid-pidrivu-kahovskoyi-ges/> (dostęp 20.02.2024).
- [16] Jasiński A., 2023. Urbanistyczny wymiar wojny w Ukrainie/The urban dimension of war in Ukraine, *Housing Environment*, 43/2023 Współczesna architektura mieszkaniowa w przestrzeni miasta/Contemporary Housing Architecture In City Space E-ISSN 2543-8700, DOI: 10.4467/25438700sm.23.012.18171.
- [17] Jonsson M., Norberg J., 2022. Russia's war against Ukraine: military scenarios and outcomes. *Survival*, 64 (6), 91–122.
- [18] Krueger E., Rao C.S.P., Borchardt D. (2019). Quantifying urban water supply security under global change, *Global Environmental Change*, 56:66-79, DOI: 10.1016/j.gloenvcha.2020.03.009.
- [19] Materials and Theses International Scientific Conference Development of Architecture in Europe During The War in Ukraine and after the Victory Over the Rf, dedicated to the 20th Anniversary of the Foundation of the Department AED, 28 - 29 November 2023. Lviv, Ukraine, ISBN 978-617-8385-49-1. Ed. Proskuryakov V.I., Ed. Cpolom.
- [20] Proskuryakov, V., Bogdanova, Yu., Kopylyak, I., 2023. Current directions of architectural education at the Department of Architectural Design of the National University of Lviv Polytechnic, in the conditions of war and after victory. *Bulletin of the National University, Lviv Polytechnic. SerioArchitecture*, No. 1 (9). P. 168-176.
- [21] Rogoża, J., Ukraina w obliczu katastrofy demograficznej, Nr 524 11.07.2023, Ośrodek Studiów Wschodnich. Dostępny: <https://www.osw.waw.pl/sites/default/files/Komentarze%20OSW%2024.pdf> (dostęp 19.04.2024).
- [22] UN High Commissioner for Refugees (UNHCR), Operational Data Portal, <https://data.unhcr.org/en/situations/ukraine> (dostęp 10.05.2024).
- [23] Xiong W., 2023. Construction of Non-inherited Digital Platform based on PEST-SWOT Model, *Applied Mathematics and Nonlinear Sciences*, 8(2) (2023), 1819-1828. <https://doi.org/10.2478/amns.2023.1.00285> (dostęp 20.04.2024).
- [24] Zaulichyna, I., Yasinsky, M., 2023. Historical and architectural analysis of the city of Bakhmut. *Bulletin of the National University, Lviv Polytechnic. Series Architecture*, No. 1(9). Pp. 86-97.
- [25] Zhang F., Chan A. P. C., Darko A., Chen Z., Li D., 2022. Integrated applications of building information modeling and artificial intelligence techniques in the AEC/FM industry, *Automation in Construction*, 7/2022, p. 104289.

[26] Zima K., Plebankiewicz E., Wieczorek, D. A SWOT Analysis of the Use of BIM Technology in the Polish Construction Industry. Buildings 2020, 10, 16. <https://doi.org/10.3390/buildings10010016>.

[27] Destroyed historical buildings of Lviv after the Russian attack on the city, https://dzieje.pl/dziedzictwo-kulturowe/zniszczona-historyczna-zabudowa-lwowa-po-rosyjskim-ataku-na-miasto?utm_source=chatgpt.com (accessed 25.09.2024).

ONLINE SOURCES

[1] <https://dtm.iom.int/responses/ukraine-response> (accessed 10.05.2024).

[2] https://www.lemonde.fr/international/article/2024/02/23/guerre-en-ukraine-les-reponses-du-monde-a-vos-questions-les-plus-frequentes_6117346_3212.html (accessed 3.04.2024).

[3] <https://www.worldbank.org/en/country/ukraine/overview> (accessed 29.05.2024).

[4] https://www.propertydesign.pl/architektura/104/norman_foster_ujawnia_masterplan_odbudowy_charkowa.41861.html (accessed 24.02.2024).

[5] <https://kse.ua/ua/russia-will-pay/> (accessed 04.09.2024).