ISSN 2522-4182

DOI: 10.32347/2522-4182.17.2025.189-199
УДК624.9

ANALYSIS OF SOME CASES RESIDENTIAL BUILDINGS DESTRUCTION AS A RESULT OF COMBAT ACTIONS

Valeriy NUZHNYI[1], Vira KOLIAKOVA[2]

[1,2] Kyiv National University of Construction and Architecture
31, Povitryanykh Syl Ave., Kyiv, Ukraine, 03037
[1] nuzhnyi.vv@knuba.edu.ua https://orcid.org/0000-0002-0400-3204
[2]koliakova.vm@knuba.edu.ua, http://orcid.org/0000-0001-6879-8520

Abstract. The problem of residential infrastructure destruction as a result of the aggression of the Russian Federation is very relevant in Ukraine. If houses are subject to major repairs, they may have various damages, from major to relatively minor. Also, during inspections, the consequences of long-term fires that were not extinguished and the structures from the fire have completely lost their load-bearing capacity are often found. Such damages can be severe and localized within the framework of the frame cells, apartments, rooms on the lower floors, which makes it impossible to carry out radical actions, such as complete replacement. For example, replacing structures could require dismantling the floors above, which is not advisable.

This article provides examples of failures that have been encountered in practice when developing major renovation projects. It highlights aspects of deeper problems that are not obvious at first glance. Insufficient consideration of these factors leads to inappropriate decisions that require adjustments during the work process. This actually leads to an increase in the cost of major renovations that were not previously taken into account.

The article provides recommendations for making optimal, and often the only possible, decisions when developing major building renovation projects.

Keywords: damage**;** building structures; destruction; fire damage; major repairs.

Valeriy NUZHNYI
Lector Department of Steel and Timber Structures,
PhD (Tech. Sci.)

Vira KOLIAKOVA
Associate Professor, Department of Reinforced Concrete and Stone Structures
Assoc. Prof., PhD (Tech. Sci.)

INTRODUCTION

In the modern realities of Ukraine, unfortunately, the topic of damage to buildings and structures as a result of hostilities is very relevant. Since 2022, a number of publications have been published on this topic in professional publications, which characterize various aspects of this issue. These works also propose methods for performing major repairs and strengthening building structures.

In this article, I would like to present somewhat more in-depth research into rather narrow aspects of this issue. I would like to mainly present interesting practical examples that the authors encountered when inspecting buildings and structures and when choosing a method of reparation.

ANALYSIS OF CURRENT RESEARCH

The topic of the impact of wars and terrorist acts on building structures in peacetime is a topic of a narrow circle of scientists involved in military science, weapons development and

civil defense, including standards [1, 2, 3, 4]. In a broader sense, in the field of civil engineering, this topic arises and acquires wide and deep relevance only when, unfortunately, the country's society is faced with the consequences of tragic periods of its history during wars and armed conflicts. Ukraine is no exception in this case..

Modern research can be conditionally divided into several directions. The first direction is the study of the features of the action of weapons on structures, the analysis of force effects, methods for calculating penetration, shock waves, etc. [5, 6, 7]. The second direction of research is the topic of designing civil defense structures and protecting civil infrastructure [8, 9, 10, 11]. The third direction of research can be called the generalization and study of the consequences of the impact of weapons on structures, the phenomenology of destruction and methods of major repairs of damaged building structures. Such works include a comparison of the survivability and features of destruction of buildings with different structural schemes, as well as methods of their restoration and strengthening [12,13,14, 15,16,17, 18, 19, 20]. Also, in recent years, state standards and building codes have been significantly improved [21, 22]. Thus, the DSTU [21] already contains typical schemes and recommendations for assessing the technical deterioration of buildings damaged as a result of hostilities and terrorist acts.

This article also belongs to the direction of research on destruction, in which some practical examples from empirical experience are presented and their evaluation and generalization are provided.

STATEMENT OF RESEARCH GOALS

When examining the structures of buildings and structures damaged by combat operations, mechanical destruction caused by the action of weapons can be observed.

The effect of ammunition on building structures is characterized by the following effects:

1. Shock-impulse action due to a direct impact from the arrival of the ammunition;
2. The explosion of an ammunition, which causes a direct explosive high-explosive effect, is also characterized by the following effects:
   - Damage by the scattering of primary fragments from the explosion of the ammunition;
   - Damage by the scattering of secondary fragments from destroyed structures, furniture, doors, etc.;
   - Damage by a blast wave that creates excessive pressure on the structure and can lead to serious destruction and can break glass in a radius of up to 200..250 m depending on the presence of obstacles in the wave path [1];
3. The effect of high temperatures and fire.

The peculiarity of this impact is that the fire spreads quickly, massively and cannot always be quickly and effectively extinguished by fire brigades due to the fact that either hostilities are taking place in the given area or an air raid is ongoing.

At the same time, the force and temperature effects exceed any calculated and permissible factors that were taken into account when designing buildings and structures.

To correctly assess the consequences of the effects that arose when a weapon hit, it is necessary to understand the nature of the impact itself, the force factors that acted and caused the consequences. Also very useful is any information on the studied precedents and analogues of destruction, which would allow a more accurate assessment of the consequences, make an adequate decision and more accurately recognize the technical and economic indicators and parameters of major repairs at the design stage. Therefore, the purpose of this article is to show and summarize some typical cases of damage that the authors encountered in practice.

MATERIALS AND RESEARCH METHODS

The authors investigated specific cases that were considered during detailed inspections of multi-storey residential buildings in the Kyiv

region in Bucha, Irpen, and Gostomel, where active hostilities took place in February-March 2022.

These houses were completely renovated. During the clearing and reinforcement of the affected areas, some damaged structural elements had more hidden defects and damage than it seemed at first glance. As a result, it was necessary to adjust the design solutions..

The second serious impact is the prolonged action of the fire, which was not extinguished. The structures were severely damaged beyond the fire resistance limit, which required adequate assessment and decision-making..

TEACHING THE BASIC MATERIAL

All mechanical damage is short-term in action and very strong, being beyond the working limit of materials. This is manifested both in the impulse action of a direct impact by a munition upon impact, and in the action of a blast wave.

An interesting case may be the one that occurred in the city of Bucha, when a mortar shell hit the balcony slab of a residential building on the 7th floor of a 8-story residential building with brick longitudinal load-bearing walls.

The damage diagram is shown in Fig. 1. Photo in Fig. 2. Thus, as a result of the impact of a mortar shell, a balcony slab was damaged. A corner was knocked out and destroyed in the slab, and at the same time, deep cracks were visible in the partition wall, in which this slab was pinched from the side of the affected corner. The nature of the cracks development, depth, and area of distribution were not visible at first glance. The facade insulation on the wall was also destroyed and the wall surface itself was damaged by blast fragments. At the same time, beacons were installed on the cracks, which showed further progression of the crack opening, as a result of which the company operating the building decided to install supports within the opening.

When attempting to pull the wall together with a metal clamp, it was discovered that it had delaminated across the entire height and area within the 7th floor and as a result required complete re-laying. This was accomplished with sequential dismantling, re-supporting, and re-laying of the masonry in sections.

In the final conclusion, such destruction can be considered typical when ammunition hits the balcony slab and it can lead to progressive destruction of the wall within the upper floors with the collapse of the slabs. In the described case, it was fortunate that the impact occurred on the penultimate floor and the load on the laminated partition was not large and measures for temporary support were taken in time.

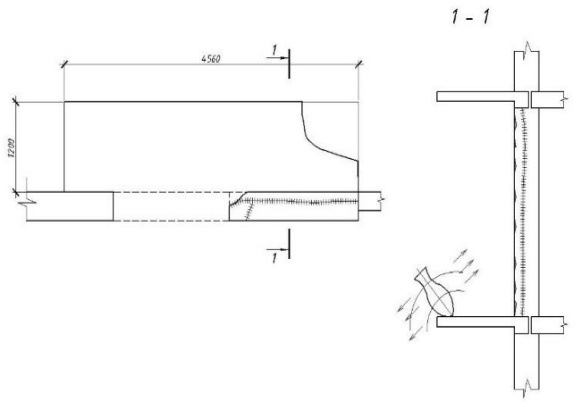

Fig. 1 Diagram of structural damage due to a mortar shell hitting a balcony slab

Рис. 1 Схема конструктивних пошкоджень, спричинених влучанням мінометного снаряда в плиту балкону

Fig. 2 Appearance of the crack from the end of the wall. Photo by V. Nuzhnyi

Рис. 2 Тріщини на торці стіни. Автор фото В.Нужний

Another type of damage worth paying attention to is massive damage to monolithic reinforced concrete frame buildings from impacts, shell explosions, and fire.

Thus, a multi-storey residential building in the city of Irpin was located in a combat zone and suffered massive damage. The exterior of the building is presented in Fig. 3.

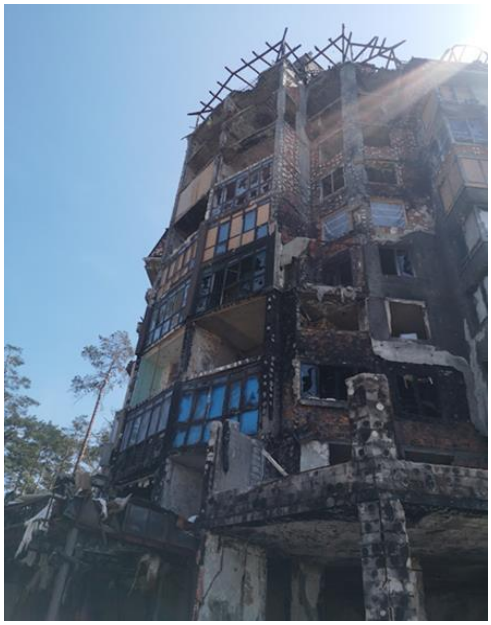

Fig. 3 Exterior view of a section of a building with a monolithic reinforced concrete frame that was damaged during hostilities. Photo by V. Nuzhnyi

Рис. 3 Зовнішній вигляд фрагмента будівлі з монолітним залізобетонним каркасом, пошкодженої під час бойових дій. Автор фото В. Нужний

In this building, the consequences of the arrival of shells, mortar shells were observed, which caused both mechanical damage and long-term fires. The roof with the attic floor was completely destroyed and all the damage was localized - within the apartments, rooms. The total amount of damage did not exceed 30..35%. Therefore, it was decided to save the house and carry out its major repairs. The structures of the corner section, which is presented in Fig. 3, were especially damaged. Starting from the 6th floor, the frame elements had massive damage (see Fig. 4, 5, 6, 7).

Fig. 4 External view of the damage within the floor. Photo by V. Nuzhnyi

Рис. 4 Зовнішній вигляд пошкоджень у межах перекриття. Автор фото В. Нужний

Fig. 5. Pylon hit by a projectile. Photo by V. Nuzhnyi

Рис. 5 Пілон, уражений снарядом. Автор фото В. Нужний

Fig. 6 Damage to the frame slab and columns. Photo by V. Nuzhnyi

Рис. 6 Пошкодження плит перекриття та колон каркаса. Автор фото В. Нужний

Fig. 7 Damage to the frame plate from Fig. 6, bottom view. Photo by V. Nuzhnyi

Рис. 7 Пошкодження плити каркаса з рис. 6, вигляд знизу. Автор фото В. Нужний

After damage analysis, it was considered appropriate to dismantle the building frame, starting from the 6th floor. The main factor in making this decision was the significant damage to the columns and pylons (see Fig. 5 and 6). With such crushing of the concrete with the exposure of the reinforcement, the integrity of the structure is completely lost. There are also distortions of the floors located above, which, even if they are relatively intact, require dismantling.

Some damage to floors from shell and mine impacts leads to significant damage around it, which must be taken into account when designing major repairs. Thus, the floor penetration shown in Fig. 6 and 7 was cleared of splintered and cracked concrete around it, and as a result, the damage zone turned out to be almost equal in area to a cell (see Fig. 8).

Similarly, it is possible to classify less extensive damage at first glance, for example, through-hole damage to a pylon by a projectile, which leads to a 50..60% loss of strength (see Fig. 9). Moreover, any through-hole damage is characterized by a small hole at the entrance and large-scale chipping of concrete with destruction of the reinforcing frame at the exit.

Fig. 8 Cleared impact zone from Figs. 6 and 7, which nearly corresponds to the dimensions of a structural bay. Photo by V. Nuzhnyi

Рис. 8 Розчищена зона ураження з рис.6 і 7, що майже відповідає розмірам чарунки каркаса. Автор фото В. Нужний

Fig. 9 Through-hole damage to the pylon. Photo by V. Nuzhnyi

Рис. 9 Сквозне пошкодження пілона. Автор фото В. Нужний

An example of clearing a small hole from a small-caliber projectile or mortar in a ceiling with a total diameter of up to 150 mm can also be given. Despite the fact that such an impact did not cause significant deformations and damage to the reinforcing frame at first glance, the concrete damage zone was about 1x1 m and had to be cleared (see Fig. 10).

Fig. 10 Cleaning damaged concrete after a pinpoint hit by a small-caliber projectile. Photo by V. Nuzhnyi

Рис. 10 Очищення пошкодженого бетону після точкового влучання дрібно-каліберним снарядом. Автор фото В. Нужний

Another impact on the elements of the building frame was the action of fire, which was not extinguished. In addition to explosive special agents in high-explosive ammunition and chemical cumulative action. The structures were affected by the repeated long-term burning of furniture, interior decoration elements, etc. If a fire occurs in round-hole prefabricated panels, the phenomenon of their destruction is described in [13, 19] and they are usually subject to replacement with monoline sections, steel beam floors with reinforced concrete roll, etc.

In the case of prolonged burning of a reinforced concrete frame, the following phenomena occur in structures:

- dehydration of cement, change in color of concrete to whitish-grayish, yellow, sometimes pink with a significant decrease in concrete strength to zero;
- tempering of heat-strengthened reinforcement produced in recent years. Any heating to a temperature above 400˚C leads to the beginning of tempering and a decrease in the mechanical properties of steel;
- destruction of the protective layer, exposure of reinforcement, temperature deformations, destruction of reinforcement and, as a result, destruction of the calculated reinforced concrete cross-section;
- development of large-scale cracks in the frame, especially in floors adjacent to diaphragm elements - stairwells, basement walls, etc. During a fire, the local area of the floor is unevenly squeezed between neighboring rigid vertical structures under conditions of thermal expansion. This causes cracking and the appearance of serious cracks.

The last described phenomena are characteristic both for floor slabs and for vertical monolithic reinforced concrete elements - diaphragms, pylons. The consequences of typical large-scale fire damage to floor sections are shown in Fig. 11 and 12.

Fig. 11 Effects of fire on floor slab. Photo by V. Nuzhnyi

Рис. 11 Наслідки пожежі на плиті перекриття. Фото В. Нужного

The bearing capacity of such structures cannot be assessed in any way according to [23, 24, 25], since the structural integrity of the calculated cross-section is completely destroyed. The picture is complicated by the fact that such damage is not massive in nature but is localized within certain cells (where there were rooms in which the fire occurred, and there were no neighboring ones). Thus, demolishing the house is not economically feasible, and replacing the floor in the conditions of the existing frame is complicated by the impossibility of complete replacement and re-supporting of the columns.

Fig. 12 Complete destruction of the working reinforcement in the ceiling after prolonged exposure to fire. Photo by V. Nuzhnyi

Рис. 12 Повне руйнування робочої арматури в перекритті після тривалого впливу вогню. Автор фото В. Нужний

Fig. 12 shows the complete destruction of the reinforcing mesh of the basement floor as a result of a multi-day fire in the basement, where office premises were located. When clearing the affected areas of concrete, it turned out that the cross-section of the slab had completely lost its strength throughout. As a result, a relatively large section of the floor was removed (see Fig. 13).

Fig. 13. Cleared area of the ceiling after the fire, shown in Fig. 12. View from the upper floor. Photo by V. Nuzhnyi

Рис. 13. Розчищена ділянка перекриття після пожежі, показаної на рис. 12. Вид з верхнього поверху. Автор фото В. Нужний

The described destructions are complex from the point of view of capital repairs. Replacing floors, re-supporting new ones on existing columns is a rather complex and sometimes impossible task. Its complexity lies in the impossibility of restoring the adhesion of the new part to the existing one, the impossibility of restoring the support prisms of the thrust on the columns that continue to the higher floors, etc. Therefore, the simplest of the proposed methods of repairing such floors is to introduce steel brackets on the columns and arrange steel beam cells on them using welded I-beams and closed double-walled sections, paired I-beams, etc. (see Fig. 14). The main condition for such a beam system is a small height. Provided that the beams are made with a height of up to 140..150 mm and they are covered with a plasterboard ceiling, the height and functional purpose of the room do not significantly decrease.

Fig. 14 Reinforcement of the floor slab after a fire by adding steel beams. Photo by V. Nuzhnyi
Рис. 14 Армування плити перекриття після пожежі шляхом додавання сталевих балок. Автор фото В. Нужний

CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

Unfortunately, the problem of destruction, while hostilities are ongoing, remains relevant. The boundaries of this problem cannot be determined, because the action of weapons is random in nature. Damage and injuries can be diverse and are the consequences of a complex action - impact, explosive action, fragmentation with penetration and thermal and chemical effects of fire..

Minor mechanical damage can lead to a chain of events that will lead to large-scale collapsive collapse. For example, the example of a balcony slab being hit by a small-caliber mortar shell shows how load-bearing walls can be damaged.

When performing spot repairs on the scale of the entire frame, where it is not advisable to dismantle the floors located above, it has been shown that it is advisable to use reinforcement by introducing steel beam cells.

Therefore, such cases, their patterns, require descriptions and the creation of a kind of database with recommendations and typical reinforcement solutions for mass implementation.

REFERENCE

1. **David Cormie, Geoff Mays, Peter Smit**h Blast Effects on Buildings. *Third edition ICE Publishing – London -2020*
2. **NATO - ATP-3.12.1.8** Test Procedures and Classification of the Effects of Weapons on Structures. *nsa, 2021.2.*
3. **UFC 4-023-07**: Design to Resist Direct Fire Weapons Effects (Change 1). *U.S. Department of Defense. (2017) Washington, D.C.: Unified Facilities Criteria.*
4. **H. M. Wen** (2002) Predicting the penetration and perforation of targets struck by projectiles at normal incidence*, Mec*hanics of Structures and Machines, (30:4), 543-577 DOI: 10.1081/SME-120015076
5. **Mykhaylovskyi, D. ., Skliarov, I., & Komar, O.** (2025). Comparison of methods for calculating the parameters of an explosion shock wave for the design of protective engineering structures. *Building Constructions. Theory and Practice, (16), 110–122.* [in English] https://doi.org/10.32347/2522-4182.16.2025.110-122
6. **Chyrva, T., Martynov, V., & Koliakova, V.** (2022). The influence of blasting on buildings and constructions. *Building Constructions. Theory and Practice*, (10), 143–149**.** [in English] https://doi.org/10.32347/2522182.10.2022.143-149
7. **Ivanchenko, G., Getun, G., Bezklubenko, I., Solomin, A., & Posternak., O.** (2023) Influence of explosive loads on buildings and structures of the population civil protection. *Strength of Materials and Theory of Structures (111), 108–117.* [in Ukrainian] https://doi.org/10.32347/2410-2547.2023.111.39-48
8. **Getun, G., Bezklubenko, I., Solomin, A., & Balina, O.** (2023). Features of volume-planning decisions of civil defense protective structures. *Current Problems of Architecture and Urban Planning*, (67), 203–220. [in Ukrainian] https://doi.org/10.32347/2077-3455.2023.67.203-220
9. **Vadimov, V., & Pydko, M.** (2024). Problems of civil protection of residential buildings in the cities of Ukraine in the context of sustainable development. *Current Problems of Architecture and Urban Planning*, (69), 140–156 [in Ukrainian]

https://doi.org/10.32347/2077-3455.2024.69.140-156

10. **Getun, G., Koliakova, V., Bezklubenko, I. ., & Solomin, A.** (2023). Constructive solutions for explosion-resistant buildings with civil protection facilities. *Building Constructions. Theory and Practice*, (13), 41–50. [in Ukrainian] https://doi.org/10.32347/2522-4182.13.2023.41-50.
11. **Mykhaylovskyi, D. (2025). E**volution of fortification and protective structures. *Building Constructions. Theory and Practice*, (16), 183–211. [in Ukrainian] https://doi.org/10.32347/2522-4182.16.2025.183-211
12. **Shekhovtsov, V. ., Fesenko, O., Malakhov, V., & Bondarenko, O.** (2024). Renovation with height increasing of residential buildings of the 1960s made of precast concrete. *Building Constructions. Theory and Practice*, (14), 67–78. [in Ukrainian] https://doi.org/10.32347/2522-4182.14.2024.67-7813.
13. **Dobrokhlop, M., & Dobrokhlop, Y.** (2024). Results of the technical investigation of the Logistics Center in Brovary after the rocket and artillery fire in March 2022. *Building Constructions. Theory and Practice*, (15), 66–74. [in Ukrainian] https://doi.org/10.32347/2522-182.15.2024.66-74
14. **Binkevych, K., Volodymyrov, A., & Kolchanov, A.** (2024). Analysis of destructions and strengthening methods of precast reinforced concrete floor panels. *Collection of Scientific Works of the Ukrainian State University of Railway Transport, (208), 67-79* [in Ukrainian] https://doi.org/10.18664/1994-7852.208.2024.308565
15. **Melashenko, Yu., Sliusarenko, Yu., Ishchenko, Yu., & Pavliuk, Ye.**. (2023). Experience in surveying of panel houses damaged from hostilities. *Science and Construction, 36(2), 41-50.* [in Ukrainian] https://doi.org/10.33644/2313-6679-2-2023-5.
16. **Tabarkevych, N., Serhiichuk, V., Belokon, A., & Tabarkevych, O.** (2023). Details of the survey and assessment of the state of residential building damaged due to military actions. Suitability for further operation *Abstract. Science and Construction, 35(1), 27-42* [in Ukrainian] https://doi.org/10.33644/2313-6679-1-2023-4
17. **Lisenyi, O., Hlukhovskyi, V., Marienkov, M., Dubovyk, S., Liubchenko, I., & Yakovenko, M.** (2023). Survey, Assessment of the Technical Condition, and Conditions for the Restoration of a Residential Building at 6-A V. Lobanovskyi Avenue in Kyiv Damaged as a Result of Military Actions. *Science and Construction*, 33(3–4). [in Ukrainian] https://doi.org/10.33644/10.33644/2313-6679-34-2022-6
18. **Donets, T.** (2024). Characteristics of damage to buildings with different structural systems as a result of military actions. *Science and Construction*, *40*(2). [in Ukrainian] https://doi.org/10.33644/2313-6679-2-20246
19. **Nuzhny, V.** (2022). First investigations of damage to buildings and structures as a consequence of combat actions. *Building Constructions. Theory and Practice*, (11), 104–114. [in Ukrainian] https://doi.org/10.32347/2522-4182.11.2022.104-114
20. **Менейлюк, О. І., Менейлюк, І. О., & Русский, В. В.** (2024). Research of the condition of buildings and structures damaged due to military actions. *Building Production*, (75), 17-26. [in Ukrainian] https://doi.org/10.36750/2524-2555.75.17-26.
21. **DSTU 9273:2024.** Guidelines for the Inspection of Buildings and Structures for Determining and Assessing Their Technical Condition. Mechanical Resistance and Stability: *[Entered into force on 2024-02-01]. Kyiv: State Standard of Ukraine, 2024. 47 p. (National Standard of Ukraine).*
22. **DBN V.2.2-5:2023** Protective Structures of Civil Protection: [Effective from 2023-09-01]. *Kyiv: Ministry for Communities and Territories Development of Ukraine, 2023. 140 p. (State Building Codes of Ukraine).*
23. **DBN V.1.1-7:2016** Fire Safety of Construction Sites. General Requirements [Text]: *[Effective from 2017-06-01] / Ministry for Communities and Territories Development of Ukraine. Kyiv: [s.n.], 2016. 60 p. (State Building Codes of Ukraine).*.
24. **Колякова, В.М., Божинський. М.О., & Фесенко О.А.** (2016) Розподіл температури в перерізі залізобетонної плити. *Сучасні технології та методи розрахунків у будівництві. Луцьк: ЛНТУ.(5), 232-239.*
25. **Поклонський, В.Г. Фесенко, О.А. & Тарасюк В.Г.** та ін. (2016). Розрахунок залізобетонних конструкцій на вогнестій-

кість відповідно до Єврокоду 2. Практичний посібник. *К.:Інтертехнологія,* 83 с

LITERATURE

1. **David Cormie, Geoff Mays, Peter Smit**h Blast Effects on Buildings. *Third edition ICE Publishing – London -2020*
2. **NATO - ATP-3.12.1.8** Test Procedures and Classification of the Effects of Weapons on Structures. *nsa, 2021.2.*
3. **UFC 4-023-07**: Design to Resist Direct Fire Weapons Effects (Change 1). *U.S. Department of Defense. (2017) Washington, D.C.: Unified Facilities Criteria.*
4. **H. M. Wen** (2002) Predicting the penetration and perforation of targets struck by projectiles at normal incidence*, Mec*h*anics of Structures and Machines, (30:4), 543-577* DOI: 10.1081/SME-120015076
5. **Mykhaylovskyi, D. ., Skliarov, I., & Komar, O.** (2025). Comparison of methods for calculating the parameters of an explosion shock wave for the design of protective engineering structures. *Building Constructions. Theory and Practice, (16), 110–122.* https://doi.org/10.32347/2522-4182.16.2025.110-122
6. **Chyrva, T., Martynov, V., & Koliakova, V.** (2022). The influence of blasting on buildings and constructions. *Building Constructions. Theory and Practice*, (10), 143–149**.** https://doi.org/10.32347/2522182.10.2022.143-149
7. **Ivanchenko H. M., Hetun H. V., Bezklubenko I. S., Solomin A. V.** (2023). Vplyv vybukhovykh navantazhen na budivli ta sporudy tsyvilnoho zakhystu naselennia *Opir materialiv i teoriia sporud.(111), 108–117.* https://doi.org/10.32347/2410-2547.2023.111.39-48
8. **Hetun H. V., Bezklubenko I. S., Solomin A. V., Balina O. I. (**2023). Osoblyvosti obiemno-planuvalnykh rishen zakhysnykh sporud tsyvilnoho zakhystu *Suchasni problemy arkhitektury ta mistobuduvannia. (67), 216–225* https://doi.org/10.32347/2077-3455.2023.67.203-220
9. **Vadimov, V.M., & M.O. Pydko.** (2024). Problemy tsyvilnoho zakhystu zhytlovoi zabudovy v mistakh Ukrainy v konteksti staloho rozvytku Suchasni problemy arkhitektury ta mistobuduvannia. (69), 140–156. https://doi.org/10.32347/2077-3455.2024.69.140-156
10. . **Hetun, H., Koliakova, V., Bezklubenko, I., & Solomin, A.** (2023). Konstruktyvni rishennia vybukhostiikykh budivel z prymishchenniamy tsyvilnoho zakhystu naselennia. *Budivelni konstruktsii. Teoriia i praktyka, (13), 41–50.* https://doi.org/10.32347/2522-4182.13.2023.41-50
11. **Mykhailovskyi, D.** (2025). Evoliutsiia fortyfikatsiinykh i zakhysnykh sporud. *Budivelni konstruktsii. Teoriia i praktyka, (16), 183–211.* https://doi.org/10.32347/2522-4182.16.2025.183-211
12. **Shekhovtsov , V., Fesenko, O., Malakhov , V., & Bondarenko, O. (**2024). Vidnovlennia iz nadbudovoiu zhytlovykh budynkiv masovykh serii 1960-kh rokiv zi zbirnoho zalizobetonu. *Budivelni konstruktsii. Teoriia i praktyka, (14), 67–78.* https://doi.org/10.32347/2522-4182.14.2024.67-78.
13. **Dobrokhlop , M., & Dobrokhlop , Ye.** (2024). Rezultaty tekhnichnoho obstezhennia lohistychnoho tsentru u m.Brovary, pislia raketno - artyleriiskoho obstrilu u berezni 2022 roku. *Budivelni konstruktsii. Teoriia i praktyka, (15), 66–74* https://doi.org/10.32347/2522-182.15.2024.66-74
14. **Binkevych, K., Volodymyrov, A., & Kolchanov, A.** (2024). Analiz destruktsii i metodiv pidsylennia zbirnykh zalizobetonnykh panelei perekryttiv. *Zbirnyk naukovykh prats Ukrainskoho derzhavnoho universytetu zaliznychnoho transportu, (208), 67-79* https://doi.org/10.18664/1994-852.208.2024.308565
15. **Melashenko Yu., Sliusarenko Yu., IshchenkoIu., & Pavliuk, Ye.** (2023). Dosvid obstezhennia panelnykh budynkiv, poshkodzhenykh vnaslidok boiovykh dii. *Nauka ta budivnytstvo. 36(2),41-50.* https://doi.org/10.33644/2313-6679-2-2023-5.
16. **Tabarkevych, N., Serhiichuk, V., Bielokon A., & Tabarkevych., O..** (2023). Osoblyvosti obstezhennia ta otsinky tekhnichnoho stanu zhyt-lovoho budynku, poshkodzhenoho vnaslidok viiskovykh dii, shchodo yoho prydatnosti do podalshoi ekspluatatsii. *Nauka ta budivnytstvo..(1),. 27-42* **.** https://doi.org/10.33644/2313-6679-1-2023-4
17. **Lisenyi, O.M., Hlukhovskyi , V.P., Marienkov, M.H., Dubovyk, S.O., Liubchenko, I.H., & Yakovenko M.S.** (2022). Obstezhennia, otsinka tekhnichnoho stanu ta umovy

vidnovlennia zhytlovoho budynku na prospekti Lobanovskoho, 6-A v m. Kyievi, poshkodzhenoho vnaslidok voiennykh dii. *Nauka ta budivnytstvo. (3-4), 55-68.* https://doi.org/10.33644/10.33644/2313-6679-34-2022-6

18. **Donets, T.** (2024). Kharakterystyka posh-kodzhen budivel z riznymy konstruktyvnymy systemamy vnaslidok voiennykh dii.. *Nauka ta budivnytstvo, 40(2).* https://doi.org/10.33644/2313-6679-2-2024-6
19. **Nuzhnyi, V.V.** 2022. .Pershi doslidzhennia ushkodzhennia budivel i sporud vnaslidok boiovykh dii *Budivelni konstruktsii. Teoriia i praktyka. (11), 104-114* https://doi.org/10.32347/2522-4182.11.2022.104-114
20. **Meneiliuk, O., Meneiliuk, I., & Russkyi V.** (2023). Doslidzhennia stanu budivel ta sporudposhkodzhenykh vnaslidok voiennykh dii. *Budivelne vyrobnytstvo. (75), 17-26.* https://doi.org/10.36750/2524-2555.75.17-26**.**
21. **DSTU 9273:2024.** Nastanova shchodo obstezhennia budivel i sporud dlia vyznachennia ta otsiniuvannia yikhnoho tekhnichnoho stanu. Mekhanichnyi opir ta stiikist : [Nabuv chynnosti 2024–02–01]. Kyiv : Derzhstandart Ukrainy, 2024. 47 s. (Natsionalnyi standart Ukrainy).
22. **DBN V.2.2-5:2023** Zakhysni sporudy tsyvilnoho zakhystu : [Chynnyi vid 2023-09-01]. Kyiv : Minrehion Ukrainy, 2023. 140 s. (Derzhavni budivelni normy Ukrainy).
23. **DBN V.1.1-7:2016** Pozhezhna bezpeka obiektiv budivnytstva. Zahalni vymohy [Tekst] : [chynnyi vid 2017-06-01] / Minrehion Ukrainy. — Kyiv : [B. v.], 2016. — 60 s. — (Derzhavni budivelni normy Ukrainy).
24. **Koliakova, V.M., Bozhynskyi, M.O., & , O.A. (**2016). Rozpodil temperatury v pererizi zalizobetonnoi plyty. *Suchasni tekhnolohii ta metody rozrakhunkiv u budivnytstvi. Lutsk: LNTU.(5), 232-239.*
25. **Poklonskyi, V.H. Fesenko, O.A. & Tarasiuk V.H.** ta in (2016). Rozrakhunok zalizobeton-nykh konstruktsii na vohnestiikist vidpovidno do Yevrokodu 2. Praktychnyi posibnyk *K.: Intertekhnolohiia,– 83 s*

Received: *November 01, 2025.*
Accepted: *December 05, 2025.*

АНАЛІЗ ДЕЯКИХ ВИПАДКІВ РУЙНУВАНЬ ЖИТЛОВИХ БУДИНКІВ ВНАСЛІДОК БОЙОВИХ ДІЙ

Валерій НУЖНИЙ,
Віра КОЛЯКОВА

Анотація. Дуже актуальною в Україні є проблема руйнувань житлової інфраструктури внаслідок агресії Російської Федерації. Якщо будинки підлягають капітальному ремонту, то вони можуть мати різні ураження, від великих до відносно не значних. Також при обстеженнях часто наявні наслідки тривалих пожеж, котрі не гасилися і конструкції від вогню втратили повністю несучу здатність. Такі ураження можуть носити важкий характер і локалізуватися в межах, чарунок каркасу, квартир, кімнат в нижніх поверхах, що унеможливлює виконання радикальних дій., Наприклад заміна конструкцій могла б вимагати демонтажу розашованих вище поверхів, що не є доцільним.

В даній статті наведені приклади уражень, з якими довелося стикнутися на практиці при розробці проектів капітального ремонту. Вказані аспекти більш глибоких проблем, які не є очевидними на перший погляд. Недостатнє врахування цих факторів призводить до прийняття невідповідних рішень, які потребуюь коригування в процесі робт. Це фактично призводять до збільшення витрат на капітальний ремон, які були попередньо не враховані.

В статі наведені рекомендації щодо прийняття оптимальних а часто і єдино можливих рішень при розробці проектів капітального ремонту будівель.

Ключові слова: ураження; будівельні конструкції; руйнування; вогневі ураження; капітальний ремонт.