

**VOLUME-PLANNING SOLUTIONS OF PRE-SCHOOL EDUCATION INSTITUTIONS  
WITH PLACEMENT OF SHELTERS**

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**Abstract.** The article highlights one of the most pressing problems of today – the protection of children in educational institutions. The author analyzes the main requirements of the current legislative and regulatory documentation on the protection of children in preschool education institutions during military operations; recommendations of the State Emergency Service; the main provisions of the concept of security of educational institutions.

The purpose of this study is to develop proposals for the placement of protected premises in preschool institutions, which will ensure the maximum possible safety, physical and psychological comfort of staying in a protected space in these conditions.

Proposals have been developed to change approaches to the space-planning solutions of preschool buildings with the arrangement of protected rooms in the middle span of the building, which will ensure the maximum possible safety, physical and psychological comfort of staying in a protected space.

The possibility of using the bedrooms of a kindergarten as a shelter is substantiated.

A comparative analysis of regulatory requirements for insulation and energy saving in preschool educational institutions is carried out. It is emphasized that there is a mismatch between the requirements of these requirements and the safety of existing premises of preschool institutions.

Proposals for new building codes for the protection of children in educational institutions, including the area of the premises per child, recommendations for the use of these premises in peacetime, and the composition of furniture and equipment, are analyzed.

If these proposals are adopted, which include the use of bedrooms as permanent premises in the protected part of the building, as well as ensuring the optimal ratio of energy saving and insulation requirements, architects will have to completely revise their approach to the space-planning solutions for kindergartens.

The new space-planning solutions will make preschool buildings more compact, which will provide energy savings, and most importantly, there will be rooms in the middle part of the building that will be enclosed by at least two main walls and, with appropriate structural strength, can be used as shelters.

The results of the research can be used in practice in the construction of shelters in preschools.

**Keywords:** kindergarten, protected premises, space-planning solutions, current building codes, insulation, energy saving.

**Introduction.** Already in the first months of the war, it became clear that educational institutions were one of the priority targets of missile strikes. Russian troops are destroying schools and universities, kindergartens and orphanages. The attacks are carried out with operational and tactical missiles, causing significant damage to buildings. According to the Ministry of Education and Science, as of the beginning of June, 3450 educational institutions were damaged by bombing and shelling, and 331 of them were completely destroyed. This disaster has not spared any region of Ukraine (Fig. 1) [11].

The mass deaths of children in educational institutions were avoided only because kindergartens were not open. After more than a year of war, we realized that life had changed forever and that we would not be safe for decades to come. From time to time, the situation will escalate, the enemy will accumulate forces and use missile attacks to destroy the population of Ukraine again.

Therefore, ensuring proper conditions for education and organizing a safe educational environment is the most pressing issue of our time.



Fig. 1. Destroyed kindergartens in different regions of Ukraine

**Analysis of recent research and publications.** The main provisions for protecting the population of Ukraine from military operations are clearly defined in legislation and regulations. The Civil Protection Code of Ukraine contains a list of facilities intended to protect the population. In accordance with the law, regulatory documents define the requirements for protective structures [3, 5].

In December 2021, the Institute for Public Administration and Research in Civil Protection published the State Emergency Service's guidelines "Organization of Sheltering the Population in the Civil Protection Facilities Fund". These recommendations additionally confirm the main provisions of the existing regulatory documentation [6].

In July 2022, the State Emergency Service of Ukraine published recommendations on the organization of shelter in the facilities of the fund of civil protection structures for personnel and children of educational institutions [8].

On April 7, 2023, the government adopted the Concept of Security of Educational Institutions, which contains a comprehensive strategic vision for creating a safe educational environment. The concept is based on the premise that every Ukrainian child should have access to quality education while staying in the facilities of the protective facilities fund [9].

**The goal and objectives** are to develop proposals for the placement of protected premises within the buildings of preschool institutions.

To achieve this goal, the following tasks were set:

- to analyze regulatory requirements, methodological documentation, recommendations of the State Emergency Service and orders of the Cabinet of Ministers on the safety of educational institutions;

- to consider options for the placement of protective premises in preschool education institutions that will ensure the maximum possible safety, physical and psychological comfort of staying in a protected space.

**Research methodology.** The following methods were used in the study: collection of information, study of regulatory documentation, analysis of the materials obtained and their systematization, comparative analysis of typological developments of space-planning solutions and project documentation for preschool education institutions.

**Research results.** The requirements of current legislative and regulatory documentation [3, 5], recommendations of the State Emergency Service [1, 6, 8], the main provisions of the concept of safety of educational institutions [7], as well as the norms that establish requirements for the design and construction of new and reconstruction of existing buildings of preschool education institutions [2] were analyzed.

Today, the process of creating new modern building codes to protect civilians, including in educational institutions, is underway.

According to the proposals to be included in the new State Building Standards, it is recommended that shelters for educational institutions be designed in the basement of the building or separately located in the underground space.

When no shelter is needed, these premises should be used to meet the needs of the educational institution, namely for creative studios, for club work with children, for parental education, for civil protection training with participants in the educational process and for practicing emergency algorithms, etc.

At the same time, the room should be equipped with bunk beds, children's tables and chairs, toy cabinets, shoe racks, etc. All this equipment has nothing to do with the use of the premises in peacetime.

Therefore, it turns out that a kindergarten should have two sets of this furniture for use in peacetime (the period between the intensification of armed aggression) and separately for shelter, as well as an additional storage room where all this should be stored. During a prolonged alert, employees should have time to remove the room's equipment (tables and chairs for adults, art studio equipment, etc.) and place children's beds and chairs.

It should be emphasized that, according to these recommendations, a kindergarten should have two sets of furniture, including children's beds – in bedrooms and in shelters.

The right decision is to use safe spaces for their main function. A safe space can be not only a separately built protective structure, but also a kindergarten bedroom located in the basement or middle section of the house. In this case, it is only necessary to reinforce the walls and ceilings of the room, which already has some protection "between the two walls" (Fig. 2).

The degree of protection of children in such a room will be not lower, but even higher than in a free-standing shelter due to the reflectivity of the building structures.

If it is impossible to place a shelter in an underground space, in case of a high groundwater level or in a catastrophic flood zone, the proposed solution may be the only way to ensure the protection of children.

An analysis of the regulatory requirements for the main premises of preschools specified in the current building codes showed that the area of bedrooms should be 2.4-2.5 m<sup>2</sup> per child, depending on the category of preschool education institutions [2].

At the same time, when working on the main provisions of the new state building codes, experts determined the minimum area of the main premises for preschool institutions within 3.0 m<sup>2</sup> per person in protective structures for new construction and 2.0 m<sup>2</sup> for reconstruction. As it turned out, these figures coincide with the standard for the area of sleeping rooms.

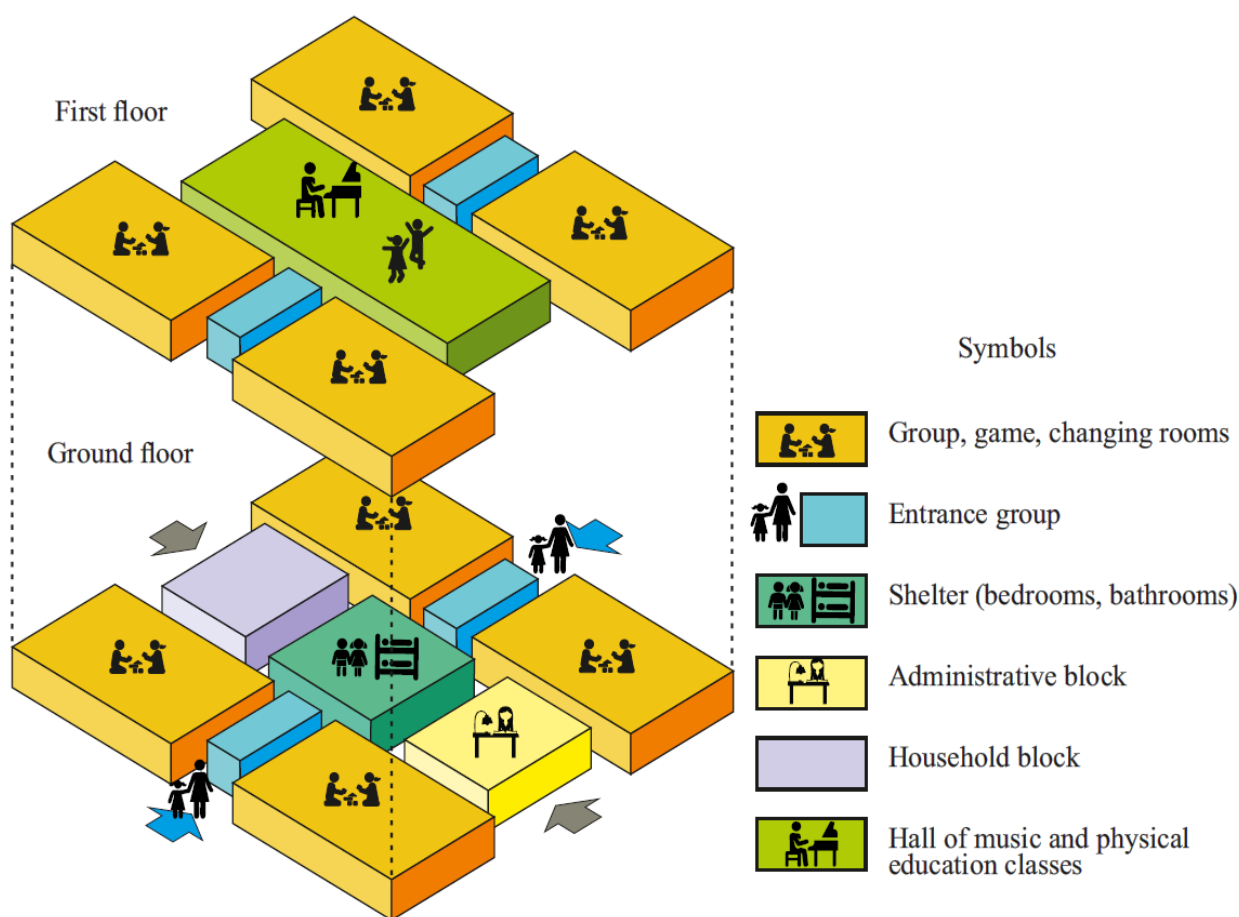


Fig. 2. Schematic diagram of the location of a shelter in preschools

The shelter should be equipped with bunk beds or transforming beds, chairs and tables for 100% of the children. Additionally, it is recommended to provide a play area, a toy closet and a shoe rack.

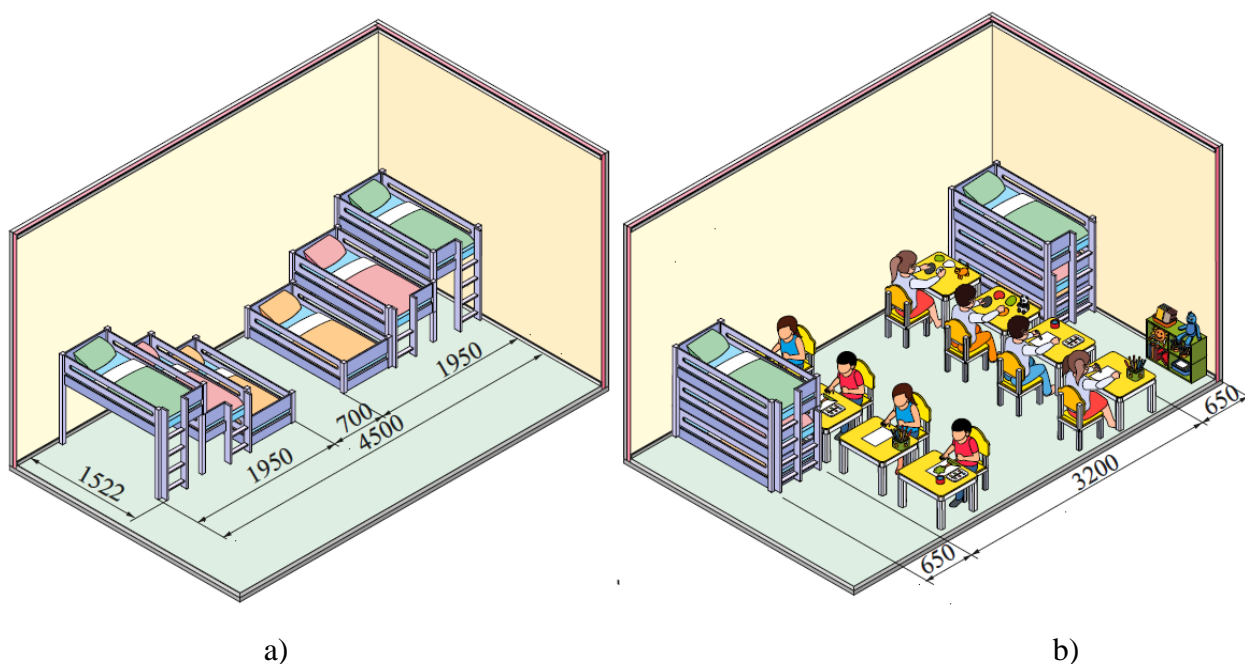
In accordance with the requirements of the Ministry of Education and Science, the main room of the shelter should have a rest area with children's beds, a play area with a carpet with toys, and a study area with tables and chairs.

We developed and analyzed options for the placement of this furniture within the main premises of the shelter when using three-tiered transformer beds.

In accordance with the requirements of the Ministry of Education and Science, the main room of the shelter should be divided into blocks of 60 children with the arrangement of furniture that should be equipped in such a room. A block for 60 children contains 3 groups of 20 children each). The area of the main room per group of children should be 60 m<sup>2</sup> at the rate of 3.0 m<sup>2</sup> per child.

If transforming beds are used, this area is sufficient to accommodate sleeping places and space for games, creativity and learning (Fig. 3).

Thus, children's bedrooms with transforming furniture can be a safe space in preschools. During an air raid, if children are resting at this time, they will not even hear the sounds of explosions, while at other times bedrooms can quickly turn into playrooms (Fig. 3).



a)

b)

Fig. 3. Arrangement of a fragment of the shelter:  
a – during daytime rest; b – during games and studying

Thus, children's bedrooms with "transformer" furniture can be a safe space in preschools. During an air raid, if children are resting at this time, they will not even hear the sounds of explosions, while at other times bedrooms can quickly turn into playrooms (Fig. 3).

If such a solution is adopted, the bedrooms that are also shelters will not have external lighting, but, in our opinion, it is not necessary for bedrooms to have good enough ventilation.

The only obstacle to this solution is the requirements for insolation and natural light. The requirements of the sanitary regulations for preschool educational institutions determine the need for natural light for the main premises of preschool educational institutions, while the list of these premises does not include bedrooms [10].

The current building codes require at least three hours of continuous sun exposure per day for bedrooms [2].

The analysis of the layout of existing preschool buildings has shown that these buildings have a rather large area of external walls, which significantly exceeds the requirements of the calculated building compactness index, which is determined by the ratio of the total area of the internal surfaces of the external envelope of the building envelope to the volume of the building that is heated or cooled. This indicator is important in determining the degree of energy saving of a building [4].

The area of window openings is much larger than necessary to meet the regulatory requirements for lighting and insolation. In terms of safety during missile strikes, the large windows and single-bay buildings of the main premises of the kindergarten make them very vulnerable. Therefore, it is necessary to harmonize the requirements for insolation, energy saving and safety of kindergarten premises.

If these proposals are accepted, regarding the use of bedrooms as permanent premises in the protected part of the building, as well as ensuring the optimal ratio of energy saving and insolation requirements, architects will have to completely revise the approach to the space-planning solutions of kindergartens. New space-planning solutions will make preschool buildings more compact, which, first of all, will provide energy savings, and most importantly, there will be rooms in the middle part of the building that will be enclosed by at least two main walls and, with appropriate structural strength, can be used as shelters.



### Conclusions.

Proposals have been developed to change approaches to the space-planning solutions of preschool educational institutions with the arrangement of protected rooms in the middle span of the building, which will ensure the maximum possible safety, physical and psychological comfort of staying in a protected space under these conditions.

A comparative analysis of the regulatory requirements for insulation and energy saving in preschool educational institutions was conducted.

If these proposals for the use of bedrooms as permanent premises in the protected part of the building are adopted, as well as ensuring the optimal ratio of energy saving and insulation requirements, architects will have to completely revise the approach to the space-planning solutions of kindergartens. The new space-planning solutions will make preschool buildings more compact, which, first of all, will provide energy savings, and most importantly, there will be rooms in the middle part of the building that will be enclosed by at least two main walls and, with appropriate structural strength, can be used as shelters.

### References

- [1] Alhorytm dii mistsevykh orhaniv vykonavchoi vlady Orhaniv mistsevoho samovriaduvannia, orhaniv upravlinnia osvitoiu, kerivnykiv zakladiv osvity shchodo zabezpechennia ukryttia uchasnykiv osvitnoho protsesu u fondi zakhysnykh sporud tsyvilnoho zakhystu. [Online]. Available: <https://dsns.gov.ua/upload/6/2/2/0/9/6/bHq4WGc8HMHX4wGPIKG9gv4DSEgLx4uEU DgqIVGV.pdf> Access date: August 8, 2023.
- [2] DBN V.2.2-4:2018. Zaklady doshkilnoi osvity. Budynky i sporudy. Chynnyi vid 2018–10–01. Kyiv.: Minrehion. 2018.
- [3] DBN V.2.2-5-97 Zakhysni sporudy tsyvilnoi oborony. Budynky i sporudy. Zi Zminamy [Chynnyi vid 2019-01-01]. – Kyiv : Minrehion, 2018.
- [4] DBN V.2.6-31:2021 Teplova izoliatsiia ta enerhoefektyvnist budivel – Chynnyi vid 2022-09-01 – Kyiv Minirehion Ukrainy 2022.
- [5] Kodeks tsyvilnoho zakhystu Ukrainy. Dokument 5403-VI, chynnyi, potochna redaktsiia vid 01.01.2023.
- [6] Orhanizatsiia ukryttia naseleattia u fondi zakhysnykh sporud tsyvilnoho zakhystu. Vprovadzhennia inzhenerno-tekhnichnykh zakhodiv tsyvilnoho zakhystu: seriia praktychnykh poradnykiv / O.Ia. Leshchenko, H.V. Truntsev, V.M. Mykhailov, M.V. Andriienko, V.F. Korobkin, N.M. Romaniuk, L.V. Kalynenko; za zah. red. P.B. Volianskoho, S.A. Partaliana. K. : IDU ND TsZ, 2021. Serii 9. 63 s. [Online]. Available: <https://radnuk.com.ua/pravova-baza/orhanizatsiia-ukryttia-naseleattia-u-fondi-zakhysnykh-sporud-tsyvilnoho-zakhystu/> Access date: August 8, 2023.
- [7] Pro skhvalennia Kontseptsii bezpeky zakladiv osvity. Rozporiadzhennia Kabinetu Ministriv Ukrainy vid 7 kvitnia 2023 r. № 301-r [Online]. Available: <https://www.kmu.gov.ua/npas/pro-skhvalennia-kontseptsii-bezpeky-zakladiv-osvity-i070423-301> Access date: August 8, 2023.
- [8] Rekomendatsii shchodo orhanizatsii ukryttia v obiektakh fondu zakhysnykh sporud tsyvilnoho zakhystu personalu ta ditei (uchniv, studentiv) zakladiv osvity. [Online]. Available: <https://www.zakon.help/files/article/12178/Rekom.shchodo.orhanizatsiyi.ukryttya.15.06.2022.pdf>. Access date: August 8, 2023.
- [9] Rozvyvalne osvitnie seredovyshe v zakladi doshkilnoi osvity: metodychni posibnyk / ukl. L. B. Mishchenko; za red. I. V. Udovychenko. Sumy. Niko: 2021. 52 s.
- [10] SR 234, Sanitarnyi rehlament dlia doshkilnykh navchalnykh zakladiv [Online]. Available: <https://zakon.rada.gov.ua/laws/show/z0563-16#Text> Access date: August 8, 2023.

[11] Zaklady osvity, shcho postrazhdaly vid bombarduvan ta obstriliv [Online]. Available: <https://mon.gov.ua/ua>. Access date: August 8, 2023.

## ОБ'ЄМНО-ПЛАНУВАЛЬНІ РІШЕННЯ ЗАКЛАДІВ ДОШКІЛЬНОЇ ОСВІТИ З РОЗМІЩЕННЯМ УКРИТТІВ

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**Анотація.** У статті висвітлено одну з найактуальніших проблем сьогодення – захист дітей в закладах освіти. Проаналізовано основні вимоги чинної законодавчої та нормативної документації, щодо захисту дітей в закладах дошкільної освіти під час воєнних дій; рекомендації Державної служби з надзвичайних ситуацій; основні положення концепції безпеки закладів освіти.

Метою даного дослідження є розробка пропозицій щодо розміщення захищених приміщень в дитячих дошкільних закладах, які забезпечать максимально можливу в цих умовах безпеку, фізичну та психологічну комфортність перебування в захищеному просторі.

Розроблено пропозиції щодо зміни підходів до об'ємно-планувальних рішень будинків дошкільних закладів освіти з влаштуванням захищених приміщень в середньому прогоні будинку, забезпечить максимально можливу в цих умовах безпеку, фізичну та психологічну комфортність перебування в захищеному просторі.

Обґрунтовано можливість використання під укриття спальних кімнат дитячого садочку.

Проведено порівняльний аналіз нормативних вимог щодо інсоляції та енергоощадження в дошкільних закладах освіти. Наголошено на невідповідності зазначених вимог й безпеки наявних приміщень дитячих дошкільних закладів.

Проаналізовано пропозиції до нових будівельних норм, щодо захисту дітей в закладах освіти, зокрема площу приміщення з розрахунку на одну дитину, рекомендації, щодо використання цих приміщень в мирний час, склад меблів та обладнання.

В разі прийняття зазначених пропозицій, щодо використання спальних кімнат як приміщень постійного призначення в захищеній частині будинку, а також забезпечення оптимального співвідношення вимог енергоощадження й інсоляції, архітекторам доведеться повністю переглянути підхід до об'ємно-планувальних рішень дитячих садочків.

Нові об'ємно-планувальні рішення зроблять будинки дошкільних закладів освіти більш компактними, що забезпечить енергоощадження, а головне, з'являться приміщення в серединній частині будинку, які будуть огорожені щонайменше двома капітальними стінами й, при відповідній міцності конструкцій, зможуть використовуватись як укриття.

Результати досліджень можуть бути використані на практиці при влаштуванні укриття в дитячих дошкільних закладах.

**Ключові слова:** дитячий дошкільний заклад, захищені приміщення, об'ємно-планувальні рішення, чинні будівельні норми, інсоляція, енергоощадження.

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