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Neglected safety: The deterioration of public shelters and emergency preparedness

Zaniedbanie bezpieczeństwa: pogorszenie stanu schronisk publicznych i przygotowania na wypadek sytuacji awaryjnych

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Abstract:

Research objectives and hypothesis/research questions

The objective of the article is to assess the current state of public shelter infrastructure in Poland in the context of evolving security threats, and to analyse the effectiveness of the legal and institutional framework governing civil protection. The study also aims to examine the gap between policy and practical implementation, particularly regarding Temporary Shelter Places (MDS), and its implications for public safety and national resilience. The study is based on the hypothesis that the long-term neglect of shelter infrastructure, combined with insufficient regulatory and organizational coordination, has significantly weakened the effectiveness and resilience of Poland's civil protection system.

Research methods

The article examines literature focusing on the deterioration of public shelter infrastructure and the current state of emergency preparedness in Poland, while also addressing the legal and institutional framework governing civil protection and the implications of recent regulations for architectural and urban planning practice. Attention is given to the contemporary risk landscape and the consequences of inadequate shelter infrastructure in the context of modern threats and real-world conflict scenarios (particularly in relation to the ongoing war in Ukraine) and its implications for regional security and civilian protection systems. The article further explores the gap between policy and practice in the design and implementation of protective infrastructure, especially in relation to funding mechanisms and the need for standardized design approaches for Temporary Shelter Places (MDS).

Main results

The findings of this article demonstrate that, more than three and a half years into the full-scale war in Ukraine, the condition of Poland's protective infrastructure remains inadequate, thereby confirming the hypothesis that long-term neglect, insufficient investment, and fragmented regulatory coordination have significantly weakened the effectiveness and resilience of the national civil protection system. The analysis revealed substantial deficiencies in the availability, technical condition, and organizational preparedness of shelter infrastructure, as well as a persistent gap between legislative initiatives and their practical implementation within architectural and urban planning processes.

Implications for theory and practice

To address both regulatory uncertainty and practical challenges, a modular, the integrated shelter design should be proposed as a scalable solution for residential developments.

Keywords:

public safety, civil protection, shelter infrastructure, temporary shelter places, emergency preparedness

Abstrakt:**Cel badań i hipotezy/pytania badawcze**

Celem artykułu jest ocena aktualnego stanu infrastruktury schronowej w Polsce w kontekście ewoluujących zagrożeń bezpieczeństwa oraz analiza skuteczności ram prawnych i instytucjonalnych regulujących system ochrony ludności. Badanie ma również na celu zidentyfikowanie luki pomiędzy założeniami polityki publicznej a praktyką wdrożeniową, ze szczególnym uwzględnieniem miejsc doraźnego schronienia (MDS), oraz określenie konsekwencji tego zjawiska dla bezpieczeństwa publicznego i odporności państwa. Badanie opiera się na hipotezie, zgodnie z którą wieloletnie zaniedbania w zakresie infrastruktury schronowej, w połączeniu z niewystarczającą koordynacją regulacyjną i organizacyjną, istotnie osłabiły skuteczność oraz odporność polskiego systemu ochrony ludności.

Metody badawcze

W pracy zastosowano metodę krytycznej analizy literatury naukowej, dokumentów strategicznych, aktów prawnych oraz raportów instytucjonalnych odnoszących się do ochrony ludności i infrastruktury schronowej w Polsce. Uzupełnieniem badań była analiza porównawcza wybranych rozwiązań funkcjonujących w Ukrainie oraz studiów przypadków dotyczących funkcjonowania infrastruktury ochronnej w warunkach kryzysowych. Przyjęte podejście badawcze pozwoliło na identyfikację najważniejszych barier systemowych, organizacyjnych i projektowych ograniczających skuteczność ochrony ludności, a także na sformułowanie rekomendacji dotyczących rozwoju nowoczesnej i zintegrowanej infrastruktury schronowej.

Główne wyniki

Wyniki artykułu wskazują, że pomimo upływu ponad trzech i pół roku od rozpoczęcia pełnoskalowej wojny w Ukrainie stan infrastruktury ochronnej w Polsce pozostaje niewystarczający, co potwierdza przyjętą hipotezę badawczą, zgodnie z którą wieloletnie zaniedbania, niedostateczny poziom inwestycji oraz rozproszona koordynacja regulacyjna istotnie osłabiły skuteczność i odporność krajowego systemu ochrony ludności. Przeprowadzona analiza wykazała znaczące braki w zakresie dostępności, stanu technicznego oraz przygotowania organizacyjnego infrastruktury schronowej, a także utrzymującą się lukę pomiędzy inicjatywami legislacyjnymi a ich praktyczną implementacją w procesach architektonicznych i urbanistycznych. Wynika to między innymi z nadmiaru regulacji, standardów technicznych oraz wytycznych, które pozostają trudne do zastosowania w praktyce projektowej.

Implikacje dla teorii i praktyki

W celu ograniczenia zarówno niepewności regulacyjnej, jak i trudności praktycznych należy zaproponować modułowy, zintegrowany projekt schronu jako skalowalne rozwiązanie dla zabudowy mieszkaniowej.

Słowa kluczowe:

bezpieczeństwo publiczne, ochrona ludności, infrastruktura schronowa, miejsca tymczasowego schronienia, gotowość na sytuacje kryzysowe

Introduction

The full-scale invasion of Ukraine by Russia in February 2022 marked a profound turning point in the security perception of Central and Eastern Europe, particularly in Poland (Maślanka, 2025). For decades, Polish society had functioned within a relatively stable geopolitical environment, resulting in a gradual erosion of public awareness and preparedness for large-scale military threats. The outbreak of war abruptly exposed critical gaps in civil defense infrastructure and prompted widespread concern among citizens regarding the availability and adequacy of protective shelters in the event of an armed conflict (Papamichael, Voukkali, Vrionides et al., 2025).

In response to these emerging anxieties, the Supreme Audit Office (Poland) conducted a comprehensive assessment of local government preparedness shortly after the invasion (NIK, 2024). The findings published in March 2024, revealed significant systemic deficiencies: the Supreme Audit Office conducted inspections of 39 protective structures across 20 municipalities, as well as facilities administered by four regional governors. The audit findings indicate that, out of 25 shelters and 19 concealment facilities recorded in municipal inventories, only 3 shelters and 2 concealment facilities were in very good technical condition. The majority of shelters (17) and more than half of the concealment facilities (10) failed to meet the required technical standards. Both types of structures exhibited significant deficiencies, including vandalized interiors, absence of essential installations, blockage by debris, or permanently sealed emergency exits (Górski, 2025). Additionally, there was a widespread lack of air filtration and ventilation systems; where such systems were present, they were often non-functional and had not undergone maintenance or periodic servicing. In many cases, even when filtration units had been installed, they had not been replaced for over a decade (NIK, 2024; Górski, 2025).

This data highlights a significant gap in civil protection infrastructure in Poland. While the absolute number of facilities may seem substantial, their limited capacity relative to the total population suggests that the system is not prepared for large-scale emergencies. The findings also reveal strong regional disparities, with some voivodeships far better equipped than others. Overall, the figures point to a need for modernization, expansion, and more strategic planning in terms of public safety and resilience.

Therefore, this article aims to provide a critical assessment of the state of public shelter infrastructure in Poland in the context of evolving security threats following the Russian invasion of Ukraine. It seeks not only to identify and analyse the scale of existing deficiencies (such as poor technical condition, limited capacity, and significant regional disparities), but also to evaluate the effectiveness of the current legal and institutional framework governing civil protection. A central objective is to examine the growing gap between policy and practice, particularly the reliance on Temporary Shelter Places (MDS).

Building on this diagnosis, the article aims to highlight the broader consequences of long-term neglect, including increased risks to civilian safety, weakened social resilience, and diminished trust in public institutions. It examines the deterioration of public shelter infrastructure and the current state of emergency preparedness in Poland, while also addressing the legal and institutional framework governing civil protection and the implications of recent regulations for architectural and urban planning practice. Attention is given to the contemporary risk landscape and the consequences of inadequate shelter infrastructure in the context of modern threats and real-world conflict scenarios. The article further explores the gap between policy and practice in the design and implementation of protective infrastructure, especially in relation to funding mechanisms and the need for standardized design approaches for Temporary Shelter Places (MDS). The study is based on the hypothesis that the long-term neglect of shelter infrastructure combined with insufficient regulatory and organizational coordination, has significantly weakened the effectiveness and resilience of Poland's civil protection system. The study concludes by identifying key findings and presenting recommendations aimed at improving the effectiveness, reliability, and resilience of civil protection systems.

1. The integration of civil defence requirements into architectural and urban planning practice

In response to the evolving geopolitical context in Europe the regulatory landscape concerning civil protection infrastructure in Poland has undergone significant transformation. The adoption of the Act of 5 December 2024 on the Protection of Population and Civil Defence (Act, 2024), followed by the draft amendment of 23 October 2025 (Draft Act, 2025), and further clarified through the Instruction on the Application of Provisions Regarding Temporary Shelter Places (pl. *Miejsca Doraźnego Schronienia*, MDS) of 9 January 2026 (Instruction, 2026), collectively establish a new legal and operational framework for integrating protective spaces within the built environment. According to these three documents, as of 1 January 2026, all newly designed multi-family residential developments in Poland are required to ensure the possibility of organizing temporary shelter spaces in emergency situations. This obligation reflects a shift from optional or fragmented civil defence provisions toward a systematic, mandatory incorporation of protective functions in construction practices. Importantly, the responsibility is not limited to new developments. Public authorities responsible for civil protection are now also mandated to identify existing and planned buildings that may serve as shelters, hideouts, or temporary shelter spaces, where:

- Shelter – a building structure or part of a building with a closed and hermetically sealed construction, equipped with filtration-ventilation systems or regenerative absorbers (Act, 2024, article 74);

- Hideout – a building structure or part of a building with a non-hermetic (non-sealed) construction (Cuny, 1994);
- Temporary shelter places (pl. *miejsca doraźnego schronienia*, MDS) – building structures adapted for the temporary protection of people (Anjomshoa, Heravi, 2025).

The scope of the regulation primarily concerns buildings or structures with underground components. The legislation explicitly identifies several categories of investments subject to the new requirements. These include:

- Public utility buildings, such as schools, administrative offices, office buildings, and commercial centres. In accordance with Articles 93 and 94 of the Act on the Protection of Population and Civil Defence, such buildings must either incorporate dedicated protective structures (shelters or hideouts) or, if these are not included, be designed and constructed in a manner that allows for the organization of temporary shelter spaces;
- Multi-family residential buildings, which under Article 94 of the Act on the Protection of Population and Civil Defence are required to be designed and constructed to enable the establishment of temporary shelter spaces. This introduces a baseline obligation across the housing sector, significantly expanding the potential network of protective infrastructure;
- Underground garages, although the current legal wording does not clearly distinguish whether this applies exclusively to standalone structures or also to garages integrated within larger buildings. Indirect interpretation, based on §102 of the Regulation of the Minister of Infrastructure of 12 April 2002 on technical conditions for buildings and their location (Regulation, 2002), suggests that both interpretations may be valid. This ambiguity introduces a degree of uncertainty in implementation and design practice;
- Underground transport infrastructure, including metro systems, tram tunnels, and railway infrastructure. According to Article 95 of the Act on the Protection of Population and Civil Defence, these structures are subject to stricter requirements, including the obligation to implement shelters or hideouts rather than merely enabling temporary shelter arrangements.

Despite the broad scope of the regulation, certain exemptions apply. According to the Instruction on the Application of Provisions Regarding Temporary Shelter Places of 9 January 2026 (Instruction, 2026) the two most significant exceptions are as follows:

- the requirement to provide temporary shelter spaces does not apply if a fully compliant protective structure (i.e., a shelter or hideout) is already included in the investment;
- the obligation is waived if the designed capacity of the temporary shelter space would be below 15 persons.

In parallel to the regulations concerning civil protection in buildings, additional legal frameworks address the protection of infrastructure considered strategically important for state security and defence – the Regulation of the Council of Ministers of 21 April 2022 on facilities of particular importance for state security and defence and their special protection (Regulation, 2022). It establishes another formal classification system, but for strategic infrastructure; including military facilities, energy infrastructure, transport corridors, communication systems, airports, ports, hydrotechnical structures, and facilities connected with the storage of hazardous or radioactive materials. It also introduces mandatory procedures for recognising such facilities, preparing dedicated protection plans, coordinating security responsibilities between state authorities, and ensuring the continuity of protection measures through the involvement of the armed forces, police, and other public security institutions.

Another significant regulation is The Regulation of the Polish Minister of the Interior and Administration of 4 November 2025 (Regulation, 2025), which establishes comprehensive technical requirements for protective structures, including shelters and concealment facilities intended for civil protection and emergency situations. It defines several categories of protective buildings – from basic concealment spaces (U-1 to U-3) to high-resistance shelters (S-1 to S-3) – each designed to withstand different levels of blast pressure, structural collapse, radiation, fire, and chemical or biological contamination. The legislation sets standards for the location, construction, waterproofing, structural resistance, ventilation, and minimum occupancy conditions of these facilities, including requirements for autonomous operation during emergencies. It also introduces rules governing maximum travel distances to shelters, ensuring accessibility for the population in urban and rural areas. In addition, the regulation references Polish technical standards and engineering principles that must be followed during the design, construction, reconstruction, and operation of civil protection infrastructure.

Overall, the Polish legal framework concerning shelters and protective infrastructure is dispersed across numerous regulations and executive acts. It reflects an early but decisive stage of integrating civil defence considerations into architectural and urban planning processes. As a result, both designers and administrative bodies face the challenge of translating general legal provisions into consistent and effective design solutions (Ninan, Lim, De Boer et al., 2024).

While the current legislative framework in Poland introduces a differentiated system of collective protection facilities, distinguishing between shelters, hideouts, and temporary shelter places, this categorization raises critical questions regarding the expected performance and safety levels of each typology (Anjomshoa, Heravi, 2025). In particular, the designation of MDS as spaces “adapted for the temporary protection of people” may lead, in practice, to the adoption of minimal compliance strategies rather than robust protective solutions. This tendency is reinforced by the fact that the design and construction of fully compliant shelters require adherence

to a highly complex set of technical and requirements (Regulation of the Minister of the Interior and Administration of 4 November 2025), which may incentivize investors and developers to favour the comparatively less demanding MDS solutions as a more accessible and cost-efficient alternative. Thus, it is reasonable to argue that temporary shelter places should be designed and constructed to standards approaching those of fully defined shelters, wherever technically and economically feasible (Xiong, Wu, Yang et al., 2025). Although the Act allows for a lower level of technical specification for MDS compared to hermetically sealed shelters, such differentiation may not adequately reflect the spectrum of contemporary threats, including blast effects, toxic industrial releases, and radiological hazards.

International literature and existing civil defence guidelines consistently emphasize that the effectiveness of protective infrastructure depends not only on availability but also on performance reliability under extreme conditions (Marchezini, Saito, Londe et al., 2025). For instance, studies on civil protection systems highlight that non-hermetic structures provide significantly reduced protection against airborne contaminants and pressure waves compared to sealed shelters equipped with filtration systems (Alexander, 2002; Perry, Lindell, 2003). Similarly, guidance from organizations such as Federal Emergency Management Agency (FEMA, 2021) and the International Committee of the Red Cross (ICRC, 2015) underscores the importance of ensuring adequate ventilation control, structural resistance, and safe occupancy conditions in emergency sheltering environments.

Moreover, research in the field of disaster resilience and protective design suggests that under-designing shelter infrastructure may create a false sense of security, potentially increasing vulnerability during high-impact events (Vale, Campanella, 2005). In urban environments, where evacuation may not be feasible within required timeframes, the quality and robustness of in-situ protection become critical determinants of survival outcomes (Galkin, Samchuk, Lyfenko et al., 2025).

From an architectural and engineering perspective, the incremental cost of upgrading MDS to higher performance standards – such as improved structural reinforcement, basic air filtration provisions, and controlled access points – may be justified when evaluated against the potential human and economic losses associated with inadequate protection (Maliński, Kwiatkowski, 2011). This is particularly relevant in the context of multi-family residential buildings, where population density amplifies risk exposure.

In addition, aligning MDS design more closely with shelter standards would contribute to greater consistency and clarity in the design process, reducing interpretative ambiguity currently observed in the implementation of the regulations. It would also facilitate future adaptability, allowing such spaces to be upgraded to fully compliant shelters if required by evolving regulations or threat scenarios (Galkin, Samchuk, Lyfenko et al., 2025).

In conclusion, while the introduction of MDS represents an important step toward expanding the network of protective infrastructure in Poland, its current definition as merely “temporary” solutions should not justify reduced performance expectations. As a result, it is essential to critically examine the current condition and effectiveness of existing public shelters, as they provide a practical benchmark against which the concept of Temporary Shelter Places (MDS) can be assessed.

2. Contemporary threat landscape and risks associated with the deterioration of civil protection infrastructure

According to the information published in March by Supreme Audit Office (NIK, 2024), the Lublin Voivodeship contains only 21 shelters and 247 concealment sites, with a total capacity sufficient for approximately 5% of its population. More critically, findings from ongoing inspections indicate that none of the existing shelters are capable of providing full protection in the event of a military attack. The inventory of these facilities reveals extensive deficiencies resulting from years of neglect in civil protection infrastructure. According to Krzysztof Wiejak (2025), although shelters should function as hermetically sealed structures equipped with independent power sources, air filtration systems, emergency water supplies, and secure evacuation routes, in practice, however, many of these requirements are not met. For instance, water reserves stored in tanks would require chemical treatment to ensure safety, while available protective equipment, such as gas masks, often dates back to the 1980s and is no longer considered reliable despite being technically sealed. Further inspections of individual facilities highlight the extent of degradation. In one case, a shelter lacks a functioning backup power supply, its airlock does not ensure airtight conditions, and sanitary facilities resemble outdated infrastructure from several decades ago. Equipment is frequently damaged, improperly stored, or obsolete, and interiors are cluttered with deteriorating materials. As a result, many of these spaces resemble relics of the Cold War era rather than functional environments capable of ensuring the safety of hundreds of civilians. This example underscores how inadequate infrastructure not only increases physical risk but also reinforces public perceptions of vulnerability and institutional unpreparedness, particularly in regions most exposed to potential external threats.

In light of these factors, the risks associated with the deterioration of public shelters extend far beyond infrastructure alone. They encompass a complex interplay of safety, governance, social cohesion, and strategic preparedness, underscoring the urgent need for comprehensive and coordinated action.

These risks are not merely theoretical, as demonstrated by the ongoing war in Ukraine. One of the defining characteristics of the conflict has been the exceptionally high number of civilian casualties, particularly during its initial phase (Luczaj,

Leonowicz-Bukała, Krasko, 2024). This outcome has been closely linked to the limited availability of adequate protective infrastructure. A shortage of properly equipped shelters – such as reinforced bunkers, anti-radiation facilities, and dual-use protective structures – combined with their poor technical condition and restricted accessibility, has significantly reduced the level of civilian protection (Maślanka, 2025). As a result, authorities have often been forced to recommend the use of improvised spaces, including residential basements, which do not provide sufficient safety. These factors collectively illustrate how deficiencies in shelter infrastructure can directly translate into increased vulnerability and a higher incidence of civilian harm, underscoring the potential consequences for countries that remain inadequately prepared (Zhydkova, Hleba, Gnatiuk et al., 2023).

In turn, those civilians who managed to find shelter have been required to endure prolonged periods of sheltering during missile strikes, often spending many hours or even days in improvised protective spaces such as apartment bathrooms, underground parking facilities, and metro stations (Galkin, Samchuk, Lyfenko et al., 2025). These conditions were particularly severe during the winter months, when sub-zero temperatures coincided with widespread power outages, rendering heating systems inoperative.

Daily life has been further disrupted by both planned and unplanned electricity shortages. In some cases, access to power has been limited to only two short intervals per day, each lasting approximately two hours. Such restrictions have frequently resulted in the loss of essential services, including water supply, heating, lighting, and general electrical functionality. Despite these constraints, individuals have continued to carry out routine domestic activities – such as cooking, cleaning, and maintaining their households – while simultaneously fulfilling professional responsibilities (Ross, 2023). The provision of equipment such as uninterruptible power supplies (UPS), battery packs, generators, and rechargeable lighting has mitigated some of the difficulties associated with power disruptions. Nevertheless, for those residing in Kyiv and the surrounding areas, everyday life has remained exceptionally challenging (Luczaj, Leonowicz-Bukała, Krasko, 2024).

In the Polish context, these examples underscore the potential scenario that could emerge in the absence of adequate investment in shelter infrastructure and emergency preparedness systems; the deterioration of public shelters and the limited state of emergency preparedness in Poland generate a wide range of risks, affecting not only physical safety but also social stability and national resilience. These risks become particularly acute in the context of contemporary threats, including armed conflict, hybrid warfare, and climate-related disasters (Siniecki, 2023).

One of the most immediate risks is the direct threat to civilian life and health. In the event of military escalation, air raids, or missile strikes, the lack of accessible and functional shelters significantly reduces the population's ability to seek timely protection. Given that only a small proportion of existing facilities meet technical

standards, many citizens may be left without safe refuge, increasing potential casualties and overwhelming emergency response systems. In crisis situations, the absence of properly maintained shelters can also lead to chaotic and uncoordinated evacuations, further exacerbating risks and reducing the effectiveness of response measures (Cuny, 1994).

The current situation also contributes to social and psychological consequences. Public awareness of insufficient protection infrastructure can heighten anxiety, fear, and a sense of insecurity among citizens. This is particularly relevant in regions geographically closer to potential conflict zones, where perceived risk is higher. Over time, such conditions may erode public trust in state institutions and their capacity to ensure safety (Vranceanu, Tuclea, Schiopu, 2025; Williams, Fathallah, 2024).

Finally, the long-term neglect of civil defense infrastructure may have broader implications for national resilience and strategic deterrence. A population that is poorly protected and insufficiently prepared is more vulnerable not only physically but also psychologically, which may influence the overall stability of the state in times of crisis (Rogowska, Павлова, 2023).

Overall, these circumstances illustrate the profound impact of infrastructural instability on civilian life, while also highlighting the resilience, adaptability, and sustained productivity of individuals operating under prolonged crisis conditions.

3. Bridging the gap between policy and practice in protective infrastructure design

Pursuant to Article 106(1) of the Shelter Act, the competent civil protection authorities provide earmarked grants to the owner or the manager of a building designated to serve as a protective structure or a temporary shelter place, in connection with the necessity to ensure its protective function. These grants may be allocated for the construction, reconstruction, and preparation for use of protective structures, as well as for the organization of temporary shelter places. The introduction of such public funding constitutes a significant instrument influencing the design and implementation of collective protection facilities (Ramazani, Yari, Heydari et al., 2022). While the availability of such financial support creates clear opportunities to enhance the quality of shelters, it also introduces a set of structural challenges that may affect design outcomes.

One of the primary advantages of the funding mechanism is its potential to raise technical and performance standards. By allowing grants to cover up to 100% of the additional costs associated with the provision of protective functions, the legislation reduces the economic barriers that have historically limited the integration of high-quality shelter solutions. This creates favourable conditions for the incorporation of enhanced structural resistance, improved ventilation and filtration systems,

and more robust spatial configurations capable of ensuring safe occupancy during emergencies (Bagatska, 2024). In this sense, financial support can act as a catalyst for aligning architectural practice with higher standards of resilience and safety.

However, the discretionary nature of the funding mechanism introduces a degree of uncertainty that may negatively influence design strategies. Since the allocation of grants is not guaranteed, investors and designers may adopt a conservative approach, focusing on minimum compliance with statutory requirements rather than pursuing higher-performance solutions. This may result in a preference for temporary shelter places (MDS) over fully equipped shelters, as well as the adaptation of existing spaces instead of the construction of purpose-designed protective structures (Baddeley, 2011).

Furthermore, as shown in the study by Supreme Audit Office (NIK, 2024), the selective allocation of financial support may lead to uneven quality across projects and regions. Buildings that receive full funding may achieve a significantly higher level of protection compared to those that rely solely on private investment. This creates the risk of spatial disparities in safety and resilience, potentially undermining the objective of ensuring equitable protection for the population.

In the long term, the effectiveness of this funding mechanism will depend on its integration within a coherent regulatory and technical framework (Marchezini, Saito, Londe et al., 2025). If properly implemented, it has the potential to support the development of a comprehensive and high-quality network of protective infrastructure. Conversely, if applied inconsistently or without clear performance benchmarks, it may contribute to a fragmented system characterized by varying standards and limited functional reliability (Hylton, 2022).

4. From regulation to design: Establishing standards for temporary shelter places

The financial mechanisms introduced under the Act of 5 December 2024 on Civil Protection and Civil Defence (Act, 2024) create important opportunities to improve protective infrastructure. However, their effectiveness depends on clear design expectations and practical implementation guidance (Williams, Fathallah, 2024). While the current regulatory framework establishes obligations and funding instruments, it does not sufficiently translate them into concrete architectural and engineering standards, particularly for Temporary Shelter Places (MDS) (Zetter, 2012).

Poland, therefore, needs a model architectural example of a high-quality MDS. Such a reference design – based on clear technical, spatial, and functional principles – would serve as both a compliance benchmark and a practical tool for designers, investors, and public authorities. It would demonstrate how MDS can achieve a level of safety comparable to shelters while remaining economically and technically feasible.

A standardized model would reduce ambiguity and support consistent decision-making across the construction sector. It would also ensure that financial support leads to real improvements in design quality, rather than minimum-compliance solutions (Gattupalli, 2024). By clearly defining key parameters – such as structure, ventilation, accessibility, spatial layout, and adaptability – stakeholders could allocate resources more effectively and deliver meaningful protective outcomes (ISO, 2019). Standardized design references would also help harmonize protective infrastructure across regions, reducing disparities and supporting a more coherent system of civil protection. Over time, this would ensure that even basic protective spaces provide a reliable and adequate level of safety (Lee, Noh, Choi et al., 2017).

Ultimately, strengthening Poland's civil protection framework requires bridging the gap between regulation and design practice (Siniecki, 2023). Establishing a widely recognized architectural standard for MDS would ensure that this form of protection is not only financially supported, but also technically sound and consistently implemented, enhancing the resilience of the built environment.

Conclusions

The findings of this article showcase that more than three and a half years into the full-scale war in Ukraine, the condition of Poland's protective infrastructure can be succinctly described as inadequate.

The contemporary public discourse has largely focused on so-called Temporary Shelter Facilities, which are often misconstrued as readily available protective solutions. In practice, however, these spaces – typically underground parking structures or storage facilities – require substantial time and logistical preparation before they can be repurposed for emergency use (Anjomshoa, Heravi, 2025). This includes clearing the premises, ensuring structural reinforcement, establishing secure access points, and equipping the sites with essential protective and life-support systems (Zhydkova, Hleba, Gnatiuk et al., 2023). Consequently, their utility in the context of sudden, high-intensity threats is highly limited. Reliance on such provisional measures without the parallel development of permanent, fully operational shelters significantly undermines the resilience of national safety systems. Even when adequately prepared, MDS facilities offer only partial protection and are generally incapable of safeguarding occupants against blast waves, fire hazards, or chemical contamination (David, Salles, 2025). As a result, they should either be regarded as supplementary components rather than primary elements of civil defence strategies, or their assumed adequacy should be evaluated in light of the actual performance, availability, and technical state of the existing shelter infrastructure.

According to Article 92 of Act of 5 December 2024 on the Protection of the Population and Civil Defence (Act, 2024), collective protection facilities must meet the requirements defined in technical and construction regulations under the Polish Building Law, including specific technical conditions related to construction, use, and site placement. These facilities are required to comply with the provisions of the Regulation of the Minister of the Interior and Administration of 4 November 2025 on Technical Requirements for Protective Structures and the Technical Requirements for Their Use and Location, ensuring adequate structural strength, fire safety, ventilation, evacuation routes, access to utilities, sewage disposal, and other systems necessary for the survival of occupants. Public debate highlights potential negative consequences of the legislation, such as increased costs and extended timelines for development projects (Moreu-Żak, Kuszewska, 2025; Langowski, 2025). At the same time, it is argued that mandatory shelter construction may stimulate innovation in the construction sector, leading to new technologies and materials, with safety benefits outweighing the costs.

To address both complicated regulatory landscape and practical challenges, the integrated shelter design should be proposed as a scalable solution for residential developments. In accordance with design guidelines by various experts (Panas, 2012; Gausa, 2003; Littlefield, 2012) the concept could follow principles such as:

- **Structural System and Safety:** The shelter is to be designed as a reinforced concrete module integrated into the underground level (e.g., parking garage). It uses high-performance concrete and prefabricated elements to ensure durability, blast resistance, and reduced construction time. Fire-resistant materials and compartmentalization enhance fire safety performance;
- **Ventilation and Environmental Control:** A hybrid ventilation system combines mechanical ventilation with passive air filtration units. The system is equipped with HEPA and activated carbon filters, ensuring protection against smoke, toxic substances, and biological threats. Backup manual ventilation ensures operability during power outages;
- **Evacuation and Accessibility:** The shelter includes at least two independent evacuation routes, clearly marked and compliant with fire safety regulations. Universal accessibility is ensured through barrier-free design, enabling use by people with disabilities;
- **Utilities and Infrastructure,** so the design incorporates independent emergency systems:
 - water storage (minimum 3 days supply),
 - autonomous power supply (battery storage supported by photovoltaic panels where feasible),
 - basic sanitary facilities connected to a protected sewage system or temporary storage tanks;

- **Functional Flexibility:** To mitigate cost concerns, the shelter is designed as a dual-use space. Under normal conditions, it can function as storage, a fitness area, or a technical space. This approach improves economic feasibility and aligns with developer expectations;
- **Modular and Scalable System:** The shelter is based on a modular grid that allows adaptation to different building sizes and typologies. Prefabrication reduces construction time and increases quality control, directly addressing concerns about delays in project delivery.

Although the above points generally reflect the principles of shelter design, the concept requires further development into a comprehensive and cohesive design proposal that combines regulatory compliance with architectural efficiency. The solution should be articulated as an integrated architectural and engineering scheme, in which structural, environmental, infrastructural, and functional components are systematically coordinated. This entails the inclusion of detailed technical specifications, spatial organization, and performance criteria, ensuring that the proposal is not only conceptually robust but also feasible, compliant with regulatory frameworks, and applicable within real-world construction processes. Such a project has the potential to respond directly to the challenges identified in public discourse (Tarí, Molina-Azorín, Heras, 2012):

- **Cost Optimization:** Integration with existing underground structures and modular prefabrication reduces additional costs;
- **Time Efficiency:** Standardized components accelerate construction;
- **Regulatory Flexibility:** The system is adaptable to future detailed regulations once issued;
- **Innovation Stimulus:** Encourages the use of advanced materials, smart systems, and sustainable technologies;
- **Enhanced Safety:** Provides real, functional protection aligned with the intent of Article 92.

In light of the conclusions formulated in this study, the continuation of research on civil protection infrastructure is recommended, with particular emphasis on the technical performance, accessibility, and reliability of public shelters, as well as their role in strengthening societal resilience and public safety. Special attention should be given to the development of advanced, integrated design solutions for protective infrastructure, especially modular and dual-use shelter systems, which may significantly enhance the effectiveness, adaptability, and economic feasibility of civil protection measures. Such an approach reflects the growing importance of resilience-oriented design and demonstrates increasing maturity in the management of safety and security within the built environment (Langowski, 2025).

The implementation of modular shelter systems could enable the standardisation of key components, reduce design uncertainty, and minimise additional construction costs, while still allowing adaptation to the specific structural, technical, and

functional requirements of individual projects. This approach may also support developers in complying with future legal requirements without substantially affecting the economic viability or usability of residential developments (Marchezini, Saito, Londe et al., 2025). Furthermore, future studies should examine the effectiveness of existing legal and institutional frameworks and evaluate the practical implementation of regulatory requirements across different regions and building typologies.

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