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Ad hoc conclealments for civil protection and civil defence tasks

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Abstract

The possibilities to use the hasty cover for civil protective and civil defense tasks are proposed in this paper. The hasty covers are elements no-expensive and fast in execution, which are complementary to the protective infrastructure useful for crisis situations. The structure of the problem and research methods are characterized.

Keywords: civil protection, ad hoc solutions, civil defense tasks

1 Introduction

The article proposes the possibility of using ad hoc hides for civil protection and civil defense tasks. Ad hoc concealments are a cheap and quick element complementing the stationary protection infrastructure useful in crisis situations. The structure of the problem was characterized and research methods were indicated.

2 Admission

Shelters are used to support civil protection and civil protection projects in European countries [6, 11, 13]. In most countries, appropriate legal, financing and technical rules have been developed for the construction and maintenance of stationary type shelters. Under normal conditions, i.e. the absence of crisis risks [15], the shelters that are necessary for the formation of a specific protective structure in the area of objects selected for the group of critical infrastructure and direct civil protection are usually ehased. However, practically no european country, with the exception of Switzerland, is fully completed in advance of the necessary shelters, in particular for the direct protection of people. The missing part of the discussed objects is planned to be made, among others, with the help of shelters and hides built temporarily. For Polish in existing shelters and so-called stationary type hiding places, only about 4.4% of the population can be accommodated. The listed Polish stationary type hiding places are in fact shelters with the lowest immune standard, specified in the requirements [8].

The presented paper characterizes the essence, types and tasks of hiding the ad hoc type. Selected possibilities and principles of solving concealments for civil protection and civil defense tasks were presented.

3 General characteristics of shelters and hide

Systems and fortification facilities were constantly adapting to the challenges generated by the solutions of means of destruction, methods of struggle and threats to the living environment and human activity [12, 13]. Particular changes and needs appeared already in the initial phase of using aviation as a combat tool. Aviation was used not only in the operational tasks of the army but also to destroy targets in the depths of the territory of the attacked country. During the conflicts, mainly administrative centers, industrial centers, material stocks and residents of the country were attacked.

This threat has become even more important in the phase of the emergence of missile weapons and mass destruction. The list of contemporary threatsis also filled by conventional means of destruction of the new generation, industrial, warehouse, transport failures, terrorist attacks as well as natural hazards [14, 16]. In connectionwith the above, shelters

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and hiding places have become a necessity both in the fieldand on the territory of the country. Modernfortification systems consist of individual shelters and hiding places scattered throughout the territory of the country in accordance with specific protectiveand protective tasks. According to the professional fortification definition [9, 13], a shelter is a structurally closed structure, protecting people or specific property from assumed blatant factors from all possible sides. A hiding place is a structurally open structure, protecting people or certain property from assumed blatant factors only from specific sides.

In the situation of impossibility of making even an emergency shelter, some solutions of shieldinge may constitute hiding. Concealments have limited general resistance, because they do not protect the interior to the same extent against the factors of destruction from any direction [10]. Hide tasks include:

- protection of the population before emergency shelters or other protective measures are made,
- protection of contractors in theact of building ad hoc shelters or performing other operational tasks,
- a cover for technical equipment or tools.

Stationary and ad hoc hiding places can be distinguished. Examples of stationary hides are such objects as road tunnels, pedestrian crossings, typical basements of buildings and other structures, which in the considered situation can be treated as two-function. Ad hoc solutions can be obtained as follows:

- from handheld elements and materials,
- supported by prefabricated elements lub assembled from such elements, preferably with a relatively small weight.

It is advisable to prepare emergency covers on the "weaker" directions ofthe blood and convenient accesses. Solutions made of variousconstruction materials such as steel sheets, glued wood, composites, reinforced concrete and others stumble. In the case of prefabricated solutions, the aim is to achieve the highest possible resistance with the lowest possible weight. In the discussed solutions, the rule is to maximize the use of the natural protective properties of the soil, which is of significant economic importance.

It can be noted that ad hoc expansion requires a specific space. It is important to choose the location of the discussed ad hoc objects. Ideally, these places should be free from particularly high concentrationspredicted from agronutritions. It is worth emphasizing that in cities the development of the discussed places with new residential and public buildings is still progressing. This results in a constant change in location conditions, which are important due to the degree of resistance of a given hiding.

Assumptions determining the concealment resistance and full characteristics of the protective concept should be included in the appropriate classification formula. More information on the objects in question can be found in the publications [1, 2, 4, 9, 12, 13].

4 Examples of ad hoc hide solutions

Below we will present examples of ad hoc solutions that can be taken into account in the planning of civil protection and civil protection tasks.

The Military Institute of Engineering Technology, together with alter, developed a light type folding shelter for military tasks of field fortification expansion of the area [3]. Elements of the shelter structure are made of polyester-glass laminate with increased strength. With the same elements, you can also construct objects referring to the idea of hiding. The concealment is assembled manually by means of connectors permanently attachedto the joined elements. The size of the folding elements makes it possible to transport them without disturbing the road gauge. The assembly time of the supporting structure of the concealment with a length of 5m. forceand four people is about 1 hour. A general view of the structure of this hiding place is shown in Figure 1.

The width of the concealment in the floor plane is 1.80m. The basic composite segment has a length of 1 meter. It is possible to combine segments into modules of any length.

The shielding structure shown in Figure 1 is already a solution to concealment. Usefulness for the assumedcivil defense tasks as well as assumptions of the individual type, we will obtain as a result of appropriate modification. For example, by using local soil, additional protective elements or materials and handy elements. It follows from the above that concealments can be successively strengthened as far as possible.

Figure 1. Supporting structure of the concealment – general view [5]

A diagram of another solutionis shown in Figure 2. The possibility of simultaneous use of new technologies with typical handheld materials is taken into account. The height of the H_o shower is selected according to the parameters of the assumed glaring factors.

According to the size of the space for buildings, ad hoc hiding places can be located as free-standing single objects or in groups of several or even several objects. In the case of the objects in question, it is natural to be able to vary the capacity of the hides, and thus their length. In a special case, as a result of establishing an area free from assumed hazards, for example from rubble, single-line or irregular spatial sequences can be obtained to hide. An example of the location of the shelters under consideration in the area is illustrated in Figure 3.

Hides, as already mentioned, have a structurally open housing. Therefore, it should be borne in mind that as a result we will obtain conditions of limited protection and therefore increased risk. This situation requires special attention when the task concerns the direct protection of people. It can be seen that concealments can support the task of centering people at a set time with specific threats. In special cases of environmental contamination, the duration of human hiding should be kept to a minimum. On the other hand, it is possible to indicate situations in which the time in question will not be subject to specific restrictions.

Each time reserve should be used to reinforce the initial version of the concealment, starting with its "closing", as well as to collect additional materials and reinforcing elements and, if possible, equipment. It is advisable to think about the principles of such work in the period preceding the time of danger. The need for adequatedocumentary and organisational support is also evident.

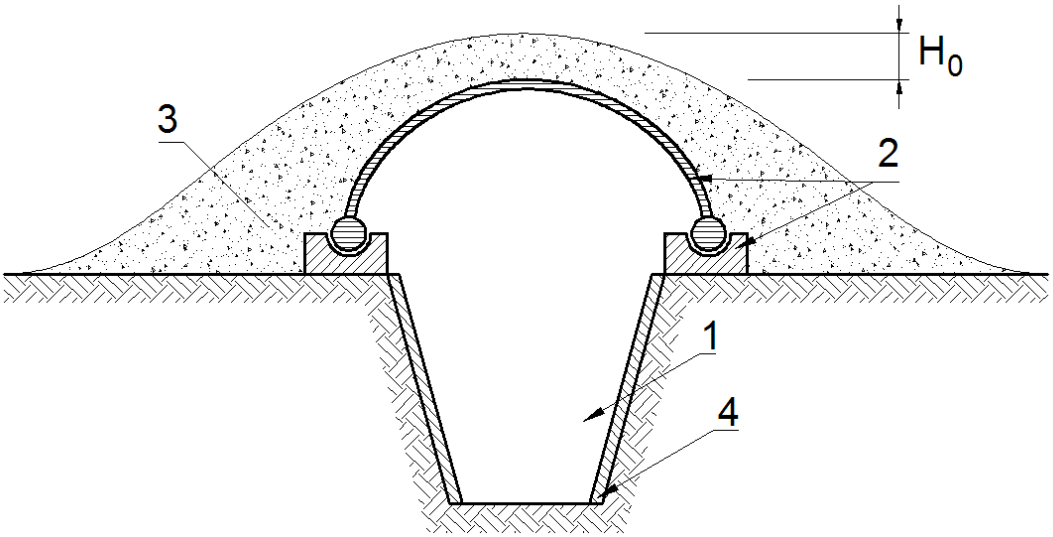

Figure 2. Example of a concealment solution, 1-trench or shooting ditch, 2-elements of laminate covering, 3- ground backfilling, H o-minimum thickness of the backfill, 4-covering of trench slopes frommaters or laminates

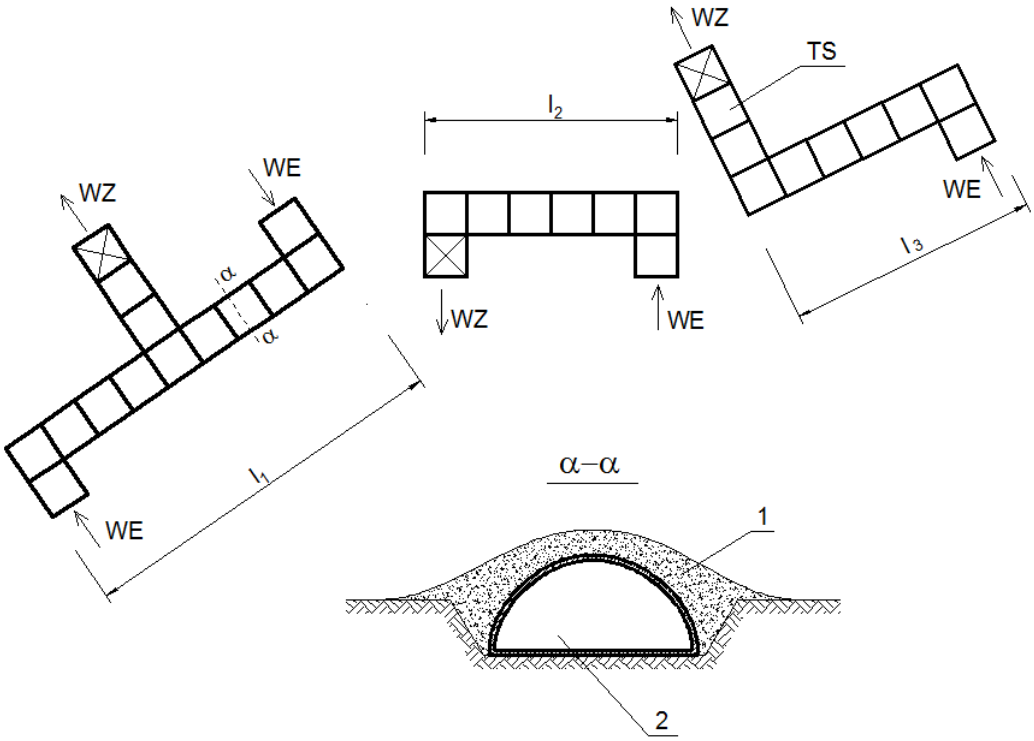

Figure 3. Diagram of possible location of temporary hides in the field, TS-typical modol, l_1, l_2, l_3- length of single hides, WZ, WE-closing elements, 1-back, 2-cross-section of a typical module

5 Basic impacts

5.1 Rubble

Debris affects the underground part of the building subject to destruction as well asbuildings and neighboring structures and thus hiding.

The probable extent of the rubble pile and its height are estimated mainly on the basis of research and observations

from periods of past armed conflicts. Information in this regard can be found in the literature [16] It canbe noted that Polish and German data on the height of rubble H_g of buildings with frame and multi-storey structures are convergent, then:

$H_g \geq 0.25H_b$

where H_b is the height of the building.

Russian estimates of the amount of rubble give lower values. On the other hand, estimating the extent of rubble L_g according to Polish formulas gives the highest results:

$L_g \geq 0.5H_b + 3(m)$

The intensity of the calculated static load from the rubble $\Delta\rho_r$ is determined depending on the number of storeys n of the above-ground part of the building. In the case of buildings with a reinforced concrete or steel frame structure, the load in question may be expressed by the formula:

$\Delta\rho_r = 10kPa, for\ n \leq 2$

$\Delta\rho_r = [10 + 2.5(n-2)] \leq 25\ kPa, for\ n > 2$

5.2 Impacts of objects and debris

In shelter construction for civil protection, strikes with heavy falling objects or structural elements separated during the destruction of the building are considered. The depth of penetration of the falling element into the structural material of the shelter ceiling or into the outer protective layer depends on the impact velocity, the shape and value of the cross-sectional area of the impactor element and the deformation characteristics of the collided elements.

The phenomenon of impact, apart from the ingress effect, is also characterized by permanent changes in the structure of the material and the possibility of the formation of debris analogous to the case of the action of a contact charge explosion. In addition to the listed local type effects, the impact causes vibrations of the entire element or structural system.

5.3 Protection against penetrating radiation

Below we will present the rules for calculating protective layers only against residual radiation from radioactive fallout. The basic tasks therefore include determining the thickness of protective layers against the discussed radiation. We will apply here the relationship between the weakened dose Do and the exposure dose of radiation D_o, which penetrates the layer of material with thickness H:

$$D_o = \frac{D}{10^{\frac{H}{d_{r10}}}} \tag{1}$$

where d_{r10} is a layer of nine times the attenuation of residual radiation. Layers d_{r10} can be taken:

for concrete - 0.2 m,

for land - 0.3 m,

for brick - 0.25 m,

for wood - 0.8 m,

for steel - 0.06 m.

From the above formula follows the dependence on the thickness of the protective layer depending on the multiplicity of radiation attenuation K_r :

$$H = d_{r10}\ lgK_r \tag{2}$$

In the case of layered protective partitions, after taking into account the physics of residual radiation suppression from (3) we will get:

$$\sum_{i=1}^{i=m} h_i \rho_i \rho_1 \tag{3}$$

$$d_{r10(1)}\ lg\ K_r \tag{4}$$

where : h_1,..... h_m – thickness of individual layers [m],

ρ_1,..... ρ_m– material densities [kg/m3].

The multiplicity of radiation attenuation should be at least 100 times.

To protect the entrances and openings from radiation, it is recommended to use the effect of refraction of the radiation path. One refraction at an angle of 90o corresponds to a weakening of radiation of the order of K10 times.

6 Conclusion

The paper characterizes the basic tasks in the area of fortification expansion for civil protection and civil defense. The main attention was paid to the ad hoc expansion using s and hide the ad hoc type. Ad hoc expansion is an important undertaking in a situation where it is impossible to prepare in advance a set of stationary shelters supporting civil protection and civil defense tasks.

The possibility of using solutions based on new composite construction materials has been taken into account.

The new composite materials offer the possibility of obtaining much better thermal and corrosion resistance compared to standard materials of this type. The requirements for bullet and splinter resistant products [7] are met. These materials in specific applications allow a reduction in product weight of about 37% compared to aluminium and 48% compared to steel.

It can also be noted that, in the situation under consideration, the existence of production plants which have the technologies in question is of great importance.

The development of the presented concepts is conditioned by the existence of such a system of civil protection and civil defense, in which the supporting role of modern fortification solutions is appreciated. An appropriate example is the most recent doctrinal approach of the NATO treaty [3, 10]. The problem of fortification expansion was included there as a priority as part of the program called "force protection engineering".

Although the presented considerations concern ad hoc actions, it is important to perform pre-emptive analyses in the field of planning the location of the discussed facilities and recognizing soil and water conditions. The problem is important because in large cities there is still the development of free areas that are important from the point of view of civil defense tasks.

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