УДК 725

O. Chub¹, I. Kreizer²

¹*Kharkovproject Institute, Ukraine* ²*O.M. Beketov National University of Urban Economy in Kharkiv, Ukraine*

RECONSTRUCTION OF THE "UNIFEHT" UNIVERSITY STADIUM DURING THE MILITARY AGGRESSION IN THE CITY OF KHARKIV

The issue of reconstruction of the destroyed stadium "Unifecht" of Kharkiv National University named after V.N. Karazin in the city of Kharkiv during the military aggression by Russia is the subject of research of this article. Unifekht Stadium was the training base of Olympic fencing champions, it was here that world champion Dmytro Karyuchenko, multiple champion of Ukraine Maksym Hvorost, and world champion Olena Voronina mastered the art of rapier. The article examines the proposal of a draft project for the restoration of the "Unifecht" stadium, carried out by the project organization "Institute "Kharkivproekt" on a charitable basis. "Kharkivproekt" Institute has experience in preparing Ukrainian stadiums for international sports competitions. During the Euro-2012 European Football Championship games in Ukraine and Poland, this organization carried out the reconstruction project of the "Metalist" stadium in Kharkiv. Such experience helps to introduce new functional changes and take into account modern requirements during the reconstruction of sports facilities are taken into account, factors affecting the complex reconstruction of the stadium are considered. The article describes the work experience and proposals of Ukrainian architects regarding the restoration of a destroyed object under the conditions of martial law in Ukraine.

Keywords: sports facilities, multifunctional stadium, reconstruction.

Introduction

The Mayor of Kharkiv, Igor Terekhov, names the approximate damages as a result of aggression from Russia - 9 billion dollars, destroyed schools, kindergartens, medical institutions, sports facilities, playgrounds, architectural monuments, about 500 residential buildings are not subject to restoration, and 150 thousand residents of the city were left with their homes. The enemy is constantly shelling the critical infrastructure of the city. At the same time, the mayor assures that building reconstruction projects are being developed using the funds of the city budget, and repair work is ongoing in buildings where possible. People's lives come first [1].

Along with these works, a group of Kharkov architects works in the city, who are in contact with the British architect Norman Foster, who is developing a concept for the development of the city of Kharkiv in the future after the end of hostilities. In addition to this group, there are already online competitions for the restoration of the liberated territories of Ukraine that suffered as a result of armed Russian aggression. The goal of foreign and Ukrainian architects, with the help of design ideas, is to move away from the Soviet past as much as possible towards a modern vision of the development of Ukrainian affected cities and their infrastructure. A certain number of project organizations of the city of Kharkiv are also involved in surveying, fixing the condition, as well as developing project documentation for the future restoration of destroyed buildings. Important sports facilities in Kharkiv were damaged by enemy shelling, including: "Unifecht" of the Kharkiv National University (KHNU) named after V. N. Karazina, sports complex "Polytechnic" of Kharkov National University "KhPI", training complex "Dynamo", training base of football club "Metalist", and others. In this article, attention is paid to the study of preparation for the reconstruction of "Unifecht" of the Kharkiv National University named after V. N. Karazina [2]. The history of the stadium and educational and training complex of V.N. Karazin KhNU begins in the late 1970s; built on Pavlovo Pole in Kharkiv. The department of physical education and sports worked here; there were several halls for futsal, basketball, badminton, boxing. The highlight of the sports complex were the fencing halls, where future champions trained. Reconstruction of the sports complex was planned for 2022, but the war began. On March 5, a Russian plane fired two missiles at the building. As a result, the ceiling collapsed, windows and part of the walls fell out, and the floor was destroyed [2]. Against the background of constant shelling by the Russians and the destruction of residential areas of the city, and most importantly of the center, where the majority of higher education institutions are concentrated, among which there are

architectural monuments, sports complexes and dormitories, almost immediately after the extent of the destruction was determined, preparatory work for the restoration of the Unifecht complex began ". The architects of the "Kharkivproekt" institute offered to create a concept for the restoration of "Unifecht" on a free basis. taking into account international requirements for sports facilities with the aim of holding international level competitions after the end of hostilities. Until February 24, 2022, the process of forming new sports and health centres and reconstruction of existing sports facilities in line with global trends in the development of sports and physical culture took place quite intensively in Ukraine. Ukraine's participation in major international sports events was a powerful stimulus for the development of sports infrastructure. An example of this was the holding of the Euro-2012 European football championship on the territory of Ukraine and Poland. Eight stadiums (four in each country) were prepared for this event in both countries as base facilities with all the necessary infrastructure, which consisted of an additional subsystem (sports facility, hotel, airport, etc., transport facilities including roads and parking lots, medical care, office premises, media centres, energy facilities, sites of mobile communication systems), service subsystem (trade, service and financial institutions) and auxiliary subsystem (sports villages for accommodation of participating teams, temporary hospitality towns, urban fan zones). The sports complex "Unifecht", the building of which was destroyed at the beginning of the war, was chosen as the object of the study. The problem of the research is to gain experience in the reconstruction of sports facilities that have received damage of military origin. The purpose of the study is to prepare the necessary documentation for the reconstruction of completely or partially destroyed sports buildings and buildings for their restoration after the end of hostilities.

Review of research

Requirements for football stadiums are constantly changing. Convenience and safety for spectators, new technologies and efficient commercial operation are the main guidelines for the formation of requirements for sports complexes. The increasing complexity of the planning structure of the sports stadium increasingly affects the functioning of the stadium. Safety regulations and directives often have a decisive influence on the geometry of the stands and the structure of the seating of the fans. Therefore, in the work at each stadium, as a rule, individual solutions are used, which is especially important. In addition, a modern sports stadium must have reserves for accommodating and adapting additional equipment for large-scale events. Publications devoted to sports facilities can be conditionally divided into groups that consider this type of facilities from different positions:

- the authors of the article investigated the impact of the poor state of school sports equipment and inventory on the motor activity of graduates in adulthood [3];

- A real-time sports violence detection system is proposed, which processes huge input stream data and recognizes violence by simulating human intelligence [4];

- methods of recruiting talented athletes into highclass sports using the example of Australian football [5];

- Recommendations for the design and construction of large stadiums [6];

- Analysis of unobstructed visibility calculations; the method of calculating the tribune profile curve, etc. [7];

- European researchers study issues related to the design and construction of sports facilities and predict the directions of development of such facilities in the future [8];

- Leading design firms engaged in the design and construction of sports facilities investigate and offer planning of the future sports facility, guided by such basic principles as:

1) Forecasting the long-term use of the facility;

2) Measures of demand for this object in the future, in connection with which it must have the ability to transform;

3) Strict economy of funds allocated for design and construction, in the event that this object has no prospects for long-term use (in such cases, even the issue of construction of temporary structures is considered) [9];

- European specialists in the field of designing and building stadiums consider the interdisciplinary principle of designing stadiums, according to which the work of architects and engineers is interconnected, since the design, development of structural solutions for the roof, stadium bowl, manufacturing and installation involve specialists from various fields of engineering: automobile - and mechanical engineering, aerospace technologies, etc., and modern computer programs provide an opportunity to calculate any complexity of the structure. Parametric characteristics are important for the formation of requirements for the shape of the building. The goal of the interdisciplinary approach is also to use progressive methods during the design of stadiums [10];

- Among specialists, there are considerations about the prospects of experimental design of stadiums. In the last decade, the architecture of stadiums has changed a lot in connection with commercialization and media systems towards a dramatic approach (extravagance of the constructive solution of the roof, new possible designs regarding the formation of the geometry of the stands, etc). At the same time, changing standards and increasing requirements for this type of construction lead to an intense creative surge and the search for non-trivial solutions. The experience of interdisciplinary work on the expansion of modern approaches in the design of football stadiums is studied; the search for new formats of architectural solutions is carried out (theatricality of architecture, extraordinary solutions of the stands, the specificity of their geometry in order to bring the viewer closer to the field to improve visibility [11]:

- the analysis of the consequences of the design and construction of sports facilities for grand sporting events of a global scale, for example, the Olympic Games, the World Football Championships, etc., which after the end of the competition become unnecessary and turn into so-called "white elephants", is carried out. Options for creating a concept for the design and construction of stadiums are being considered, which will later be able to avoid such a fate [12];

- Analysis of the different types of facilities that form the infrastructural basis of sports and their characteristics is also an important element. On the example of the Great Forest stadium in Debrecen, a study of the profitability of the operation of a multifunctional stadium was carried out, as well as a demonstration of various possibilities of use [13];

- With technological development and industrial transformation, the architecture, engineering and construction (AEC) industry has moved from the traditional drawing-based design mode to a digital and computer-based mode. In recent years, the application of augmented reality (XR) technology, including virtual reality (VR), augmented reality (AR) and mixed reality (MR) technology, emphasizes the effect of immersion and interactivity, the experience between reality and virtuality, making breakthroughs in project architecture. The study developed by the authors of [14] proposes a new design process mode - a BIM-based XR system — and compares it with a traditional design process mode through a real stadium project. Three evaluation perspectives, including aesthetics, gaze tracking, and perceived utility evaluation, are used to compare the differences between the two modes. The result showed that the use of BIM-based XR system can provide users with more immersive effect and aesthetic evaluation of preference and perceived usefulness in design decisionmaking, communication and spatial cognition. The gaze tracking result also showed that the BIM-based XR system can realize the project as more efficient. It is expected that XR and BIM technologies can be effectively integrated and enhance the integrity of industrial applications and create a new mode of cooperation in AEC design.

Current questions facing Ukrainian architects working on the modernization of existing multifunctional stadiums:

- constant monitoring of the world experience of conducting competitions and changes in the recommendations of UEFA, FIFA, IAAF, which change taking into account the experience of conducting competitions at the world and European level;

- the condition of these stadiums; predicting their future existence; taking into account the possibilities of holding international competitions in the future.

The last modernization of the national regulatory framework was in the form of Appendix №1 from 1.10.2010 year to the State Building Regulations "Sports and physical culture and health facilities". This made it possible to partially harmonize Ukrainian design requirements with European ones regarding stadiums, two of which were built and two were reconstructed for participation in the European football championship within the framework of EURO 2012. The stadiums, of course, had to be certified for these competitions according to the norms and criteria that were put forward for European sports facilities. It should be noted that the above-mentioned appendix to the DBN "Sports and physical culture and health facilities" only partially satisfies the need to modernize the national regulatory framework for the design of sports facilities and only for football stadiums. Stadiums specializing in other sports, particularly athletics require further changes to the aforementioned state building regulations.

The depth of reconstruction and the choice of methods of working with the object of reconstruction depend on a number of factors, among which the determination of the parameters of the future object is one of the most important.

When reconstructing a stadium, as a rule, its parameters are set based on the level of the sports event for which the structure is being reconstructed. The parameters are: the capacity of the stands, the technical parameters of the football field, the requirements for the media complex, the comfort level of both the participants of the competition and the spectators, the current level of security, the technical condition of structures and engineering systems.

Making decisions regarding the design of a new stadium or the reconstruction of an existing one is preceded by a comprehensive analysis and study of the history of the object. Decisions on the methods of execution of project works

should be adopted taking into account the system of factors that determine the planning structure of the sports complex, the choice of structural scheme and materials and, ultimately, the formation of the architectural solution of the stadium.

Based on the experience gained as a result of participation in the preparation for EURO 2012, namely the design of the reconstruction of the Metalist stadium in Kharkiv, one of the authors of the article developed the principles of reconstruction of multifunctional stadiums [15]. The principles were embodied in the reconstruction project of the Kyiv CSK ZSU stadium, located on Povitroflotsky prospect. After the reconstruction, the complex should meet the IAAF category, which will allow to host competitions of the European Championship and the European Cup inclusively. Also, let's not forget about the ambitious plans of the army to hold the Invites Games in Ukraine [16]. There is also experience in designing large sports complexes: Ice Arena in Cherkasy, Ice Arena in Kharkiv.

Materials and methods - During the preparation of the article, the authors relied on the analysis of sources of information on this topic. Relevant scientific works, reference literature, requirements for the design and construction of sports facilities, as well as the history of the emergence and construction of the Unifekht sports complex in Kharkiv were considered. Thanks to the interest of the administration of the Karazin University, plans for the reconstruction were studied, which were ready for implementation by February 24, 2022. These sources of information were particularly important because they shed light not only on the history of the issue, but also on the ideas developed by the university management regarding the role of the Unifecht stadium in the life of the students and the city. In the course of the work, contact was maintained with the specialized unit of the university, which played an important role in the formation of ideas regarding the reconstruction of the stadium. Attention was focused on new functional blocks that provide additional opportunities in the development of the sports life of the university. The work methodology is based on the developed and tested system of factors in the design of multifunctional sports facilities.

Results and Discussion

The purpose of the reconstruction of the sports complex destroyed by rocket fire was to create on its basis a multi-functional complex of the University, which, according to its characteristics, can be both its sports and training base, and a stadium certified for holding both national competitions and European-level competitions - the European Student Sports Games. The sports complex in terms of its functionality includes almost all sports necessary for the Spartakiad: all types of athletics, football and rugby in the stadium, all indoor sports (futsal, basketball, volleyball, etc.), boxing, gymnastics and other in the premises of the multifunctional sports block. According to the structure and equipment of the complex, it is possible to hold Paralympic competitions or competitions like the Invincible Games. The Athletics Federation of Ukraine is very interested in the modern certified athletics complex. By analogy with the hosting of the Euro 2012 European football championship in Kharkiv due to the existence of the reconstructed "Metalist" stadium, the University sports complex after reconstruction can allow Kharkiv to be the host city of the European Universide.

The planning decisions of the project are conditioned by the location of the design area along the avenue. O. Yarosha on the northern slope of Sarzhyn Yar. The difference in markings between O. Yarosh Lane and the area of a football field is about 15 m. The complex consists of two parts:

- the stadium, built with its stands on the slope of Sarzhyn Yar in the form of an amphitheatre oriented to the east, which ends with the volume of the arena with a giant scoreboard;

- the volume of the multifunctional sports block (BFSB).

From O. Yarosh Lane, the site has two car entrances — one under the entrance esplanade, the other along the BFSB, which connects the technical areas and goes to the multi-level parking lot.

Open sports facilities are located in the southern part of the site. A pedestrian esplanade is proposed on the side of the pedestrian part of O. Yarosh Lane in front of the main entrance to the stadium. Fans from the esplanade head to the stands of the stadium through the lobby of the west stand or along the extension of the open esplanade to the north or south stands. Also, the entrance esplanade is connected to the roof, which is used as a recreational area of the complex with open access. From the same esplanade, fans can enter the lobby during indoor sports competitions.

The flow of visitors on match days, consisting of competition participants, regular spectators, VIP spectators, spectators who use wheelchairs, journalists, is designed both for the entrance and in the directions for the time of possible evacuation. The evacuation time of all participants of the competition and spectators is provided: from the stadium in 8 minutes to the safety zone with an area of 0.5 m² per person.

The standards for the movement of match visitors and the evacuation terms are declared both by the standards set forth in the "Guide To Safety at Sports Ground" [17] and by Amendment №1 to DBN V.2.2-13:2003, which appeared in 2010 with the aim of partial harmonization of national standards with international ones.

The volume of the stadium for athletics and football and rugby competitions is designed in the form of an arc-shaped volume of the western, northern and southern tribunes. It is located on the northern slope of Sarzhyn Yar. This is the surface of the existing relief. Instead of the eastern tribune, there is a two-story volume of the arena.

The sports block consists of a standard Olympic sports core. Its composition fully meets the requirements and parameters set forth in the "IAAF Track and Field Facilities Manual" [18]. The core consists of a football field, a circular 8-lane running track, which has extended 100m and 110m straights with hurdles (the possibility of 100m and 110m races is provided on both the western straight and the eastern straight, which used taking into account the direction of the wind). On the north side there is a track and pit with a barrier and water for steeplechase races.

Sectors are provided for long jump or triple jump (possibility of jumping in both directions depending on the wind direction), high jump, pole vault, javelin and discus throwing (also possibility of throwing in both directions), hammer throw, shot put.

The construction of the football field is provided seasonally with systems: water heating of the field, drainage, automatic watering, and a system for drying the lawn after rain during competitions. The lawn is covered with kapron mesh.

Heating of running tracks and athletics sectors in winter is also provided.

The second floor of the arena block has six running tracks (110 m for hurdles, including the possibility of long jump). On the first floor of the arena block there is a complex of changing rooms for football players, medical and technical facilities, and in winter a shooting range for archery.

The football and athletics complex has a normative orientation of the axis of the complex north-south with a permissible deviation of up to 15° .

Spectators' entrance to the stadium is provided from the side of O. Yarosh lane with access to the terrace from above from the stadium amphitheatre. The terraces of the northern and southern parts of the stadium are open. The western stand has a closed vestibule and a complex of premises above it (rooms for journalists, commentators, skyboxes for VIP spectators, a lounge area, premises of the stadium security management complex and management of its engineering systems such as sports lighting, scoreboard, sound system and so on (control room).Segregation of streams of regular spectators, VIP spectators, journalists, athletes is foreseen, which is foreseen by the requirements of the "Green Guide".

Places are provided on the surface of the tribune for people using wheelchairs. They are accompanied by persons, places are provided for them together. All levels of the tribunes are interconnected, except for the stairs, by elevators designed for people with special needs. Buffet service according to the catering system is provided on the western tribune in the lobby, on the north and south on the open terrace. The filling of the stands is controlled by turnstiles and metal detector frames. The exit from the stands is in the same direction. Evacuation in the event of an emergency is planned for 2/3 filling of the stands down towards the football field with a further exit towards Sarzhyn Yar. Estimated evacuation time according to the requirements of the "Green Guide" - in 8 minutes, the last spectator must leave the stand and be in the safety zone.

Seats of a comfortable size of 48 cm are taken into account in the calculation of the capacity of the stands, as is customary in modern European stadiums.

The necessary engineering systems for the competition are planned: sports lighting with a capacity of more than 2000 lux, which is placed on the structures (in the east on two masts), sound, and a giant scoreboard in the east, a system of regulatory placement of television cameras, advertising equipment and other systems.

Reinforced concrete folds of the tribunes are mostly placed along the slope. The necessary premises for spectator services are provided only at the level of -4.2 m in the northern tribune, in the western tribune a level of -7.8 m is added to them, and only in the southern tribune the space under the entire tribune is used up to the mark of -15 m (under the southern tribune except of premises for spectators there are gyms and a complex of premises for athletes in the amount for holding competitions in athletics and taking into account the service of Paralympics athletes).

All stands are covered, starting from the terrace to the first row.

The spatial and planning solutions of the stadium make a very convenient space for holding concerts and other events.

The volume of the multifunctional sports block is located on the southwest side of the stadium and along O. Yarosh Lane. The BFSB is planned and functionally related to the volume and sub-stand premises of the stadium. The roof of the BFSB is used as a recreational surface, which is connected to the pedestrian part of the alley by a wide ramp and, together with the esplanade in front of the stadium, significantly expands its recreational opportunities, especially taking into account the presence of student dormitories nearby.

The structure of the BFSB is formed by such large halls as sports and demonstration hall for futsal, basketball and volleyball competitions, another game hall with courts for basketball and volleyball, a large fencing hall with four lanes.

The sports and demonstration hall has a complex of premises for spectators, tribunes, which, depending on the type of competition (futsal or basketball/volleyball), have a capacity of 672 regular spectators for futsal competitions, plus 732 spectators on the ground floor for basketball/volleyball competitions. Skyboxes for VIP spectators have 35 seats and separate service. The same goes for journalists. There are all the necessary dressing rooms for 3 pairs of teams participating in the competition, coaches' and judges' rooms, medical rooms, doping control, a postmatch press conference room, TV studios, a panoramic studio, flash interview areas, and more.

Evacuation from the hall outside the BFSB is provided for in 6 minutes. As well as in the stadium, there are facilities for security and management of engineering systems for the display of competitions (Control Room).

The four-lane fencing hall is located at +0.000.

In addition, there are boxing, kickboxing, MMA, gyms, gymnasiums.

All halls are equipped with the required number of changing rooms with showers, coaching and methodical rooms.

Planning decisions allow, in addition to the educational and training process, to use the BFSB as a fitness club.

The volume of the track and field arena is twostory. The second floor contains the arena itself with 6 running tracks in length, which allows races of 100 m and 110 m with hurdles, long jump, triple jump.

The presence of such a arena is stipulated by the requirements of the "IIAF Track and Facilities Manual" for sports demonstration stadiums, which are certified for European championship competitions [18].

The roof and western wall of the arena is a stainedglass segment, open to the side of the stadium, which increases the visibility of the competition event.

The first floor contains changing rooms/showers including for footballers, should a football or rugby match be held at the stadium.

In addition to the technical premises for sports equipment (barriers, mats, racks, etc.), there are machines for taking care of the football field and paths. In addition, a winter archery range can be placed.

Multi-level parking. The space of a multi-level parking lot with a partially sloping floor (to eliminate the need for a ramp) is placed by stairs behind the terrain under the volume of the BFSB. All entrances to the parking lot are from O. Yarosh lane. The parking lot is equipped with an entry control system and a navigation system for finding a free space. Part of the parking space will be used as a wartime storage facility with all necessary elements (additional exits, ventilation, toilets, and generators).

Conclusion

The current situation: serious destruction of sports complex buildings and a very outdated sports core both in the part of the football field and running tracks, as well as the stands adjacent to the slope of the terrain, lack of lighting and infrastructure. The sports complex reconstruction project aims to raise the status of the university. After implementation, the university will be able to train athletes, including for participation in European universities, as well as host competitions of the same level. In the "Unifecht" sports complex, after reconstruction, almost all types of Universiades can be presented - all types of athletics, football, rugby, all indoor sports (including futsal and basketball, in which the university's athletes held championship titles), and also on the basis of the complex can there is a fitness club.

After the implementation of the project decision, the complex can be certified for holding European competitions or certified for registering high results/records in compliance with the norms/standards of UEFA and IAAF (l/athletics federation). The sports core includes: a running track with 8 tracks, sectors for long jump by direction, sectors for high jump and sectors for throwing. Football field with heating, irrigation, drainage and drainage systems. The tracks are also heated. A tribune for spectators from the railway folds 12-13 thousand for spectators, journalist/commentator sections, sky boxes for VIP spectators. In the grandstand building, there are rooms for serving spectators (toilets, buffets), infrastructure for athletes (locker rooms, showers, medical stations, doping cabinets, etc.). The entire complex of premises has been designed, including both spectators and athletes in wheelchairs (for example, the Invincible Games). On the eastern side, the core is bounded by an athletics arena with 6 tracks 130 m long. On the western side, the complex includes a multifunctional block with an educational and demonstration game hall with a grandstand for 600 spectators, a lobby for them, halls for wrestling, boxing, changing rooms, etc. This unit can also be used as a fitness club. A 2-story parking lot with approximately 400 parking spaces is planned. The tribune amphitheater, covered with a metal shell on cantilever trusses, is ideal for concerts, including taking into account the lighting of more than 2000 lux and other engineering infrastructure.

The project of the reconstruction of the "Unifecht" stadium was made on a free basis, focused on the search for possible investors for further design and construction works.

References

1. Terekhov named the approximate damages caused to Kharkiv due to the invasion of the Russian Federation.(2022) *Suspielne Novosti*. Retrieved from: https://suspilne.media/330296-terehov-nazvav-priblizni-zbitkiharkovu-cerez-vtorgnenna-rf

2. Ruined victories. How the Russians destroyed sports facilities in Kharkiv. (2022) *Kharkiv Today*. Retrieved from: https://2day.kh.ua/ua/kharkow/zruynovani-peremohy-yak-rosiyany-nyshchyly-sportyvni-sporudy-v-kharkovi

3. Black, N., Johnston, D. W., Propper, C., & Shields, M. A. (2019). The effect of school sports facilities on physical

activity, health and socioeconomic status in adulthood. *Social Science* & *Medicine*, 220, 120-128. https://doi.org/10.1016/j.socscimed.2018.10.025

4. Fenil, E., Manogaran, G., Vivekananda, G. N., Thanjaivadivel, T., Jeeva, S., & Ahilan, A. (2019). Real time violence detection framework for football stadium comprising of big data analysis and deep learning through bidirectional LSTM. *Computer Networks*, *151*, 191-200. https://doi.org/10.1016/j.comnet.2019.01.028

5. Woods, C. T., Cripps, A., Hopper, L., & Joyce, C. (2017). A comparison of the physical and anthropometric qualities explanatory of talent in the elite junior Australian football development pathway. *Journal of science and medicine in sport*, 20(7), 684-688. <u>https://doi.org/10.1016/j.jsams.2016.11.002</u>

6. Güppert K., Stockhusen K., Dziewas D. ect. (2012) Stadia for the FIFA Worldcup 2014 in Brazil. *Bautechnik*, *10*, 712–717.

7. King M. (2012) Aquatics Centre, London 2012. Olimpic and Paralympics Games. *Bautechnik*, *10*, 701–711.

8. Schöne L. (2012) Stadium in blue-construction of «Grand Stade du Havre». *Bautechnik, 10,* 686–693.

9. Nixdorf S. (2008) Stadium ATLAS. Berlin, 368.

10. Güppert K. (2012) Under large roofs – Interdisciplinary design of stadiums. *Bautechnik, 10,* 694–700.

11. Pape T., Brückner F., Kloft H. etc. (2012) Outstanding View. *Bautechnik*, *10*, 669–678.

12. Bienhaus A. (2012) Sustainable Stadium concepts – how to avoid «white elephants». *Bautechnik*, *10*, 679–685.

13. Gábor Kozma, Klára Czimre, Bence András Bács, Alexandru Ilieş, Christa Sára Pfau, Gheorghe Codruț Bulz and Zoltán Bács (2022) A Special Type of Multifunctional Stadiums: Great Forest Stadium in Debrecen (Hungary). *Buildings*, *12(12)*, 2261. https://doi.org/10.3390/buildings12122261

https://doi.org/10.3390/buildings12122261 14. Hao-Yun Chi, Yi-Kai Juan and Shiliang Lu (2022) Comparing BIM-Based XR and Traditional Design Process from Three Perspectives: Aesthetics, Gaze Tracking, and Perceived Usefulness. *Buildings* 12(10), 1728. https://doi.org/10.3390/buildings12101728

15. Chub A.N., Kreizer I.I. (2020) Principles of reconstruction of multifunctional stadiums on the example of the Kiev stadium of CSC Armed Forces of Ukraine. *IOP Conference Series: Materials Science and Engineering, Volume 907,* Innovative Technology in Architecture and Design (ITAD 2020) 21-22 May 2020, Kharkiv, Ukraine, 012066. https://doi.org/10.1088/1757-899X/907/1/012066

16. Chub O., Kreizer I. (2021) State of reconstruction of Ukrainian multifunctional stadiums after EURO-2012. *Linguistics and Culture Review*, *5*(*S4*), 1114-1123. https://doi.org/10.21744/lingcure.v5nS4.1750

17. Guide to Safety at Sports Ground "Green Guide". *Sports Grounds Safety Authority*. Retrieved from <u>https://sgsa.org.uk/greenguide/</u>

18. IAAF Track and Field Facilities Manual (2008), 144. https://athleticssa.org.za/SportsInfo/IAAF-Track-and-Field-Facilities-Manual-2008-Edition-Chapters.pdf

Література

1. Терехов назвав приблизні збитки, заподіяні Харкову через вторгнення РФ. Суспільне Новини. 2022. Режим доступу: <u>https://suspilne.media/330296-terehov-nazvav-</u> priblizni-zbitki-harkovu-cerez-vtorgnenna-rf

2. Зруйновані перемоги. Як росіяни нищили спортивні споруди в Харкові. Kharkiv Today. 2022. Режим доступу: <u>https://2day.kh.ua/ua/kharkow/zruynovani-peremohy-yak-</u> rosiyany-nyshchyly-sportyvni-sporudy-v-kharkovi

3. Black, N., Johnston, D. W., Propper, C., & Shields, M. A. (2019). The effect of school sports facilities on physical activity, health and socioeconomic status in adulthood. Social *Science & Medicine, Vol. 220, P. 120-128.* <u>https://doi.org/10.1016/j.socscimed.2018.10.025</u>

4. Fenil, E., Manogaran, G., Vivekananda, G. N., Thanjaivadivel, T., Jeeva, S., & Ahilan, A. (2019). Real time violence detection framework for football stadium comprising of big data analysis and deep learning through bidirectional LSTM. Computer Networks, Vol. 151, P. 191-200. https://doi.org/10.1016/j.comnet.2019.01.028

5. Woods, C. T., Cripps, A., Hopper, L., & Joyce, C. (2017). A comparison of the physical and anthropometric qualities explanatory of talent in the elite junior Australian football development pathway. Journal of science and medicine in sport, Vol. 20, Issue 7, P. 684-688. https://doi.org/10.1016/j.jsams.2016.11.002

6. Güppert K., Stockhusen K., Dziewas D. ect. (2012) Stadia for the FIFA Worldcup 2014 in Brazil. Bautechnik, 10, P. 712–717.

7. King M. (2012) Aquatics Centre, London 2012. Olimpic and Paralympics Games. Bautechnik, 10, P. 701–711.

8. Schöne L. (2012) Stadium in blue-construction of «Grand Stade du Havre». Bautechnik, 10, P. 686–693.

9. Nixdorf S. (2008) Stadium ATLAS. Berlin, 368 p.

10. Güppert K. (2012) Under large roofs – Interdisciplinary design of stadiums. Bautechnik, 10, P. 694–700.

11. Pape T., Brückner F., Kloft H. etc. (2012) Outstanding View. Bautechnik, 10, P. 669–678.

12. Bienhaus A. (2012) Sustainable Stadium -concepts – how to avoid «white elephants». Bautechnik, 10, P. 679–685.

13. Gábor Kozma , Klára Czimre, Bence András Bács, Alexandru Ilieş, Christa Sára Pfau, Gheorghe Codruț Bulz and Zoltán Bács (2022) A Special Type of Multifunctional Stadiums: Great Forest Stadium in Debrecen (Hungary). Buildings, 12(12), 2261. https://doi.org/10.3390/buildings12122261

14. Hao-Yun Chi, Yi-Kai Juan and Shiliang Lu (2022) Comparing BIM-Based XR and Traditional Design Process from Three Perspectives: Aesthetics, Gaze Tracking, and Perceived Usefulness. Buildings 12(10), 1728. https://doi.org/10.3390/buildings12101728

15. Chub A.N., Kreizer I.I. (2020) Principles of reconstruction of multifunctional stadiums on the example of the Kiev stadium of CSC Armed Forces of Ukraine. IOP Conference Series: Materials Science and Engineering, Volume 907, Innovative Technology in Architecture and Design (ITAD 2020) 21-22 May 2020, Kharkiv, Ukraine, 012066. https://doi.org/10.1088/1757-899X/907/1/012066

16. Chub O., Kreizer I. (2021) State of reconstruction of Ukrainian multifunctional stadiums after EURO-2012. Linguistics and Culture Review, Vol. 5, No. S4, P. 1114-1123. https://doi.org/10.21744/lingcure.v5nS4.1750

17. Guide to Safety at Sports Ground "Green Guide". Sports Grounds Safety Authority. Retrieved from https://sgsa.org.uk/greenguide/

18. IAAF Track and Field Facilities Manual (2008), 144 p. https://athleticssa.org.za/SportsInfo/IAAF-Track-and-Field-Facilities-Manual-2008-Edition-Chapters.pdf

Рецензент: доктор архітектури, професор, завідувач кафедри урбаністики та містобудування І.В. Древаль, Харківський національний університет міського господарства імені О.М. Бекетова, Україна.

Автор: ЧУБ Олександр Миколайович

кандидат архітектури Інститут «Харківпроект» E-mail – alexchub.22@gmail.com

ID ORCID: https://orcid.org/0009-0005-3087-2402

Автор: КРЕЙЗЕР Ірина Ігорівна кандидат архітектури, доцент кафедри основ архітектурного проєктування Харківський національний університет міського господарства імені О.М. Бекетова E-mail – <u>Iryna.Kreizer@kname.edu.ua</u> ID ORCID: <u>https://orcid.org/0000-0003-2112-7353</u>

РЕКОНСТРУКЦІЯ УНІВЕРСИТЕТСЬКОГО СТАДІОНУ "УНІФЕХТ" ПІД ЧАС ВІЙСЬКОВОЇ АГРЕСІЇ В МІСТІ ХАРКОВІ

О. Чуб¹, І. Крейзер²

¹Інститут «Харківпроект», Україна

²О.М. Харківський національний університет міського господарства імені Бекетова, Україна

Питання реконструкції зруйнованого стадіону «Уніфехт» Харківського національного університету імені В.Н. Каразіна в м. Харкові під час військової агресії з боку Росії є предметом дослідження даної статті. Стадіон «Уніфехт» був тренувальною базою олімпійських чемпіонів з фехтування, саме тут опановували мистецтво рапіри чемпіон світу Дмитро Карюченко, багаторазовий чемпіон України Максим Хворост, чемпіонка світу Олена Вороніна. У статті розглядається пропозиція ескізного проєкту відновлення стадіону «Уніфехт», що виконується проєктною організацією «Інститут «Харківпроект» на благодійних засадах. Інститут «Харківпроект» має досвід підготовки українських стадіонів до міжнародних спортивних змагань. Під час ігор Чемпіонату Європи з футболу Євро-2012 в Україні та Польщі ця організація виконувала проєкт реконструкції стадіону «Металіст» у Харкові, такий досвід дозволяє вносити нові функціональні зміни та враховувати сучасні вимоги під час реконструкції зруйнованого стадіону. В статті проаналізовано сучасний європейський підхід в реконструкції багатофункціональних стадіонів. Актуальним залишається питання експлуатації подібних об`єктів в умовах викликів, що спіткали світ в останні роки. Розглянуті приклади демострують поміркований і зважений підхід до подібних стадіонів, наголошується на тому, щоби перед прийняттям рішення щодо реконструкції приймались рішення щодо подальшої долі і експлуатації багатофункціональних стадіонів. Враховано європейські вимоги та вітчизняне законодавство, норми проєктування та будівництва спортивних споруд, розглянуто фактори, що впливають на комплексну реконструкцію стадіону У статті описано досвід роботи та пропозиції українських архітекторів щодо відновлення зруйнованого об'єкта. в умовах воєнного стану в Україні. Методика роботи грунтувалась на порівняльному аналізі подібних прикладів реконструкції стадіонів, враховувася практичний досвід роботи архітекторів над спортивними спорудами, також проєкт виконувався у співпраці із керівництвом зруйнованого спортивного комплексу «Уніфехт» Каразинського університету, враховувались вже існуючі види спорту, а також вносилися в розробку пропозиції щодо проведення міжнародних спортивних змагань.

Ключові слова: спортивні споруди, багатофункціональний стадіон, реконструкція.